¦ăŜ !dzűK2NJλÎl·űλ2y˜

Ly˜LJNJŜăŜyűλy∃ űKλă űKŜăλă λy˜LJl·NJűλl·f ŦdzťŦλťťY˜Ŝyű 2Ŧ űKŜ NJŜljdzλNJŜY˜Ŝyűă Ŧ2NJ l·y˜l·ŘØl·yŎŜŘ ŘŜ∃NJŜŜ l·ű LŘl·K2 {űl·űŜ ¦yλØŜNJăλűèΣ L l·∃NJŜŜ űKl·ű űKŜ [λōNJl·NJè ăKl·ťť Y˜l·ţŜ λű ŦNJŜŜťè l·Øl·λťl·ōťŜ Ŧ2NJ λyãLJŜŎűλ2yΦ L ŦdzNJűKŜNJ ăűl·űŜ űKl·ű LJŜNJY˜λăăλ2y˜ű2 Ř2øyť2l·Ř l·yŘκ2NJ LJNJλyű Y˜è űKŜăλă Ŧ2NJ ăÔK2ťl·NJťè LJdzNJLJ2ăŜă Y˜l·è ōŜ ∃NJl·yűŜŘ ōè űKŜ 5Ŝl·y˜2Ŧ űKŜ DNJl·Řdzl·űŜ {ŎK22ťΣ 5Ŝl·y˜2Ŧ Y˜è l·Ŏl·ŘŜY˜λŎ ŘλØλăλ2yΣ 2NJ ōè űKŜ ¦yλØŜNJăλűè [λōNJl·NJλl·yΦ Lű λă dzyŘŜNJăű22Ř űKl·ű l·yè Ŏ2LJèλy∃ 2NJ LJdzōťλŎl·űλ2y˜2Ŧ űKλă űKŜăλă Ŧ2NJ ŦλYl·yŎλl·f ∃l·λy˜ăKl·ťť y˜2ű ōŜ l·ťť2øŜŘ øλűK2dzű Y˜è øNJλűűŜy˜LJŜNJY˜λăăλ2yΦ

{λ∃yYl·űdzNJŜ

5l·űŜ

9ăűl·ōfłăKłyƎ l· /ℕJłűŜℕJłl· ŦƧℕJ /Ƨ†fŜƎłl·űŜ /èōŜℕJ 5ŜŦŜyãŜ /Ƨ⅄LJŜűłűłƧy⅄Ly?ŜŎűă

! vdzl·fłűl·űłØŜ !yl·fèăłă

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! űKŜăłă ădzōY⅄łűűŜŘ ły⅄LJl·ℕJűłl·f ŦdzfŦłffY⅄Ŝyűŧ ƧŦ űKŜ ℕŜIjdzłℕJŜY⅄Ŝyűă ŦƧℕJ űKŜ ŘŜƎℕJŜŜ ƧŦ

a l·ăűŜℕJ ƧŦ .dzăłyŜăă !ŘY⅄łyłăűℕJl·űłƧy⅄ły⅄űKŜ 5ŜLJl·ℕJűY⅄Ŝyűŧ ƧŦ .dzăłyŜăă

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a l·è нлмп

/ƧLJèℕΛƎKűнлмп õè wèI·y˙ . ŜŎ˥ăűŜI·ŘΣ /L{{ t

! ff wΛƎKűă wŜăŜℕØŜŘ

/2ΥΥλűűŜŜ !ǈǈǋ2ØI·ť

¢2 űKŜ DǋI·ŘdzI·űŜ CI·ŎdzŧűèΥ

¢KŜ ΥŜΥōŜǋă 2Ŧ űKŜ Ŏ2ΥΥλűűŜŜ I·ǈǈ2λƴűŜŘ ű2 ŜÈI·Υλƴ Ŝ űKŜ űKŜăλă 2Ŧ wèI·ƴ .ŜŎɿăűŜI·Ř ŦλƴŘ λű ăI·űλăŦI·Ŏű2ǋè I·ƴŘ ǋŜŎ2ΥΥŜƴŘ űKI·ű λű ōŜ I·ŎŎŜǈűŜŘφ

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5ǋφ 5ŜƴƴλăΥǋdzΥØλŜŘŜΣ
/2ΥΥλűűŜŜ aŜΥōŜǋ

ψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψ
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DǋI·ŘdzI·űŜ CI·ŎdzŧűèwŜǈǋŜăŜƴűI·űλØŜ

Idaho State
UNIVERSITY

Office of Research
921 South 8th Avenue, Stop 8130 • Pocatello, Idaho 83209-8130

April 14, 2014

Mr. Ryan Beckstead
c/o Idaho State University
921 S. 8th Ave.
Pocatello, ID 83209

Dear Mr. Beckstead:

Based on the information provided to me, it is my determination that your project titled, "Establishing a Criterion for Collegiate Cyber Defense Competition," does not constitute research with human subjects as defined in 45 CFR 46.102(f). Therefore, it does not require any submission to or approval by the Human Subjects Committee (the IRB for Idaho State University).

Please feel free to contact me if you have any questions or concerns.

Sincerely,

Ralph Baergen, PhD, MPH, CIP
Chair, Human Subjects Committee

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Dedication

L ø2dztŘ fλ]Ŝ ű2 ŘŜŘλŎI·űŜ űKλă űKŜăλă ű2 Y'è DNI·yŘY'I· I·yŘ DNI·yŘLJI· . ŜŎ]ăűŜI·Řφ ¢KŜλNJ KŜfLJ I·yŘ ŜyŎ2dzNJI·∃ŜY'Ŝyű λă øKI·ű Y'2űλØI·űŜŘ Y'Ŝ ű2 2ōűI·λy'Y'è ŜŘdzŎI·űλ2yφ L ø2dztŘ y2ű ōŜ Ŏ2Y'LJfŜűλy∃ Y'è Y'I·ăűŜNΩă ŘŜ∃NJŜŜ λŦ λű øŜNJŜ y2ű Ŧ2NJ űKŜY'φ

L ø2dztŘ I·fă2 fλ]Ŝ ű2 ŘŜŘλŎI·űŜ űKλă ű2 Y'è ø2yŘŜNJŦdztf øλŦŜΣ øK2 ŜyŎ2dzNJI·∃ŜŘ Y'Ŝ űKNJ2dz∃K λű I·ffΣ I·yŘ ű2 Y'è]λŘă øK2 L K2LJŜ øλftf KI·ØŜ I· ŘŜăλNJŜ ű2 2ōűI·λy'I·ă Y'dzŎK ŜŘdzŎI·űλ2y' I·ă LJ2ăăλōfŜφ

Acknowledgements

L ø2dztŘ fλ]Ŝ ű2 l·Ŏ]y2øtŜŘ∃Ŝ l·yŘ űKl·y] 5№Φ Wl·YŜă C№2ăű ŦZ№ l·ff Kλă KŜfLJ λy
2№∃l·yλÎλy∃ l·yŘ 2ōűl·λyλy∃ ă2dz№ŎŜă ŦZ№ Yè űKŜăλăΦ I Ŝ KŜfLJŜŘ YŜ ű2 ∃Ŝű űK№2dz∃K űKλă øK2tŜ
LJ№2ŎŜăăΦ L ø2dztŘ l·tă2 fλ]Ŝ ű2 űKl·y]ă 5№Φ /2№Ŝè {ŎK2dz Ŧ2№ Kλă KŜfLJ λyűKλy]λy∃ 2dzűăλŘŜ űKŜ
ō2ÈΣ LJdzttλy∃ λy2űKŜ№ ăλYdztl·űλ2yă l·yŘ LJdzűűλy∃ dzLJ øλűK Yè Ŏ№l·Îλy̆ŜăăΦ L ø2dztŘ l·tă2 fλ]Ŝ ű2
űKl·y] a l·№2l·yŷl· I dztŜű Ŧ2№ űKŜ K2dz№ă 2Ŧ KŜfLJ øλűK ŜŘλűλy∃ Yè űKŜăλăΦ !y2űKŜ№ LJŜ№ă2y̆L
ø2dztŘ fλ]Ŝ ű2 űKl·y] λă 5øl·èyŜ ² λttλl·Yă Ŧ2№ űl·]λy∃ űλYŜ 2dzű 2Ŧ Kλă ōdzăè ăŎKŜŘdztŜ ű2 l·tt2ø
YŜ ű2 λyűŜ№ØλŜø KλY l·yŘ Ŧ2№ Kλă LJŜ№Yλăăλ2y̆ű2 dzăŜ b//5/ λy?ŜŎűăΦ [l·ăűtèΣ L ø2dztŘ fλ]Ŝ ű2
űKl·y] Yè øλŦŜΣ !y∃Ŝtl·Σ Ŧ2№ KŜfLJλy∃ YŜ ăűl·è 2y̆űl·ă] l·yŘ ŜŘλűλy∃ ăŜ№ØλŎŜăΦ

Table of Contents

[ƛăű ƈŦ CƛƎdzǊŜă .... Ȅƛ

[ƛăű ƈŦ ¢ŀōſŜă .... Ȅƛƛ

[ƛăű ƈŦ ! ōōǊŜǾƛŀűƛƈƴã .... Ȅƛƛƛ

! ōăűǊŀǓű .... ȄƛǾ

/ Ką LJűŜǊ LY Lƴ́űǊƈŘdzǓűƛƈƴ .... м

{űŀűŜ Y Ŝƴ́ű ƈŦ űKŜ tǊƈōſŜY .... м

wŜăŜŀǊǓK v dzŜăűƛƈƴ .... н

5ŜŦƛƴƛűƛƈƴã .... н

/ ѐōŜǊ 5ŜŦŜƴăŜ / ƈY LJŜűƛűƛƈƴ ¢ŜŀY ă .... н

{ǑŜƴŀǊƛƈ .... р

9ƴǾƛǊƈƴY Ŝƴ́ű .... с

LƴʔŜǑűă .... ф

! ăădzY LJűƛƈƴãк[ƛY ƛűŀűƛƈƴãк5ŜſƛY ƛűŀűƛƈƴã .... мл

{ƛƎƴƛŦƛǑŀƴǑŜ ƈŦ űKŜ {űdzŘѐ .... мл

/ Ką LJűŜǊ LLY [ƛűŜǊŀűdzǊŜ wŜǾƛŜǿ .... мн

/ ѐōŜǊ / ƈY LJŜűƛűƛƈƴã .... мо

/ ƈY LJŜűƛűƛƈƴ ƖăűƈǊѐ .... мс

/ ŀLJűdzǊŜ űKŜ Cſŀƌ .... мт

/èōŜǎ 5ŜŦŜýãŜ 9ÈŜǎŎàãŜ ... мт

Lýű ŜǎýΛ·űàƵýΛ·ƒ /Ι·ǈűdzǎŜ űΚŜ CƒΙ·∃ ... му

bΙ·űàƵýΛ·ƒ /ƵƒƒŜ∃àΙ·űŜ /èōŜǎ 5ŜŦŜýãŜ /ƵΥǈŜűàűàƵý ... му

5/o 5à∃àűΙ·ƒ CƵǎŜýãàŎã ... мф

/èōŜǎ tΙ·űǎàƵű ... нл

tΙ·ýƵǈƒè ... нл

hØŜǎ űΚŜ ² àǎŜ ... нм

/ƵƒƒŜ∃àΙ·űŜ /èōŜǎ {ŜŎdzǎàűè /ΚΙ·ΥǈàƵýãΚàǈ /dzǈ ... нн

{àΥdzƒΙ·űàƵýã ... но

aŜŘàŎΙ·ƒ ... нп

!ØàΙ·űàƵý ... нр

[ŜΙ·ǎýàýƺ űΚŜƵǎàŜã ... нс

.ƒƵƵΥΩã ¢Ι·ÈƵýƵΥè ... нс

YƵƒōΩã 9ÈǈŜǎàŜýűàΙ·ƒ [ŜΙ·ǎýàýƺ ¢ΚŜƵǎè ... нт

/ΚΙ·ƒƒŜý∃Ŝ .Ι·ãŜŘ [ŜΙ·ǎýàý∃ ... ну

!ŎűàØŜ [ŜΙ·ǎýàý∃ ... нф

DΙ·ΥŜπ.Ι·ãŜŘ [ŜΙ·ǎýàý∃ ... нф

9ØΙ·ƒdzΙ·űàƵý Ι·ýŘ ¢Ŝãűàý∃ ... ол

/ΚΙ·ǈűŜǎ LLLY aŜűΚƵŘƵƒƵ∃è Ι·ýŘ CàýŘàý∃ã ... он

wŜăŜŀǐŎK ... он

{űdzŘŜƴű {dzǐǾŜè ... он

LƴűŜǐǾʎŜǿ ... пн

! ƴŀŧèăʎă ƻŦ b / / 5 / LƴʕŜŎűă ... пп

/ Kŀ LJűŜǐ L±Y / ƻƴŎŧdzăʎƻƴã ... пф

DdzʎŘŜŧʎƴŜă ŦƻǐLƴʕŜŎűă ... пф

CdzǐűKŜǐ wŜăŜŀǐŎK ... рм

wŜŦŜǐŜƴŎŜă ... рн

! LJLJŜƴŘʎ9 ! Y LƴűŜǐǾʎŜǿ ǿʎűK 5ǿŀèƴŜ ² ʎŧŧʎŀ Y ă ... ру

! LJLJŜƴŘʎ9 . Y tw / / 5 / { ŀűdzǐŘŀè {dzǐǾŜè ... то

! LJLJŜƴŘʎ9 / Y tw / / 5 / {dzƴŘŀè {dzǐǾŜè ... фл

! LJLJŜƴŘʎ9 5Y { ŀűdzǐŘŀè {dzǐǾŜè 5ŀűŀ ... млф

! LJLJŜƴŘʎ9 9Y {dzƴŘŀè {dzǐǾŜè 5ŀűŀ ... мнм

List of Figures

CλƎdzǋŜ мY /ƻϒǇŜǘλǘλƻy 9yØλǋƻyϒŜyǘ у

CλƎdzǋŜ нY нлмл b//5/ LyʹŜŎǘ пт

CλƎdzǋŜ оY нлмм b//5/ LyʹŜŎǘ пу

List of Tables

¢l·ōƒŜ мΎ /èōŜǸ 5ŜŦŜy̆ãŜ /ƻΎǇŜűλűλƻy̆ ¢ŜI·Ύă .... о

¢l·ōƒŜ нΎ /èōŜǸ /ƻΎǇŜűλűλƻy̆ã .... мп

¢l·ōƒŜ оΎ /èōŜǸ /ƻΎǇŜűλűλƻy̆ ¢λΎŜƒλy̆Ŝ .... мс

¢l·ōƒŜ пΎ {ƌǸØŜè {ƌΎΎl·Ǹè .... ор

¢l·ōƒŜ pΎ Ly̆ʔŜŎű 5λŦŦλŎƌƒűè .... оу

¢l·ōƒŜ cΎ Ly̆ʔŜŎű 9ŘƌŎl·űλƻy̆l·ƒ ±l·ƒƌŜ .... оф

¢l·ōƒŜ тΎ Ly̆ʔŜŎű !ǇǇƒλŎl·ōλƒλűè .... пл

¢l·ōƒŜ yΎ Ly̆ʔŜŎű ¢ŜŎƘy̆λŎl·ƒ Øăφ tƻƒλŎè .... пм

List of Abbreviations

NCCDC ς bl·ŭλ2yl·f /2ffŜƎλl·ŭŜ /èōŜNJ 5ŜŦŜyãŜ Ŏ2YˇLJŜŭλŭλ2yˇ
CCDC ς /2ffŜƎλl·ŭŜ /èōŜNJ 5ŜŦŜyãŜ /2YˇLJŜŭλŭλ2yˇ
CIA ς /ŜyŭNJl·f LyŭŜffλƎŜyŎŜ !ƎŜyŎè
CSIS ς /ŜyŭŜNJ Ŧ2NJ {ŭNJl·ŭŜƎλŎ l·yŘ LyŭŜNJyl·ŭλ2yl·f {ŭdzŘλŜă
CTF ς /l·LJŭdzNJŜ ŭKŜ Cfl·Ǝ
iCTF ς LyŭŜNJyl·ŭλ2yl·f /l·LJŭdzNJŜ ŭKŜ Cfl·Ǝ
CDX ς /èōŜNJ 5ŜŦŜyãŜ 9ÈŜNJŎλăŜ
UCSB ς ¦yλØŜNJăλŭè 2Ŧ /l·fλŦ2NJyλl· l·ŭ {l·yŭl· .l·NJōl·NJl·
CIAS ς /ŜyŭŜNJ Ŧ2NJ Ly Ŧ2ăŭNJdzŎŭdzNJŜ !ăădzNJl·yŎŜ l·yŘ {ŜŎdzNJλŭè
NSA/CSS ς bl·ŭλ2yl·f {ŜŎdzNJλŭè !ƎŜyŎèк/ŜyŭNJl·f {ŜŎdzNJλŭè {ŜNJØλŎŜ
INFOSEC ς LyŦ2NJYˇl·ŭλ2yˇ{ŜŎdzNJλŭè
NASCAR ς bl·ŭλ2yl·f !ăă2Ŏλlŭλ2yˇŦ2NJ {ŭ2Ŏ] /l·NJ !dzŭ2 wlŎλyƎ
NCAA ς bl·ŭλ2yl·f /2ffŜƎλl·ŭŜ !ŭKfŜŭλŎ !ăă2Ŏλlŭλ2yˇ
IT ς LyŦ2NJYˇl·ŭλ2yˇ¢ŜŎKy2f2Ǝè
HIPAA ς lŜl·fŭK LyãdzNJl·yŎŜ t2NJŭl·ōλfλŭè l·yŘ !ŎŎ2dzyŭl·ōλfλŭè !Ŏŭ
FISMA ς CŜŘŜNJl·f LyŦ2NJYˇl·ŭλ2yˇ{ŜŎdzNJλŭè al·yl·ƎŜYˇŜyŭ !Ŏŭ
VLAN ς ±λNJŭdzl·f [2Ŏl·f !NJŜl· bŜŭø2NJ]
SCADA ς {dzLJŜNJØλă2NJè /2yŭNJ2f l·yŘ 5l·ŭl· !ljdzl·ăλŭλ2yˇ
HMI ς ldzYˇl·yˇ al·ŎKλyŜ LyŭŜNJŦl·ŎŜ
DNS ς 52Yˇl·λyˇbl·YˇŜ {èăŭŜYˇ
PRCCDC ς tl·ŎλŦλŎ wλYˇ /2ffŜƎλl·ŭŜ /èōŜNJ 5ŜŦŜyãŜ /2YˇLJŜŭλŭλ2yˇ
VPN ς ±λNJŭdzl·f tNJλØl·ŭŜ bŜŭø2NJ]
CEO ς /KλŜŦ 9ÈŜŎdzŭλØŜ hŦŦλŎŜNJ
CIO ς /KλŜŦ LyŦ2NJYˇl·ŭλ2yˇhŦŦλŎŜNJ
CPR ς /l·NJŘλ2 tdzfYˇ2yl·NJè wŜădzăŎλŭl·ŭλ2yˇ
FDA ς C22Ř l·yŘ 5NJdzƎ !ŘYˇλyλăŭNJl·ŭλ2yˇ
BYOD ς .NJλyƎ ¸2dzNJ høyˇ5ŜØλŎŜ
CBL ς /Kl·ffŜyƎŜ .l·ăŜŘ [Ŝl·NJyλyƎ
GBL ς Dl·YˇŜπōl·ăŜŘ [Ŝl·NJyλyƎ
ABSEL ς !ăă2Ŏλlŭλ2yˇŦ2NJ .dzăλyŜăă {λYˇdzfl·ŭλ2yˇl·yŘ 9ÈLJŜNJλŜyŭλl·f 9ÈŜNJŎλăŜă
ISU ς LŘl·K2 {ŭl·ŭŜ ¦yλØŜNJăλŭè
IM ς LyãŭI·yŭ aŜăăl·ƎλyƎ
CRM ς /NJŜø wŜă2dzNJŎŜ al·yl·ƎŜYˇŜyŭ
LOS ς [λyŜ hLJŜNJl·ŭλ2yl·f {λYˇdzfl·ŭλ2yˇ
ISO ς LyŭŜNJyl·ŭλ2yl·f hNJƎl·yλÎl·ŭλ2yˇŦ2NJ {ŭl·yŘl·NJŘλÎl·ŭλ2yˇ
PCI ς tl·èYˇŜyŭ /l·NJŘ LyŘdzăŭNJè
COBIT ς /2yŭNJ2f hō?ŜŎŭλØŜă Ŧ2NJ LyŦ2NJYˇl·ŭλ2yˇ ɔ wŜfl·ŭŜŘ ¢ŜŎKy2f2Ǝè
RMF ς wlă] al·yl·ƎŜYˇŜyŭ CNJl·YˇŜø2NJ]
ITIL ς LyŦ2NJYˇl·ŭλ2yˇ¢ŜŎKy2f2Ǝè LyŦNJl·ăŭNJdzŎŭdzNJŜ [λōNJl·NJè
KSA ς Yy2øfŜŘƎŜ 2Ŧ {]λffă l·yŘ !ōλfλŭλŜă
NIST ς bl·ŭλ2yl·f LyãŭλŭdzŭŜ 2Ŧ {ŭl·yŘl·NJŘă l·yŘ ¢ŜŎKy2f2Ǝè
NICE ς bl·ŭλ2yl·f LyλŭλlŭλØŜ Ŧ2NJ /èōŜNJăŜŎdzNJλŭè 9ŘdzŎl·ŭλ2yˇ
DHS ς 5ŜLJl·NJŭYˇŜyŭ 2Ŧ l2YˇŜfl·yŘ {ŜŎdzNJλŭè
CE&A ς /èōŜNJăŜŎdzNJλŭè 9ŘdzŎl·ŭλ2yˇl·yŘ !øl·NJŜyŜăă
CCP ς /èōŜNJ /2YˇLJŜŭλŭλ2yã tNJ2?ŜŎŭ
NICCS ς bl·ŭλ2yl·f LyλŭλlŭλØŜ Ŧ2NJ /èōŜNJăŜŎdzNJλŭè /l·NJŜŜNJă l·yŘ {ŭdzŘλŜă

Abstract

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59C9b{9 /h a t9¢L¢Lhb LbW9/¢{

¢KŜăλă !ōăűNJI·Ŏű π LŘI·K2 {űI·űŜ ¦ yλØŜNJăλűè π нлмп

¢KŜ bI·űλ2yI·f /2ffŜ∃λI·űŜ /èōŜNJ 5ŜŦŜyãŜ /2YˇLJŜűλűλ2yˇKI·ă ∃NJ2øyˇű2 λyŎfdzŘŜ 2ØŜNJ мул ăŎK22făΣ Ŏ2YˇLJŜűλy∃ λyˇűŜyˇŘλŦŦŜNJŜyű NJŜ∃λ2yI·f ŜØŜyűăΣ øλűK øλyŷŜNJă LJNJ2ŎŜŜŘλy∃ 2yˇű2 I·Ŧλ yI·f yI·űλ2yI·f Ŏ2YˇLJŜűλűλ2yΦ C2NJ űKŜ Ø2fdzyűŜŜNJă øK2 NJdzyˇNJŜ∃λ2yI·f Ŏ2YˇLJŜűλűλ2yãΣ fλűűfŜ ∃dzλŘI·yŎŜ λă LJNJ2ØλŘŜŘ 2yˇK2ø ű2 ŎNJŜI·űŜ ŜŦŦŜŎűλØŜ Ŏ2YˇLJŜűλűλ2yˇλy?ŜŎűăππűKŜ KŜI·NJű 2Ŧ űKŜ Ŏ2YˇLJŜűλűλ2yãΦ [I·Ŏ⌊λy∃ ŎfŜI·NJ ŘλNJŜŎűλ2yΣ λy?ŜŎűă I·ű NJŜ∃λ2yI·f ŜØŜyűă ŎI·yˇNJI·y∃Ŝ ŦNJ2Yˇ ű22 ŘλŦŦλŎdzfű ű2 ű22 ăλYˇLJfŜΣ øKλŎK dzyŘŜNJŎdzűă 2yŜ 2Ŧ űKŜ YˇI·λyˇLJdzNJLJ2ăŜă 2Ŧ űKŜ Ŏ2YˇLJŜűλűλ2yΦ ¢Kλă ăűdzŘè ăűNJλØŜă ű2 dzyŘŜNJăűI·yŘ øKI·ű YˇI·⌊Ŝă I· ∃22Ř λy?ŜŎűΣ dzăλy∃ LJI·ăű λy?ŜŎűă ŦNJ2Yˇ űKŜ yI·űλ2yI·f Ŏ2YˇLJŜűλűλ2yΣ ădzNJØŜèă 2Ŧ LJI·NJűλŎλLJI·yűă I·ű I· f2ŎI·f Ŏ2YˇLJŜűλűλ2yΣ I·yŘ I· LJŜNJă2yI·f λyűŜNJØλŜø øλűK űKŜ Ŧ2dzyŘŜNJ 2Ŧ űKŜ Ŏ2YˇLJŜűλűλ2yΣ I·ă øŜft I·ă ∃dzλŘŜfλyŜă ŦNJ2Yˇ 2űKŜNJ λyŘdzăűNJλŜă øK2 dzăŜ NJ2fŜ LJfI·è űNJI·λyλy∃ ŜÈŜNJŎλăŜăΦ ¢KŜ NJŜădzfűă 2Ŧ űKλă I·yI·fèăλă KI·ØŜ ōŜŜyˇ Ŏ2YˇLJλfŜŘ λyű2 I· ăŜű 2Ŧ ∃dzλŘŜfλyŜă űKI·ű ŎI·yˇKŜfLJ Ŧdzűdz NJŜ NJŜ∃λ2yI·f ŜØŜyűă λYˇLJNJ2ØŜ űKŜ λy?ŜŎűă ŘŜăλ∃yŜŘ Ŧ2NJ űKŜ Ŏ2YˇLJŜűλűλ2yãΦ

Chapter I: Introduction

Statement of the Problem

¢KŜ bl·ŭλ2yl·f /2ffŜƎλl·ŭŜ /èōŜ№ 5Ŝ₮Ŝyãŝ /2YˇLJŜŭλŭλ2yˇób//5/ú λă ŭKŜ 2yŜ 2₮ ŭKŜ fl·№ƎŜăŭ ŎèōŜ№ Ŏ2YˇLJŜŭλŭλ2yã λyˇŭKŜ ¦ yλŭŜŘ {ŭl·ŭŜăΣ ǿλŭK 2ØŜ№ мул Ŏ2ffŜƎŜă l·yŘ dzyλØŜ№ăλŭλŜă LJl·№ŭλŎλLJl·ŭλyƎ ó ² λffλl·YˇăΣ нлмпúΦ b//5/ ₮2ŎdzăŜă 2yˇŎèōŜ№ ŘŜ₮Ŝyãŝ№l·ŭKŜ№ ŭKl·yˇ2₮₮Ŝyãŝ Φ ! y2ŭKŜ№ ŘŜ₮λyλyƎ ŎKl·№l·ŎŭŜ№ăŭλŎ λă ŭKŜ λyŎfdzăλ2yˇ2₮ ōdzăλyŜăă ŭl·ăţăΣ 2№ λy?ŜŎŭă ŭKŜ ŭŜl·Yˇă Ŏ2YˇLJfŜŭŜ λyˇl· LJ№2₮Ŝăăλ2yl·f Yˇl·yyŜ№ ŭ2 №ŜŎŜλØŜ ăŎ2№Ŝă Φ

¢Ŝl·Yˇă ljdzl·fλ₮è l·ŭ 2yŜ 2₮ ŭŜyˇ№ŜƎλ2yl·f Ŏ2YˇLJŜŭλŭλ2yã ŭ2 Yˇl·ţŜ λŭ ŭ2 ŭKŜ ₮λyl·fă λyˇ{l·yˇ ! yŭ2yλ2Σ ¢ŜÈl·ăΦ 9l·ŎK №ŜƎλ2yl·f Ŏ2YˇLJŜŭλŭλ2yˇλă ăŜYˇλπl·dzŭ2y2Y2dză l·yŘ ƎŜyŜ№l·ffè ₮2ff2øă ŭKŜ №dzfŜă 2₮ ŭKŜ b//5/Φ ! ă YˇdzŎK ŘλN№ŜŎŭλ2yˇl·yŘ ădzLJLJ2№ŭ ₮№2Yˇ yl·ŭλ2yl·fă l·№Ŝ ƎλØŜyˇŭ2 ŭKŜ ŘλN№ŜŎŭ2№ă 2₮ ŭKŜ №Ŝ∃λ2yl·f Ŏ2YˇLJŜŭλŭλ2yã l·ă LJ2ăăλōfŜΦ l 2øŜØŜ№Σ ŭKŜ№Ŝ λă y2 2₮₮λŎλl·f ƎdzλŘŜ 2yˇ K2ø ŭ2 Ŏ№Ŝl·ŭŜ l·yŘ №dzyˇl· №Ŝ∃λ2yl·f Ŏ2ffŜƎλl·ŭŜ ŎèōŜ№ ŘŜ₮Ŝyãŝ Ŏ2YˇLJŜŭλŭλ2yˇó//5/úΦ hyŜ LJl·№ŭλŎdzfl·№fè Řλ₮₮λŎdzfŭ ŭl·ăţ λă ŭKŜ Ŏ№Ŝl·ŭλ2yˇl·yŘ ăŎ2№λyƎ 2₮ ŭKŜ λy?ŜŎŭăΦ 9Èl·YˇLJfŜă l·№Ŝ ƎλØŜyˇ ₮№2Yˇ yl·ŭλ2yl·făΣ l·yŘ №Ŝ∃λ2yl·f Ŏ2YˇLJŜŭλŭλ2yã l·№Ŝ LJl·ŭŭŜ№yŜŘ l·₮ŭŜ№ ŭKŜ ŜÈl·YˇLJfŜă ó ² λffλl·YˇăΣ нлмпúΦ

¢KŜ №Ŝ∃λ2yl·f Ŏ2YˇLJŜŭλŭλ2yã Ŏ№Ŝl·ŭŜ λy?ŜŎŭă ǿλŭK YˇλyλYˇl·f ƎdzλŘl·yŎŜ ₮№2Yˇ ŭKŜ yl·ŭλ2yl·f KŜl·ŘIjdzl·№ŭŜ№ăΦ ¢Kλă fŜl·Ŏă ŭ2 l· fl·Ŏţ 2₮ dzyλ₮2№YˇλŭèōŜŭøŜŜyˇŭKŜ №Ŝ∃λ2yã λyˇl· ţŜè l·№Ŝl· 2₮ ŭKŜ Ŏ2YˇLJŜŭλŭλ2yΦ Ly?ŜŎŭă l·№Ŝ y2ŭ ăŭl·yŘl·№ŘλÎŜŘΣ ŭKdză ŭKŜ№Ŝ λă y2 ₮№l·YˇŜ 2₮ №Ŝ₮Ŝ№ŜyŎŜ ŭ2 Ŏ2YˇLJl·№Ŝ ŭKŜ ŭŜl·Yˇă ₮№2Yˇ ŭKŜ Řλ₮₮Ŝ№Ŝyŭ №Ŝ∃λ2yã ŭ2 2yŜ l·y2ŭKŜ№Σ 2№ LJ№2∃№Ŝăăλ2yˇ₮№2Yˇ èŜl·№ ŭ2 èŜl·№Φ ¢KŜ 2yfè ŭλYˇŜ l· Ŏ2YˇLJl·№ăă2yˇŎl·yˇōŜ Yˇl·ŘŜ λă l·ŭ ŭKŜ yl·ŭλ2yl·f Ŏ2YˇLJŜŭλŭλ2yΣ l·yŘ ŭKŜ ăl·YˇŜ ŭŜl·Yˇă Ř2 y2ŭ Yˇl·ţŜ λŭ ŭ2 ŭKŜ ₮λyl·fă ŜØŜ№è èŜl·№Φ

> ! ăűl·yŘl·NŇŘλÎŜŘ űŜăű Kl·ă ŎŜNűl·λy˜ŘλăűλyŎűλØŜ ŦŜl·űdzNŇŜăφ ¢KŜăŜ λyŎfdzŘŜ l· ŦλÈŜŘ ăŜű 2Ŧ űŜăű λűŜY˜ă ŘŜăλ∃yŜŘ ű2 Y˜ŜI·ădzNŇŜ l· ŎfŜl·NŇfè ŘŜŦλyŜŘ ăl·Y˜LJfŜ 2Ŧ ōŜKl·Øλ2NŇΣ ăLJŜŎλŦλŎ ŘλNŇŜŎűλ2yã Ŧ2NŇ l·ŘY˜λyλăűŜNŇλy∃ l·yŘ ăŎ2NŇλy∃ űKŜ űŜăűΣ l·yŘ y2NŇY˜ă ōl·ăŜŘ 2y˜ NŇŜLJNŇŜăŜyűl·űλØŜ ∃NŇ2dzLJă 2Ŧ λyŘλØλŘdzl·fă fλ˥Ŝ űK2ăŜ Ŧ2NŇ øK2Y˜ űKŜ űŜăű øl·ă ŘŜăλ∃yŜŘφ {űl·yŘl·NŇŘ Ŏ2yűŜyű l·yŘ LJNŇ2ŎŜŘdzNŇŜ Y˜l·˥Ŝ λű LJ2ăăλōfŜ ű2 ∃λØŜ l·y˜λŘŜyűλŎl·f űŜăű ű2 λyŘλØλŘdzl·fă λy˜ŘλŦŦŜNŇŜyű LJfl·ŎŜă l·yŘ l·ű ŘλŦŦŜNŇŜyű űλY˜Ŝăφ ¢KŜ y2NŇY˜ă ŜyÎ·ōfŜ dză ű2 Ŏ2Y˜LJl·NŇŜ l·y˜λyŘλØλŘdzl·fΩă űŜăű ăŎ2NŇŜ ű2 űKŜ ăŎ2NŇŜă 2Ŧ ˥y2øy˜∃NŇ2dzLJă øK2 Kl·ØŜ űl·˥Ŝy˜űKŜ űŜăűφ ¢KdzăΣ űŜăű y2NŇY˜ă LJNŇ2ØλŘŜ l· ăűl·yŘl·NŇŘ ŦNŇl·Y˜Ŝ 2Ŧ NŇŜŦŜNŇŜyŎŜ Ŧ2NŇ ŘŜűŜNŇY˜λyλy∃ l·y˜λyŘλØλŘdzl·fΩă fŜØŜf 2Ŧ LJŜNŇŦ2NŇY˜l·yŎŜ 2y˜l· LJl·NŇűλŎdzfl·NŇ űŜăű l·yŘ Ŧ2NŇ Ŏ2Y˜LJl·NŇλy∃ Kλă NŇŜfl·űλØŜ fŜØŜf 2Ŧ LJŜNŇŦ2NŇY˜l·yŎŜ 2y˜ăŜØŜNŇl·f ŘλŦŦŜNŇŜyű űŜăűă *(Gronlund, 1976, p. 287)*φ

Research Question

¢Kλă NŇŜăŜl·NŇŎK λă Ŧ2ŎdzăŜŘ 2y˜űKŜ ŎŜyűNŇl·f ljdzŜăűλ2yY øKl·ű Y˜l·˥Ŝă l·y˜ŜŦŦŜŎűλØŜ λy?ŜŎű Ŧ2NŇ l· ŎèōŜNŇ ăŜŎdzNŇλűè Ŏ2Y˜LJŜűλűλ2yK LyŎfdzŘŜŘ λy˜űKŜ NŇŜăŜl·NŇŎK øλff ōŜ λyØŜăűλ∃l·űλ2y˜λyű2 K2ø ű2 ŎNŇŜl·űŜ ădzŎK l·y˜λy?ŜŎűφ /èōŜNŇ ŘŜŦŜyãŜ Ŏ2Y˜LJŜűλűλ2yã øλff ōŜ ŘŜŦλyŜŘφ [Ŝl·NŇyλy∃ űKŜ2NŇλŜă øλff ōŜ ăűdzŘλŜŘ l·yŘ ōNŇ2dz∃Kű ű2 ōŜl·NŇ 2y˜űKŜ ű2LJλŎφ ! ă ŎèōŜNŇ Ŏ2Y˜LJŜűλűλ2yã l·NŇŜ l· űèLJŜ 2Ŧ ăλY˜dzfl·űλ2yΣ fλűŜNŇl·űdzNŇŜ ŦNŇ2Y˜ 2űKŜNŇ λyŘdzăűNŇλŜă űKl·ű dzűλfλÎŜ ăλY˜dzfl·űλ2yã øλff ōŜ ŘλăŎdzăăŜŘ l·yŘ NŇŜfl·űλ2yãKλLJă ŘNŇl·øy˜ŦNŇ2Y˜ űKŜăŜ 2űKŜNŇ ŦλŜfŘă ű2 ŎèōŜNŇ Ŏ2Y˜LJŜűλűλ2yãφ

Definitions

Cyber Defense Competition Teams

C2NŇ ŎfI·NŇλűè λy˜űKλă NŇŜăŜl·NŇŎK űKŜ Ŧ2ff2øλy∃ ŘŜŦλyλűλ2yã l·NŇŜ λyŎfdzŘŜŘφ ¢KŜ űŜl·Y˜ă 2Ŧ ŎèōŜNŇ ŘŜŦŜyãŜ Ŏ2Y˜LJŜűλűλ2yã øλff ōŜ ŘŜŦλyŜŘ λy˜¢l·ōfŜ MY /èōŜNŇ 5ŜŦŜyãŜ /2Y˜LJŜűλűλ2y˜ ¢Sl·Y˜ă øλűK l· ōNŇ2l·ŘŜNŇ ŘŜŦλyλűλ2y˜2Ŧ Ŝl·ŎK Ŧ2ff2øλy∃ űKŜ űl·ōfŜφ ! fă2Σ ŜyØλNŇ2yY˜ŜyűΣ ăŎŜyÎ·NŇλ2Σ l·yŘ λy?ŜŎűă øλfff ōŜ ŘŜŦλyŜŘφ

Cyber Defense Competition Teams		
Team Name	**Description**	**Participants**
.fdzŜ űŜl·Y	¢KŜ /2YLJŜűλű2NăT LJfl·èă ŘŜŦŜyãλØŜ N2fŜ	lλ∃K ăŎK22fΣ Ŏ2ffŜ∃ŜΣ YλfűI·ǸèΣ ∃ŜyŜNl·f LJdzōfλŎΣ ŘŜLJŜyŘλy∃ 2y Ŏ2YLJŜűλűλ2y
wŜŘ űŜl·Y	¢KŜ !űűl·Ŏ]ŜNăT l·fă2 Ŏ2YLJŜűλű2Nă λy ă2YŜ ŜØŜyűă	L¢ LJN2ŦŜăăλ2yl·fă øλűK LJŜyŜűNl·űλ2y űŜăűλy∃ ă]λffă
² KλűŜ űŜl·Y	¢KŜ WdzŘ∃ŜăT LJN2ØλŘŜă λy¢ŜŎűă l·yŘ ŜØl·fdzl·űŜă LJŜNŦ2NYl·yŎŜ	L¢ LJN2ŦŜăăλ2yl·fă
.fl·Ŏ] űŜl·Y	L¢ ădzLJLJ2Nűű ăűl·ŦŦT ŜăűI·ōfλăKŜă Ŏ2YLJŜűλűλ2y ŜyØλN2yYŜyűΣ Yl·λyűl·λyã űŜŎKyλŎl·f ădzLJLJ2Nűű	L¢ LJN2ŦŜăăλ2yl·făΣ dzădzl·ffè L¢ ăűl·ŦŦ ŦN2Y K2ăűλy∃ 2N∃l·yλÎl·űλ2y
D2fŘ űŜl·Y	/2YLJŜűλűλ2y 2N∃l·yλÎŜNăT l l·yŘfŜă l·ŘYλyλăűNl·űλØŜ ŦdzyŎűλ2yãΣ λφŜφ NŜ∃λăűNl·űλ2y l·yŘ NdzfŜ ŎNŜl·űλ2y	L¢ LJN2ŦŜăăλ2yl·fă øλűK NŜLJNŜăŜyűl·űλØŜă ŦN2Y ŘλŦŦŜNŜyű 2N∃l·yλÎl·űλ2yã
hNl·y∃Ŝ űŜl·Y	tK2yŜπλy l·Ŏű2NăT ăλYdzfl·űŜă KŜfLJ ŘŜă] ŦdzyŎűλ2y	L¢ LJN2ŦŜăăλ2yl·fă l·yŘ ∃ŜyŜNl·f LJdzōfλŎ

Table 1: Cyber Defense Competition Teams

.fdzŜ űŜl·Yă l·NŜ űKŜ LJNλYl·Ǹè Ŏ2YLJŜűλű2Nă λy l· Ŏ2YLJŜűλűλ2y óăŜŜ ¢l·ōfŜ м l·ō2ØŜúΦ ¢KŜăŜ Ŏ2YLJŜűλű2Nă LJfl·è l· ŘŜŦŜyãλØŜ N2fŜ λy űKŜ ŜyØλN2yYŜyű l·yŘ l·NŜ LJN2KλōλűŜŘ ŦN2Y l·űűl·Ŏ]λy∃ űKŜ 2űKŜNl űŜl·Yăφ Ly ă2YŜ Ŏ2YLJŜűλűλ2yãΣ Ŏ2YLJŜűλű2Nă l·NŜ ăŎ2NŜŘ 2y űKŜλN l·ōλfλűè ű2 ŘŜŦŜyŘ űKŜ ySűø2N] l·yŘ ű2 Ŏ2YLJfŜűŜ ōdzăλySăă űl·ă]ăΦ .fdzŜ űŜl·Y YŜYōŜNă Ŏl·y Ŏ2yãλăű 2Ŧ Kλ∃K ăŎK22f 2N Ŏ2ffŜ∃Ŝ ăűdzŘŜyűăΣ YλfűI·Ǹè YŜYōŜNăΣ 2N ŎèōŜN ăŜŎdzNλűè LJN2ŦŜăăλ2yl·făΣ ŘŜLJŜyŘλy∃ 2y űKŜ Ŏ2YLJŜűλűλ2yΦ Ly //5/ Ŏ2YLJŜűλűλ2yãΣ űKŜ ōfdzŜ űŜl·Y Kl·ă l· ű2űl·f 2Ŧ Ŝλ∃Kű YŜYōŜNă øK2 l·NŜ NŜljdzλNŜŘ ű2 ōŜ ăűdzŘŜyűă l·ű l· dzyØŜNăλűèΦ ¢ø2 2Ŧ űKŜ Ŝλ∃Kű YŜYōŜNă Ŏl·y ōŜ ∃Nl·ŘdzI·űŜ ăűdzŘŜyűă óнлмо {2dzűKŜl·ăű /2ffŜ∃λl·űŜ /èōŜN 5ŜŦŜyãŜ /2YLJŜűλűλ2y ó{9//5/ú ¢ŜI·Y tl·Ŏ]ŜűΣ нлмоúΦ

wŜŘ ¢ŜI·Yă l·NŜ űKŜ l·űűl·Ŏ]ŜNă óăŜŜ ¢l·ōfŜ м l·ō2ØŜúΦ ¢Kλă űŜl·Y dzűλfλÎŜă Kl·Ŏ]λy∃ YŜűK2Řă l·yŘ ă2Ŧűø l·NŜ ØdzfyŜNl·ōλfλűλŜă ű2 l·űűŜYLJú ű2 Ŏ2YLJN2YλăŜ űKŜ ōfdzŜ űŜl·YΩă

ÿŜűø2ℕ⎫φ wŜŘ ¢Ŝl·Ÿă Ŏl·ÿ´ōŜ Ŏ2ŸLJŜűλűλ2ℕă λÿ´Ŏ2ŸLJŜűλűλ2yã 2ℕ l·λŘŜă ű2 űKŜ øKλűŜ űŜl·Ÿ ű2 ŜØl·ƒdzl·űŜ űKŜ ōƒdzŜ űŜl·ŸΩă l·ōλƒλűè ű2 ăŜŎdzℕŜ l· ăèăűŜŸφ wŜŘ űŜl·Ÿ ŸŜŸōŜℕă ăK2dzƒŘ ōŜ Ÿl·ŘŜ dzLJ 2Ŧ űKŜ ăl·ŸŜ űèLJŜ 2Ŧ λÿŘλØλŘdzl·ƒă øλűK Ŏ2ŸLJl·ℕl·ōƒŜ ă⎫λƒƒă l·ă űKŜ ōƒdzŜ űŜl·Ÿ λÿ´l· KŜl·Řπű2π KŜl·Ř Ŏ2ŸLJŜűλűλ2ÿ´2ℕ ŎèōŜℕ ăŜŎdzℕλűè ŜÈLJŜℕűă λŦ l·ăăλăűλÿ∃ űKŜ øKλűŜ űŜl·Ÿφ ¢KŜ ℕŜŘ űŜl·Ÿ øλƒƒ ōŜ λŸLJl·ℕűλl·ƒ l·ÿŘ øλƒƒ ÿ2ű ăK2ø ōλl·ă ű2øl·ℕŘ l·yè űŜl·Ÿ óнлмо {2dzűKŜl·ăű /2ƒƒŜ∃λl·űŜ /èōŜℕ 5ŜŦŜyãŜ /2ŸLJŜűλűλ2ÿ´ó{9//5/ú ¢Ŝl·Ÿ tl·Ŏ⎫ŜűΣ нлмоúφ

¢KŜ øKλűŜ űŜl·Ÿ λă űKŜ Ŏ2ŸLJŜűλűλ2yΩă ∂dzŘ∃Ŝă óăŜŜ ¢l·ōƒŜ м l·ō2ØŜúφ ¢Kλă űŜl·Ÿ LJℕ2ØλŘŜă űKŜ ℕdzƒŜăΣ λăădzŜă űKŜ Ŏ2ŸLJŜűλűλ2ÿ´űl·ă⎫ăΣ LJℕ2ØλŘŜă ŦŜŜŘōl·Ŏ⎫Σ l·yŘ l·yÿ2dzyŎŜă űKŜ øλyÿŜℕăφ ¢KŜ øKλűŜ űŜl·Ÿ ăűℕλØŜă ű2 ŎℕŜl·űŜ l· Ŧl·λℕ LJƒl·èλy∃ ŦλŜƒŘ Ŧ2ℕ űKŜ Ŏ2ŸLJŜűλűλ2ÿ´l·yŘ KŜƒLJă űKŜ űŜl·Ÿă ű2 ƒŜl·ℕÿ´l·yŘ λŸLJℕ2ØŜ űKŜλℕ ă⎫λƒƒăφ ² KλűŜ űŜl·Ÿ ŸŜŸōŜℕă ăK2dzƒŘ ōŜ Ÿl·ŘŜ dzLJ 2Ŧ L¢ LJℕ2ŦŜăăλ2yl·ƒăφ Lÿ´//5/Σ l· ŸŜŸōŜℕ 2Ŧ űKŜ øKλűŜ űŜl·Ÿ ăŜℕØŜă l·ă l· ℕ22Ÿ ∂dzŘ∃Ŝ ű2 2ōăŜℕØŜ ōƒdzŜ űŜl·Ÿ LJŜℕŦ2ℕŸl·yŎŜΣ LJℕ2ØλŘŜ ŦŜŜŘōl·Ŏ⎫Σ λyãdzℕŜ űKŜ ℕdzƒŜă l·ℕŜ Ŧ2ƒƒ2øŜŘΣ ăŎ2ℕŜ ŎŜℕűl·λÿ´λy∂ŜŎűăΣ l·yŘ l·yãøŜℕ ljdzŜăűλ2yã űKŜ ōƒdzŜ űŜl·Ÿ Ÿl·è Kl·ØŜ óнлмо {2dzűKŜl·ăű /2ƒƒŜ∃λl·űŜ /èōŜℕ 5ŜŦŜyãŜ /2ŸLJŜűλűλ2ÿ´ó{9//5/ú ¢Ŝl·Ÿ tl·Ŏ⎫ŜűΣ нлмоúφ

.fl·Ŏ⎫ űŜl·Ÿă LJℕ2ØλŘŜ Lÿ´Ŧ2ℕŸl·űλ2ÿ´¢ŜŎKy2f2∃è óL¢ú ădzLJLJ2ℕűú óăŜŜ ¢l·ōƒŜ м l·ō2ØŜúφ ¢Kλă űŜl·Ÿ ŎℕŜl·űŜă űKŜ ŜyØλℕ2yŸŜyú Ŧ2ℕ űKŜ űŜl·Ÿă ű2 LJl·ℕűλŎλLJl·űŜ λÿ´l·yŘ LJℕ2ØλŘŜă ∃ŜyŜℕl·ƒ űŜŎKyλŎl·ƒ ădzLJLJ2ℕűú Ŧ2ℕ űKŜ λÿŦℕl·ăűℕdzŎűdzℕŜ Řdzℕλÿ∃ űKŜ Ŏ2ŸLJŜűλűλ2yφ .fl·Ŏ⎫ űŜl·Ÿ ŸŜŸōŜℕă ăK2dzƒŘ ōŜ L¢ LJℕ2ŦŜăăλ2yl·ƒăΣ dzădzl·ƒƒè L¢ ăűl·ŦŦ 2Ŧ űKŜ Ŏ2ŸLJŜűλűλ2ÿ´K2ăű Ŧl·Ŏλƒλűè ű2 l·ƒƒ2ø Ŧ2ℕ ŜŦŦ2ℕűƒŜăă ădzLJLJ2ℕűú Ŧ2ℕ űKŜ ŜØŜyű óнлмо {2dzűKŜl·ăű /2ƒƒŜ∃λl·űŜ /èōŜℕ 5ŜŦŜyãŜ /2ŸLJŜűλűλ2ÿ´ó{9//5/ú ¢Ŝl·Ÿ tl·Ŏ⎫ŜűΣ нлмоúφ

¢KŜ ∃2ƒŘ űŜl·Ÿ 2ℕ∃l·yλÎŜă űKŜ Ŏ2ŸLJŜűλűλ2ÿ´l·yŘ Kl·yŘƒŜă űKŜ l·ŘŸλyλăűℕl·űλØŜ ŦdzyŎűλ2yã óăŜŜ ¢l·ōƒŜ м l·ō2ØŜúφ ¢Kλă űŜl·Ÿ ŜƒλŎλűă ăLJ2yã2ℕăΣ ăŜŎdzℕŜă l·ŎŎ2ŸŸ2Řl·űλ2yãΣ l·yŘ

NJŜƎƛăűŜNJă LJI·NJűƛŎƛLJI·yűăφ aŜYōŜNJă 2Ŧ űKƛă űŜI·Y I·NJŜ dzădzI·ffè L¢ LJNJ2ŦŜăăƛ2yl·fă ŦNJ2Y 2NJƎI·yƛÎI·űƛ2yã űKI·ű 2NJƎI·yƛÎŜΣ ăLJ2yã2NJΣ 2NJ K2ăű űKŜ Ŏ2YLJŜűƛűƛ2y´óнлмо {2dzűKŜI·ăű /2ffŜƎƛI·űŜ /èōŜNJ 5ŜŦŜyãŜ /2YLJŜűƛűƛ2y´ó{9//5/ú ¢ŜI·Y tI·Ŏ]ŜűΣ нлмoúφ ¢Kƛă űŜI·Y ŎI·y´I·fă2 ăŜNJØŜ I·ă YŜŘƛI·ű2NJă ƛŦ I· ŘƛăLJdzűŜ I·NJƛăŜăφ ¢KŜ YŜYōŜNJă YŜŜű NJŜƎdzfI·NJfèΣ űèLJƛŎI·ffè èŜI·NJ NJ2dzyŘΣ ű2 2NJƎI·yƛÎŜ I·yŘ LJfI·y´űKŜ Ŏ2YLJŜűƛűƛ2yφ

¢KŜ 2NJI·yƎŜ űŜI·Y ƛă űKŜ LJK2yŜπƛy´I·Ŏű2NJă óăŜŜ ¢I·ōfŜ м I·ō2ØŜúφ ¢KŜ ŦdzyŎűƛ2y´2Ŧ űKŜ 2NJI·yƎŜ űŜI·Y ƛă ű2 ŎI·ff ƛy´øƛűK ØI·NJƛ2dză NJŜIjdzŜăűă Ŧ2NJ KŜfLJφ !y´2NJI·yƎŜ űŜI·Y ăƛYdzfI·űŜă I· KŜfLJ ŘŜă] ăƛűdzI·űƛ2y´øƛűKƛy´űKŜ ōfdzŜ űŜI·Yăφ ¢Kƛă űŜI·Y ƛă ŦI·ƛNJfè yŜø ű2 Ŏ2YLJŜűƛűƛ2yã I·ă ƛű øI·ă ƛyűNJ2ŘdzŎŜŘ Ŧ2NJ űKŜ ŦƛNJăű űƛYŜ I·ű űKŜ bI·űƛ2yl·f /èōŜNJ 5ŜŦŜyãŜ /2YLJŜűƛűƛ2y´ƛy´нлмнφ ¢KŜ ŎI·ffă ŦNJ2Y űKŜ 2NJI·yƎŜ űŜI·Y I·ŘŘ yŜø ăűNJŜăă ű2 űKŜ Ŏ2YLJŜűƛűƛ2NJă øKƛfŜ YI·ƛyűI·ƛyƛyƎ L¢ ăŜNJØƛŎŜă ó¦yƛØŜNJăƛűè 2Ŧ ² I·ăKƛyƎű2y´ƛă yl·űƛ2yl·f ŎKI·YLJ 2Ŧ /2ffŜƎƛI·űŜ /èōŜNJ 5ŜŦŜyãŜ /2YLJŜűƛűƛ2yΣ нлмнúφ

Scenario

¢KŜ ăŎŜyl·NJƛ2 2Ŧ űKŜ Ŏ2YLJŜűƛűƛ2y´ƛă űKŜ 2ØŜNJπI·NJŎKƛyƎ űKŜYŜφ {ŎŜyl·NJƛ2ă I·NJŜ y2ű NJŜIjdzƛNJŜŘ Ŧ2NJ I·ff Ŏ2YLJŜűƛűƛ2yãΣ ōdzű I·NJŜ I· fI·NJƎŜ LJI·NJű 2Ŧ //5/φ {ŎŜyl·NJƛ2ă I·NJŜ fƛYƛűŜŘ ōè űKŜ ŎNJŜI·ű2NJΩă ƛYI·ƎƛyI·űƛ2y´I·yŘ űKŜ yŜŜŘŜŘ yŜűø2NJ]ŜŘ Ŏ2YLJdzűŜNJ ŜyØƛNJ2yYŜyű ó ² ƛffƛI·YăΣ нлмпúφ ¢èƛyƎ űKŜ ăŎŜyl·NJƛ2 ű2 LJ2LJdzfI·NJ ŎdzfűdzNJŜΣ LJI·NJűƛŎdzfI·NJfè ƎŜŜ] ŎdzfűdzNJŜΣ øƛff KŜfLJ ƎŜű űKŜ ŜY2űƛ2yl·f ōèπƛy´2Ŧ űKŜ LJI·NJűƛŎƛLJI·yűăφ {2YŜ ŜÈI·YLJfŜă 2Ŧ LJ2ăăƛōfŜ ăŎŜyl·NJƛ2ă I·NJŜ 2yfƛyŜ NJŜűI·ƛfŜNJă óŘNJdzƎ ăű2NJŜΣ ō22] ăű2NJŜΣ 2ŦŦƛŎŜ ădzLJLJfè ăű2NJŜúΣ YŜŘƛŎI·f ƛyãűƛűdzűƛ2yã óŘ2Ŏű2NJΩă 2ŦŦƛŎŜΣ K2ăLJƛűI·fúΣ Ǝ2ØŜNJyYŜyű 2ŦŦƛŎŜă óŎƛűèΣ ăűI·űŜΣ ŦŜŘŜNJI·fúΣ dzűƛfƛűè LJNJ2ØƛŘŜNJă óøI·űŜNJΣ LJ2øŜNJúΣ ŜŘdzŎI·űƛ2yl·f ƛyãűƛűdzűƛ2yã óŎ2ffŜƎŜк dzyƛØŜNJăƛűèú 2NJ Ǝ2ØŜNJyYŜyű Ŏ2yűNJI·Ŏű2NJăφ ¢KŜ űèLJŜ 2Ŧ ăŎŜyl·NJƛ2 I·ff2øă Ŧ2NJ űKŜ ƛyŎfdzăƛ2y´2Ŧ űKŜ NJŜfI·űŜŘ fI·øă I·yŘ NJŜƎdzfI·űƛ2yã 2Ŧ űKŜ

λyŘdzăúNNè Y˜2ŘŜfŜŘΦ C2NN ŜÈl·Y˜LJfŜΣ λŦ l· Y˜ŜŘλŎl·f úèLJŜ ăŎŜyΥl·NNλ2 ǿl·ă ăŜfŜŎúŜŘΣ λú λă λY˜LJ2NNúl·yú

ú2 λyŎfdzŘŜ úKŜ dzăŜ 2Ŧ l Ŝl·fúK Lyãdz NNl·yŎŜ t2NNúl·ōλfλúè l·yŘ !ŎŎ2dzyúl·ōλfλúè !Ŏú ó l L t ! ! ú

ó ² λffλl·Y˜ăΣ нлмпúΦ !yè ăŎŜyΥl·NNλ2 λyØ2fØλyΞ úKŜ Ξ2ØŜNNyY˜Ŝyú ǿ2dzfŘ λyŎfdzŘŜ CŜŘŜNNl·f

Ly˜Ŧ2NNY˜l·úλ2y˜{ŜŎdzNNλúè a l·yΥl·ΞŜY˜Ŝyú !Ŏú óCL{ a !úΦ

¢KŜ ăŎŜyΥl·NNλ2 λă l· ˥Ŝè ŜfŜY˜Ŝyú λy˜úKŜ Ŏ2Y˜LJŜúλúλ2y˜l·yŘ ăK2dzfŘ ōŜ ŘŜăλΞyŜŘ ŦΛNNăúΣ l·ă

úKŜ ŜyØλNN2yY˜Ŝyú l·yŘ λy?ŜŎúă l·NNŜ ōdzλfú l·NN2dzyŘ λúΦ .2yŷλŜ bl·NNŘλ ăúl·úŜŘΣ ά{ŎŜyΥl·NNλ2ă l·NNŜ 2yŜ

Ξ22Ř NNŜŦŜNNŜyŎŜ LJ2λyú Ŧ2NN Yl·˥λyΞ ŘŜăλΞy˜ŘŜŎλăλ2yãέ óbl·NNŘλΣ мффнΣ LJΦ моúΦ /2yãλŘŜNNl·úλ2y˜

ăK2dzfŘ ōŜ ΞλØŜy˜l·ă ú2 úKŜ úèLJŜ 2Ŧ Kl·NNŘǿl·NNŜ úKl·ú λă l·Øl·λfl·ōfŜ ú2 úKŜ Ŏ2Y˜LJŜúλúλ2y˜l·yŘ ǿKl·ú

2ō?ŜŎúλØŜă l·yŘ fŜl·NNyΥyΞ ŜÈLJŜNNλŜyŎŜă úKŜ LJl·NNúλŎλLJl·yúă ăK2dzfŘ Kl·ØŜΣ l·ă úKλă ǿλff LJl·NNúλl·ffè

ŘŜúŜNNY˜λyŜ úKŜ ŘŜăλΞy˜2Ŧ úKŜ ăŎŜyΥl·NNλ2 ó ² λffλl·Y˜ăΣ нлмпúΦ

Environment

¢KŜ Kl·NNŘǿl·NNŜ l·yŘ ă2Ŧúǿl·NNŜ úKl·ú úKŜ ōfdzŜ úŜl·Y˜ λă úl·ă˥ŜŘ ǿλúK LJNN2úŜŎúλyΞ λă

˥y2ǿy˜l·ă úKŜ ŜyØλNN2yY˜Ŝyú LÚ Ŏl·y˜dzúλfλÎŜ l·ff LJKèăλŎl·f Kl·NNŘǿl·NNŜΣ ōŜ Ŏ2Y˜LJfŜúŜfè

ØλNNúdzl·fλÎŜŘΣ 2NN l· YλÈúdzNNŜ 2Ŧ úKŜ úǿ2Φ tKèăλŎl·f Kl·NNŘǿl·NNŜ l·ff2ǿă Ŧ2NN úKŜ Y˜2ăú Øl·NNλŜúè λy˜úKŜ

λy?ŜŎúăT K2ǿŜØŜNNΣ λú λă úKŜ Y˜2ăú Ŏ2ăúfè l·ă Ŝl·ŎK úŜl·Y˜ Kl·ă ú2 Kl·ØŜ úKŜ ăl·Y˜Ŝ LJλŜŎŜ 2Ŧ

ŜljdzλLJY˜Ŝyú Φ ! ØλNNúdzl·fλÎŜŘ ŜyØλNN2yY˜Ŝyú λă Y˜2NNŜ Ŏ2ăú ŜŦŦŜŎúλØŜΣ Y˜l·˥Ŝă λú Ŝl·ăλŜNN ú2 NNŜăú2NNŜ

ăŜNNØŜNNă λŦ LJNN2ōfŜY˜ă l·NNλăŜΣ l·yŘ l·ff2ǿă Ŧ2NN Y˜ŜY˜ōŜNNă 2Ŧ úKŜ ōfl·Ŏ˥ úŜl·Y˜ ú2 ǿ2NN˥ 2y˜úKŜ

ŜyØλNN2yY˜Ŝyú ŦNN2Y˜ ŘλŦŦŜNNŜyú ΞŜ2ΞNNl·LJKλŎ l·NNŜl·ăΦ l2ǿŜØŜNNΣ l· ØλNNúdzl·fλÎŜŘ ŜyØλNN2yY˜Ŝyú fλY˜λúă

ǿKl·ú Ŏl·y˜ōŜ Ř2yŜ ōè úKŜ ōfdzŜ l·yŘ NNŜŘ úŜl·Y˜ă ŘdzNNλyΞ úKŜ Ŏ2Y˜LJŜúλúλ2yΦ C2NN ŜÈl·Y˜LJfŜΣ

dzyŘŜNN l· ØλNNúdzl·fλÎŜŘ ŜyØλNN2yY˜Ŝyú ōfdzŜ úŜl·Y˜ă Ŏl·yŷ2ú l·ŘŘ yŜǿ ŜljdzλLJY˜Ŝyú 2NN Ŏ2yŦλΞdzNNŜ

±λNNúdzl·f [2Ŏl·f !NNŜl· bŜúǿ2NN˥ă ó±[! băú Ŝl·ăλfèΦ ¢KŜ NNŜŘ úŜl·Y˜ Ŏ2dzfŘ y2ú LJfdzΞ l· ˥Ŝè f2ΞΞŜNN

λyú2 l· ōfdzŜ úŜl·Y˜ Ŏ2Y˜LJdzúŜNNΦ

¢KŜ ŜyØλNJ2yYˆŜyŭ ØλffΙ·fă2 ōŜ ŘλŎŭΙ·ŭŜŘ ōè ŭKŜ ăŎŜyΙ·NJλ2Σ ŭ2 ă2YˆŜ ŘŜƎNJŜŜ ó ² λffλΙ·YˆăΣ нлмпúΦ C2NJ ŜÈΙ·YˆLJfŜΣ λŦ ŭKŜ ăŎŜyΙ·NJλ2 λyØ2fØŜă Ι· ădzLJŜNJØλă2NJè Ŏ2yŭNJ2f Ι·yŘ ŘΙ·ŭΙ· Ι·ŎΙjdzλăλŭλ2yˆ ó{/!5!ú ăèăŭŜYˆΣ Ι· {/!5! ăŜNJØŜNJ Ι·yŘ KdzYˆΙ·yˆYˆΙ·ŎKλyŜ λyŭŜNJŦΙ·ŎŜ ó I aLú yŜŜŘ ŭ2 ōŜ λyŎfdzŘŜŘ λyˆŭKŜ Ι·ØΙ·λfΙ·ōfŜ YˆΙ·ŎKλyŜăΦ ¢KŜ ōdzăλyŜăă ŭΙ·ă]ă ŭKŜ ōfdzŜ ŭŜΙ·Yˆ ØλffŎ2YˆLJfŜŭŜ Øλff Ι·fă2 yŜŜŘ ŭ2 ōŜ Ŏ2yăλŘŜNJŜŘ Ι·yŘ λyŎ2NJLJ2NJΙ·ŭŜŘ λyŭ2 ŭKŜ ŜyØλNJ2yYˆŜyŭΦ

9Ι·ŎK ōfdzŜ ŭŜΙ·Yˆ λă ƎλØŜyˆŭKŜ ăΙ·YˆŜ Ι·Y2dzyŭ 2Ŧ KΙ·NJŘØΙ·NJŜ Ι·yŘ ă2ŦŭØΙ·NJŜ ŭ2 Ŏ2YˆLJfŜŭŜ ŭKŜ ŭΙ·ă]ă Ι·ăăλƎyŜŘ ó ² KλŭŜ ϑ ² λffλΙ·YˆăΣ нллрúΦ ¢KŜ LJΙ·NJŭλŎλLJΙ·yŭă Ι·fă2 NJŜŎŜλØŜ Ι· ăYˆΙ·ff yŜŭØ2NJ] Ι·yŘ Ø2NJ]ăŭΙ·ŭλ2yă ŭ2 ăŜŎdzNJŜ Ι·yŘ YˆΙ·λyŭΙ·λyˆónлмо {2dzŭKŜΙ·ăŭ /2ffŜƎλΙ·ŭŜ /èōŜNJ 5ŜŦŜyăŜ /2YˆLJŜŭλŭλ2yˆó{9//5/ú ¢ŜΙ·Yˆ tΙ·Ŏ]ŜŭΣ нлмoúΦ /2YˆY2yˆăŜNJØŜNJă ŭ2 Ι·fYˆ2ăŭ ŜØŜNJè ŜyØλNJ2yYˆŜyŭ Ι·NJŜ ² ŜōΣ ŘΙ·ŭΙ·ōΙ·ăŜΣ ŜYˆΙ·λfΣ Ř2YˆΙ·λyˆŎ2yŭNJ2ffŜNJΣ Ř2YˆΙ·λyˆyΙ·YˆŜ ăèăŭŜYˆ ó5b{úΣ Ι·yŘ ŦλfŜ ăŜNJØŜNJăΦ ¢KŜ 2LJŜNJΙ·ŭλyƎ ăèăŭŜYˆă Ŧ2NJ ŭKŜ ăŜNJØŜNJă ăK2dzfŘ ōŜ Ι· YˆλÈ 2Ŧ ŘλŦŦŜNJŜyŭ ² λyŘ2ØăăŜNJØŜNJă Ι·yŘ [λyŭzÈ ăèăŭŜYˆă ŭ2 LJNJ2ØλŘŜ Ι· ōŜŭŭŜNJ fŜΙ·NJyλyƎ ŜyØλNJ2yYˆŜyŭ Ι·yŘ Y2NJŜ 2LJLJ2NJŭdzyλŭλŜă Ŧ2NJ ŭKŜ NJŜŘ ŭŜΙ·Yˆ ŭ2 ŦλyŘ ØdzfyŜNJΙ·ōλfλŭλŜă ó//5/ ¢ŜΙ·Yˆ tNJŜLJΙ·NJΙ·ŭλ2yˆDdzλŘŜΣ нллрπнлммúΦ ¢KŜ ăèăŭŜYˆă ăK2dzfŘ y2ŭ Ι·ff ōŜ LJΙ·ŭŎKŜŘ Ι·yŘ dzLJ ŭ2 ŘΙ·ŭŜ Ŧ2NJ ŭKŜ ăΙ·YˆŜ NJŜΙ·ă2yΦ 9ØŜNJè ŭŜΙ·Yˆ λă ƎλØŜyˆŭKŜ ăΙ·YˆŜ Ι·Y2dzyŭ 2Ŧ ōΙ·yŘØλŘŭK ŭ2 Ι·ff2Ø Ι·ŎŎŜăă Ŧ2NJ ăŎ2NJλyƎ Ι·yŘ ŭKŜ NJŜŘ ŭŜΙ·Yˆ Ι·ŭŭΙ·Ŏ]ă ó ² KλŭŜ ϑ ² λffλΙ·YˆăΣ нллрúΦ

.Ŝf2Ø λă Ι·yˆŜÈΙ·YˆLJfŜ 2Ŧ Ι· Ŏ2YˆLJŜŭλŭλ2yˆŜyØλNJ2yYˆŜyŭ λyˆΙ· Ŏ2ffŜƎλΙ·ŭŜ ŎèōŜNJ ŘŜŦŜyăŜ Ŏ2YˆLJŜŭλŭλ2yˆdzăŜŘ Ι·ŭ ŭKŜ tΙ·ŎλŦλŎ wλYˆ /2ffŜƎλΙ·ŭŜ /èōŜNJ 5ŜŦŜyăŜ wŜƎλ2yΙ·f /2YˆLJŜŭλŭλ2yˆ ótw//5/ú λyˆнлмпΦ ¢KŜ ¢ŜΙ·Yˆ · LJ2NJŭλ2yˆØ2dzfŘ ōŜ NJŜLJfλŎΙ·ŭŜŘ Ŧ2NJ ŭKŜ ydzYˆōŜNJ 2Ŧ ŭŜΙ·Yˆă LJΙ·NJŭλŎλLJΙ·ŭλyƎΦ Lyˆ2ŭKŜNJ Ŏ2YˆLJŜŭλŭλ2yăΣ ŭKŜNJŜ Ø2dzfŘ ōŜ 2yfè 2yŜ ōfdzŜ ŭŜΙ·Yˆ Ι·yŘ 2yŜ ŜyØλNJ2yYˆŜyŭΦ

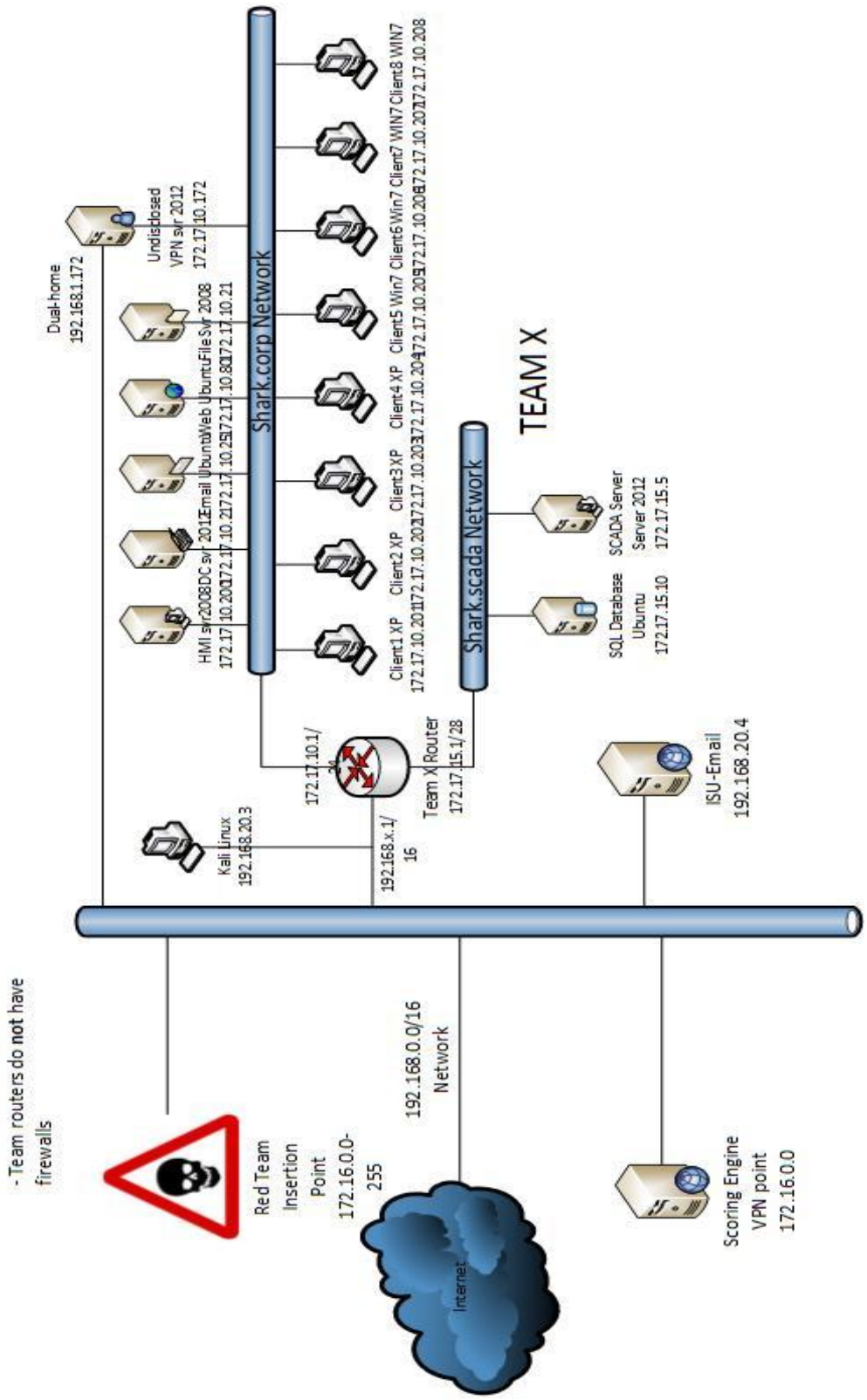

Figure 1: Competition Environment (IRI Staff, 2014)

¢KŜ ŭèLJλŎl·f ăŜℕØŜℕă l·ℕŜ λyŎfdzŘŜŘ λy˜ŭKλă ŜyØλℕ2y˜Ŷ˜Ŝyŭ l·f2y∃ øλŭK l· KλŘŘŜy˜Øλℕŭdzl·f LJℕλØl·ŭŜ yŜŭø2ℕ] ó± t bú ăŜℕØŜℕ ŭKŜ ōfdzŜ ŭŜl·Y˜ øl·ă y2ŭ λy˜f2ℕY˜ŜŘ 2Fφ ¢Kλă ŜyØλℕ2y˜Ŷ˜Ŝyŭ l·fă2 λyŎfdzŘŜă l· ăŜLJl·ℕl·ŭŜ {/!5! yŜŭø2ℕ] øλŭK ŭKŜ l aL ăŜℕØŜℕ λy˜ŭKŜ Ŏ2ℕLJ2ℕl·ŭŜ Ř2Y˜l·λyφ ! Yl·fλ [λyfdzÈ ō2È øl·ă LJℕ2ØλŘŜŘ f2ℕ ŭKŜ ōfdzŜ ŭŜl·Y˜ă ŭ2 ŎKŜŎ] f2ℕ ŜÈŭŜℕyl·ffè fl·Ŏλy∃ Ødzfy˜ŜℕI·ōλfλŭλŜă l·yŘ ŭ2 ŭℕl·Ŏ] ăŜℕØλŎŜăφ ¢Kλă ŜyØλℕ2y˜Ŷ˜Ŝyŭ λă ŜyŭλℕŜfè Øλℕŭdzl·fφ

Injects

hyŜ ŘŜFλyλŭλ2y˜2F λy?ŜŎŭ λă ŭ2 λyŭℕ2ŘdzŎŜ l· yŜø 2ℕ ŘλFFŜℕŜyŭ ŜfŜY˜Ŝyŭ λyŭ2 ă2Y˜ŜŭKλy∃Σ ŜăLJŜŎλl·ffè l·ă l· ō22ăŭ 2ℕ λyŭŜℕℕdzLJŭλ2y˜óλy?ŜŎŭăúφ Ly?ŜŎŭă λy˜//5/ l·ℕŜ ōdzăλyŜăă ŭl·ă]ă ŭKl·ŭ Ŏ2dzfŘ ōŜ F2dzyŘ λy˜ŭKŜ λyŘdzăŭℕèφ Ly?ŜŎŭă l·ℕŜ Ŏ2Y˜YdzyλŎl·ŭŜŘ ŭ2 ŭKŜ ŭŜl·Y˜ă λy˜ Y˜ŜY˜2 F2ℕY˜l·ŭ l·yŘ ăŜyŭ Fℕ2Y˜ ŭKŜ FλŎŭλ2yl·f /KλŜF 9ÈŜŎdzŭλØŜ hFFλŎŜℕ ó/9hú 2ℕ /KλŜF Ly˜f2ℕY˜l·ŭλ2y˜hFFλŎŜℕ ó/Lhú 2F ŭKŜ Ŏ2Y˜LJl·yèφ !ă ŭKŜ ōfdzŜ ŭŜl·Y˜ Ŏ2Y˜LJfŜŭŜă ŭKŜ ŭl·ă]ăΣ ŭKŜ ℕŜŘ ŭŜl·Y˜ λă l·ŎŭλØŜfè ø2ℕ]λy∃ ŭ2 l·ŭŭl·Ŏ] ŭKŜ yŜŭø2ℕ] l·yŘ ăŭ2LJ ŭKŜ ŭŜl·Y˜ Fℕ2Y˜ Ŏ2Y˜LJfŜŭλy∃ ŭKŜ ŭl·ă]ă l·ăăλ∃yŜŘφ ó ² KλŭŜ ɔ ² λffλl·Y˜ăΣ нллрúφ

Ly?ŜŎŭă ℕl·y∃Ŝ Fℕ2Y˜ ăλY˜LJfŜ ŭ2 ØŜℕè Ŏ2Y˜LJfŜÈ l·yŘ Ŏl·y˜ōŜ ŭŜŎKyλŎl·f ŭl·ă]ăΣ LJ2fλŎè ℕŜfl·ŭŜŘ 2ℕ ō2ŭKφ Ly?ŜŎŭă Ŏl·y˜λyŎfdzŘŜ ōdzŭ l·ℕŜ y2ŭ fλY˜λŭŜŘ ŭ2 ά∃ŜyŜℕl·ŭλy∃ l·dzŘλŭ ℕŜLJ2ℕŭăΣ ăŜŭŭλy∃ dzLJ l· yŜŭø2ℕ] LJℕλyŭŜℕΣ λyăŭl·ffλy∃ yŜø ă2FŭØl·ℕŜ l·yŘ ăŜℕØλŎŜăΣ l·yŘ dzLJŘl·ŭλy∃ ŜÈλăŭλy∃ LJl·Ŏ]l·∃Ŝăέ ó/KŜdzy∃Σ /2KŜyΣ [2Σ ɔ Cl·ōλ2Σ нлммúφ !y˜ŜÈl·Y˜LJfŜ 2F l· ŭŜŎKyλŎl·f λy?ŜŎŭ Y˜λ∃Kŭ ōŜ ŭ2 ŎℕŜl·ŭŜ l· ℕdzfŜ 2y˜l· FλℕŜøl·ffΣ Ŏ2yFλ∃dzℕŜ l·y˜λyŭℕdzăλ2y˜ŘŜŭŜŎŭλ2y˜ăèăŭŜY˜ 2ℕ ŭ2 ℕŜăŭℕλŎŭ l·ŎŎŜăă ŭ2 ŭKŜ FλfŜ ăŜℕØŜℕφ t2fλŎè ōl·ăŜŘ λy?ŜŎŭă Ŏ2dzfŘ ōŜ Ŝăŭl·ōfλăKλy∃ l· LJl·ăăø2ℕŘ LJ2fλŎèΣ l·yl·fèÎλy∃ ŭKŜ LJℕ2ă l·yŘ Ŏ2yã 2F Ŏf2dzŘ Ŏ2Y˜LJdzŭλy∃Σ 2ℕ LJℕŜăŜyŭλy∃ 2y˜K2ø CL{a! l·FFŜŎŭă ŭKŜ Ŏ2Y˜LJl·yèφ {Ŝŭ ŭλY˜Ŝă l·ℕŜ Ŝăŭl·ōfλăKŜŘ F2ℕ Ŝl·ŎK λy?ŜŎŭ l·yŘ l·ℕŜ ăŎ2ℕŜŘ ōè ŭKŜ øKλŭŜ ŭŜl·Y˜ l·ŭ

ŭKŜ ŭλYŜ ŘdzŜΦ /2YLJfŜÈ λy?ŜŎŭă l·NJŜ ăŎ2NJŜŘ ø λŭK Y2NJŜ LJ2λyŭă ŭKl·y˜ăλYLJfŜ λy?ŜŎŭă ó / / 5 /

¢Ŝl·Y˜ tNJŜLJl·NJl·ŭλ2y˜DdzλŘŜΣ нллрπнлммύΦ

Assumptions/Limitations/Delimitations

C2NJ LJdzNJLJ2ăŜă 2Ŧ ŭKλă NJŜăŜl·NJŎK l· ădzNJØŜè ø l·ă Ŏ2yŘdzŎŭŜŘ l·ŭ ŭKŜ NJŜƎλ2yl·f t l·ŎλŦλŎ wλY˜ /2ffŜƎλl·ŭŜ /èōŜNJ 5ŜŦŜyãŜ /2YLJŜŭλŭλ2y˜KŜfŘ λy˜ a l·NJŎKΦ ! y2yèYλŭè ø l·ă dzăŜŘ l·ă ădzNJØŜè LJl·NJŭλŎλLJl·yŭă øŜNJŜ l·ă]ŜŘ ƎŜyŜNJl·f dzyλŘŜyŭλŦèλyƎ IjdzŜăŭλ2yã l·ō2dzŭ ŭKŜ Ŏ2YLJŜŭλŭλ2y˜l·yŘ λy?ŜŎŭăΦ ! fŭK2dzƎK ŭKŜ ădzNJØŜè ø l·ă l·ŘYλyλăŭŜNJŜŘ ŭ2 l·ff LJl·NJŭλŎλLJl·yŭăΣ NJŜăLJ2yãŜ NJl·ŭŜ ø l·ă 2yfè oεĵ̂ ̂ Φ ¢Kλă ø l·ă l· fλYλŭl·ŭλ2yΣ ōdzŭ ŭKŜ NJŜăŜl·NJŎKŜNJ ŦŜfŭ ŭKŜ Řl·ŭl· Ŏ2ffŜŎŭŜŘ ø l·ă l·ŘŜIjdzl·ŭŜ Ŝy2dzƎK ŭ2 ădzLJLJ2NJŭ ŭKŜ Ŏ2yŎfdzăλ2yãΦ ¢KŜ NJŜăŜl·NJŎK Ŧ2ŎdzăŜă 2y˜b / / 5 / Ŏ2YLJŜŭλŭλ2yã 2yfè ŭ2 ŘŜŦλyŜ l·y˜ŜŦŦŜŎŭλØŜ λy?ŜŎŭΣ l·ă ŜØŜNJè Ŏ2YLJŜŭλŭλ2y˜ŘλŦŦŜNJă l·yŘ λŭ ø2dzfŘ ōŜ λYLJ2ăăλōfŜ ŭ2 Yl·]Ŝ l· ƎdzλŘŜfλyŜ Ŧ2NJ l·ff ŭèLJŜă 2Ŧ ŎèōŜNJ ŘŜŦŜyãŜ Ŏ2YLJŜŭλŭλ2yãΦ

Significance of the Study

! ƎdzλŘŜ ŭ2 ŎNJŜl·ŭλyƎ λy?ŜŎŭă øλff KŜfLJ ŭ2 y2NJYl·fλÎŜ ŭKŜ LJNJ2ŎŜăă l·yŘ LJNJ2ØλŘŜ l· ŦNJl·YŜ 2Ŧ NJŜŦŜNJŜyŎŜ Ŧ2NJ Ŏ2YLJl·NJλă2yãΦ ¢Kλă øλff l·fă2 KŜfLJ ŭKŜ ŭŜl·Yă ŭ2 ŭNJl·Ŏ] ŭKŜλNJ λYLJNJ2ØŜYŜyŭ ŦNJ2Y˜ èŜl·NJ ŭ2 èŜl·NJΦ ¢KŜ ƎdzλŘŜ ăK2dzfŘ y2ŭ ăLJŜff 2dzŭ ŜÈl·ŎŭfÈ øKl·ŭ l·y˜λy?ŜŎŭ ăK2dzfŘ ōŜΣ ōdzŭ ăK2dzfŘ LJNJ2ØλŘŜ l· ŦNJl·YŜø2NJ] Ŧ2NJ K2ø l·y˜λy?ŜŎŭ λă ŎNJŜl·ŭŜŘΦ ¢Kλă NJŜăŜl·NJŎK øλff LJNJ2ØλŘŜ ădzŎK l· ŦNJl·YŜø2NJ]Φ

5dzNJλyƎ l·y˜λyŭŜNJØλŜø øλŭK 5øl·èyŜ ² λffλl·YăΣ ŭKŜ ŘλNJŜŎŭ2NJ 2Ŧ ŭKŜ b / / 5 /Σ KŜ ăŭl·ŭŜŘ ŭKl·ŭ ă2YŜ ŎNJλŭŜNJλl· Ŧ2NJ λy?ŜŎŭă ø2dzfŘ ōŜ ōŜyŜŦλŎλl·fΦ ! Ŏ2dzLJfŜ 2Ŧ ŭKŜ NJŜƎλ2yl·f Ŏ2YLJŜŭλŭλ2yã NJ2ŭl·ŭŜ ōŜŭøŜŜy˜K2ăŭ 2NJƎl·yλÎl·ŭλ2yã l·yŘ Ø2fdzyŭŜŜNJă Ŝl·ŎK èŜl·NJ 2NJ ŭø2Φ ! ƎdzλŘŜ ø2dzfŘ KŜfLJ

űKŜ yŜø Ø2ftdzyűŜŜŃăΣ 2Ń 2yŜă űKI·ű KI·ØŜ y2ű I·ăăλăűŜŘ λy˙I· Ŏ2Y˙LJŜűλűλ2y˙Ŧ2Ń I· øKλfŜΣ ű2 ∃Ŝű

dzLJ ű2 ăLJŜŜŘ λy˙ŎŃŜI·űλy∃ űKŜ λy?ŜŎűăΦ

5øI·èyŜ I·fă2 LJ2λyűŜŘ 2dzű űKI·ű I· ∃dzλŘŜ Ŏ2dzfŘ ăŜŃØŜ I·ă I· ŃŜY˙λyŘŜŃ Ŧ2Ń űK2ăŜ űKI·ű

KI·ØŜ ŜÈLJŜŃλŜyŎŜΦ Lű Y˙I·è 2ŦŦŜŃ yŜø λŘŜI·ă ű2 ŃŜ∃λ2yI·f øKλűŜ űŜI·Y˙ăΣ ădzŎK I·ă yŜø

LJKλf2ă2LJKλŜă 2Ń I·LJLJŃ2I·ŎKŜă űKI·ű KI·Ř y2ű ōŜŜy˙űŃλŜŘ ōŜŦ2ŃŜΦ ά¸2dz KI·ØŜ ű2 ∃2 űKŃ2dz∃K I·

f2ű 2Ŧ űKλy∃ă I·yŘ űKλy˙I· ō2dzű K2ø è2dz LJfdz∃ λű λy˙I·yŘ K2ø è2dz ∃λØŜ ŜØŜŃèō2Řè I· ŦI·λŃ ăK2ű

I·ű Ŏ2Y˙LJfŜűλ2yΦ {2Σ èŜI·K L ø2dzfŘ ăI·è I·ōă2fdzűŜfè I· ŎŃλűŜŃλI· ăŜű ø2dzfŘ ōŜ I· ∃22Ř űKλy∃Φ£

ó ² λffλI·Y˙ăΣ нлмпúΦ

Chapter II: Literature Review

/èōŜŃ ŘŜŦŜyãŜ Ŏ2ϒLJŜŭλŭλ2yã l·ŃŜ ǿλŘŜăLJŃŜl·Ř l·yŘ l·ŃŜ dzăŜŘ 2y˝l· Ŏ2ffŜƎλl·ŭŜ fŜØŜf l·ă ǿŜff l·ă λy˝ŭKŜ LJŃ2ŦŜăăλ2yl·f ŦλŜfŘ ŭ2 ōŜăŭ KŜfLJ ăŜŎdzŃλŭè LJŃ2ŦŜăăλ2yl·fã fŜl·Ńy˝K2ǿ ŭ2 ŦλÈ ăŜŎdzŃλŭè ōŃŜl·ŎKŜă l·yŘ Ødzfyŝ̃Ńl·ōλfλŭλŜăφ Ly˝нлмлΣ WλY˝ D2ãfŜŃΣ ŘλŃŜŎŭ2Ń 2Ŧ ŭKŜ /Ŝyŭ̃Ńl·f LyŭŜffλƎŜyŎŜ !ƎŜyŎè ó/L!ú /l·fŜyŘŜăŭλyŜ Ly˝Ŧ2ŃY˝l·ŭλ2y˝¢ŜŎKy˝2f2Ǝè hŦŦλŎŜΣ ŭ2fŘ /Ŝyŭ̃ŜŃ Ŧ2Ń {ŭ̃Ńl·ŭŜƎλŎ l·yŘ LyŭŜŃyl·ŭλ2yl·f {ŭdzŘλŜă ó/{L{úΣ ε¢KŜŃŜ l·ŃŜ l·ō2dzŭ мΣллл ăŜŎdzŃλŭè LJŜ2LJfŜ λy˝ŭKŜ ¦{ ǿK2 Kl·ØŜ ŭKŜ ăLJŜŎλl·fλÎŜŘ ăŜŎdzŃλŭè ăʅλffã ŭ2 2LJŜŃl·ŭŜ l·ŭ ǿ2ŃfŘπŎfl·ăă fŜØŜfã λy˝ŎèōŜŃăLJl·ŎŜ ς ǿŜ y˝ŜŜŘ млΣллл ŭ2 олΣллл̧ ó/fl·èŭ2yΣ нлммúφ !fŭK2dzƎK ŭKŜ ¦φ{φ λă l·KŜl·Ř λy˝2ŦŦŜyãλØŜ ŎèōŜŃ ăŭ̃Ńl·ŭŜƎλŜăΣ ŭKŜ Ŏ2dzyŭ̃Ńè fl·Ǝă ōŜKλyŘ λy˝ŘŜŦŜyãŜφ Ly˝2yŜ ŜÈl·Y˝LJfŜΣ l· Ř2ÎŜy˝yŜǿ ŦŜŘŜŃl·f ŜY˝LJf2èŜŜă ǿŜŃŜ ƎλØŜy˝l· ŎèōŜŃ ŘŜŦŜyãŜ ăʅλffã ŭŜăŭ̃ l·yŘ 2yfè 2yŜ ljdzl·ŃŭŜŃ 2Ŧ ŭKŜY˝ ʅyŜǿ ǿKl·ŭ̃ ŭ2 Ř2φ /èōŜŃ ŘŜŦŜyãŜ ăŭ̃Ńl·ŭŜƎλŜă ōŜƎl·y˝λy˝ŭKŜ .dzăK l·ŘY˝λyλăŭ̃Ńl·ŭλ2y˝l·yŘ Kl·ØŜ l·ŎŎŜfŜŃl·ŭŜŘ ŘdzŃλyƎ hōl·Y˝l·Ωă ŭŜŃY˝ ó/fl·èŭ2yΣ нлммúΣ ōdzŭ̃ ŭKλă l·ŎŎŜfŜŃl·ŭλ2y˝Kl·ă y2ŭ̃ ă2fØŜŘ ŭKŜ LJŃ2ōfŜY˝φ ǽLŭΩă y2ŭ̃ ŎdzŃŃλŎdzfl· 2Ń ŎŃŜŘŜyŭλl·fã ŭKl·ŭ̃ ǿλff ŃŜŎŃdzλŭ̃ ŭKŜ yŜÈŭ̃ ƎŜyŜŃl·ŭλ2y˝2Ŧ ŎèōŜŃŘŜŦŜyŘŜŃãφ /2ϒLJŜŭλŭλ2yã Yλ˝ƎKŭ̃ε ó/fl·èŭ2yΣ нлммúφ

w2yl·fŘ {φ /KŜdzyƎ l·yŘ l·ăă2ŎλŭŜă ăŭ̃l·ŭŜŘΣ ǽLŭ̃ λă ǿŜff ʅy2ǿ ŭKl·ŭ̃ ŎèōŜŃ ŭKŃŜl·ŭă ŭ2 ŭKŜ ¦yλŭŜŘ {ŭ̃l·ŭŜă l·ŃŜ LJŃŜØl·fŜyŭ̃ l·yŘ l·ŦŦŜŎŭ̃ 2dzŃ ă2ŎλŜŭ̃èΣ ōdzăλyŜăăΣ l·yŘ Ǝ2ØŜŃyY˝Ŝyŭ̃Σ èŜŭ̃ ŭKŜŃŜ λă y2 Ŏ2yŎŜŃŭ̃ŜŘ ŜŦŦ2Ńŭ̃ l·Y˝2yƎ 2dzŃ Ǝ2ØŜŃyY˝Ŝyŭ̃ l·yŘ LJŃλØl·ŭŜ λyŘdzăŭ̃ŃλŜă ŭ2 2ØŜŃŎ2Y˝Ŝ ŭKŜY˝ε ó/KŜdzyƎΣ /2KŜyΣ [2Σ ϑ Cl·ōλ2Σ нлммúφ /2ϒLJdzŭ̃ŜŃ ăŎλŜyŎŜ Y˝l·ϩ2Ńă l·ŭ̃ ă2Y˝Ŝ dzyØŜŃăλŭ̃λŜă Ŏl·y˝ ƎŃl·Řdzl·ŭŜ ǿλŭ̃K2dzŭ̃ ŜØŜy˝ŭ̃l·ʅλyƎ l·y˝λyŦ2ŃY˝l·ŭλ2y˝ăŜŎdzŃλŭè Ŏfl·ăăφ !fă2Σ λŭ̃ λă y2ŭ̃ŜŘ ŭKl·ŭ̃ ŜØŜy˝λŦ l· Ŏfl·ăă λă ŭ̃l·ʅŜyΣ ŭKŜ ăŭ̃dzŘŜyŭ̃ ySŜŘă Kl·yŘăπ2y˝ŜÈLJŜŃλŜyŎŜ ŭ2 ōŜ l·ōfŜ ŭ2 l·LJLJfè ŭKŜ ʅy2ǿfŜŘƎŜ λy˝ŭKŜ ǿ2ŃʅŦ2ŃŎŜφ a l·yè Ŏfl·ăăŜă ŭ̃l·ʅŜy˝λy˝Ŏ2ffŜƎŜ Ŏ2yãλăŭ̃ 2Ŧ ŃŜl·ŘλyƎ l· ŭŜÈŭ̃Σ ŎŃl·Y˝Yλ˝yƎ Ŧ2Ń l· ŭŜăŭ̃Σ K2LJŜŦdzffè LJl·ăăλyƎ ŭKŜ ŭŜăŭ̃Σ l·yŘ ljdzλŎʅfè Ŧ2ŃƎŜŭ̃ŭλyƎ Y˝2ăŭ̃ 2Ŧ ŭKŜ

ʼlyƲøfŜŘƎŜ fŜI·ℕyŜŘΦ ¦ yfŜăă LJℕI·ŎűλŎI·f I·LJLJfλŎI·űλƲ˜λă I·LJLJfλŜŘΣ űKλă λă dzyŦƲℕűdzyƖ·űŜfè űKŜ ℕŜI·fλűè ŦƲℕ Y˜Ʋăű ŎƲffŜƎŜ ăűdzŘŜyűă ó/KŜdzyƎΣ /ƲKŜyΣ [ƲΣ ƻ CI·ōλƲΣ нлммúΦ

Cyber Competitions

hyŜ øI·è ŦƲℕ ăűdzŘŜyűă űƲ ƎI·λy˜KI·yŘă Ʋy˜ŜÈLJŜℕλŜyŎŜ λă űKℕƲdzƎK ŎèōŜℕ ŎƲY˜LJŜűλűλƲyãΦ /ƲY˜LJŜűλűλƲyã I·ℕŜ Ʋℕ ƎI·yλÎŜŘ ŘλŦŦŜℕŜyűfèΣ ŘŜLJŜyŘλyƎ Ʋy˜űKŜ ŦƲŎdză ƲŦ űKŜ ŎƲY˜LJŜűλűλƲy˜óŘŜŦŜyŘ Ʋyfè̀Σ I·ûûI·Ŏ˥κŘŜŦŜyŘΣ I·ûûI·Ŏ˥ Ʋyfè̀ú I·yŘ űKŜ ûèLJŜ ƲŦ ŎƲY˜LJŜűλűƲℕă óKλƎK ăŎKƲƲfΣ ŎƲffŜƎλI·ûŜΣ Y˜λfλûI·ℕèΣ ƎŜyŜℕI·f LJdzōfλŎúΦ CƲffƲøλyƎ λă I· ûI·ōfŜ ûKI·û ăKƲøă Y˜I·ƲƲℕ ŎƲY˜LJŜűλűλƲyãΣ ûKŜ ûèLJŜ ƲŦ ŎƲY˜LJŜűλűλƲyΣ ûKŜ ăLJƲyãƲℕλyƎ ƲℕƎI·yλÎI·ûλƲyKLJŜℕăƲyΣ ûKŜ ûèLJŜ ƲŦ ŎƲY˜LJŜűλűƲℕăΣ I·yŘ øKŜℕŜ ûKŜ ŎƲY˜LJŜűλűλƲy˜λă KŜfŘΦ

Cyber Competitions				
/ƨYˇLJŜŭλŭλƨyˇ bl·YˇŜ	¢èLJŜ ƨŦ /ƨYˇLJŜŭλŭλƨyˇ	hNƱƱl·yλÎŜNƱă	¢èLJŜ ƨŦ /ƨYˇLJŜŭλŭƨNƱă	[ƨŎl·ŭλƨyˇ
/l·LJŭdzNƱŜ ŭKŜ Cfl·Ƴ ó/¢Cú	tNƱŜfλYˇλyl·NƱλŜă ç {Ŏƨ‹NƱŜŘπtNƱƨōfŜYˇ .l·ăŜŘ /ƨYˇLJŜŭλŭλƨyã /l·LJŭdzNƱŜ ŭKŜ Cfl·Ƴ	59C /hb	/λØλfλl·yã	[l·ă ±ŜƳl·ăΣ bŜØl·Řl·
LyŭŜNƱyl·ŭλƨyl·f /l·LJŭdzNƱŜ ŭKŜ Cfl·Ƴ óλ/¢Cú	tNƱŜfλYˇλyl·NƱλŜă ç {Ŏƨ‹NƱŜŘπtNƱƨōfŜYˇ .l·ăŜŘ /ƨYˇLJŜŭλŭλƨyã /l·LJŭdzNƱŜ ŭKŜ Cfl·Ƴ	tNƱƨŦΦ DλƨØl·yŷλ ±λƳyl· ŦNƱƨYˇ ¦yλØŜNƱăλŭè ƨŦ /l·fλŦƨNƱyλl· {l·yŭl· .l·NƱōl·NƱl·	!Ŏl·ŘŜYˇλŎ ¢Ŝl·Yˇă ó/ƨffŜƳλl·ŭŜú	adzfŭλπăλŭŜκ Yˇdzfŭλ ç ŭŜl·Yˇă
tl·yƨLJfè	YˇλyƳ ƨŦ ŭKŜ lλff	5ØI·èyŜ ² λffλl·Yˇă /ŜyŭŜNƱ ŦƨNƱ LyŦNƱl·ăŭNƱdzŎŭdzNƱŜ !ăădzNƱl·yŎŜ l·yŘ {ŜŎdzNƱλŭè ó/L!{ú //5/	/ƨffŜƳλl·ŭŜ ¢Ŝl·Yˇăκ tNƱƨŦŜăăλƨyl·fă	¦yλØŜNƱăλŭè ƨŦ ¢ŜÈl·ă {l·yˇ !yŭƨyλƨ
/ƨffŜƳλl·ŭŜ /èōŜNƱ 5ŜŦŜyãŜ /ƨYˇLJŜŭλŭλƨyˇ ó//5/ú	/èōŜNƱŘŜŦŜyãŜ /ƨYˇLJŜŭλŭλƨyˇ	5Øl·èyŜ ² λffλl·Yˇă /L!{ ç //5/	/ƨffŜƳλl·ŭŜ ¢Ŝl·Yˇă	¦yλØŜNƱăλŭè ƨŦ ¢ŜÈl·ă {l·yˇ !yŭƨyλƨ
/èōŜNƱ 5ŜŦŜyãŜ 9ÈŜNƱŎλăŜ ó/5·ú	/èōŜNƱŘŜŦŜyãŜ /ƨYˇLJŜŭλŭλƨyˇ	bl·ŭλƨyl·f {ŜŎdzNƱλŭè !ƳŜyŎè ób{!úκ/ŜyŭNƱl·f {ŜŎdzNƱλŭè {ŜNƱØλŎŜ ó/{{ú	¦yλŭŜŘ {ŭl·ŭŜă aλfŭŭl·NƱè !Ŏl·ŘŜYˇè óăŜYˇŜăŭŜNƱ fƨyƳ ŎƨYˇLJŜŭλŭλƨyŭ	¦yλØŜNƱăλŭè ƨŦ al·NƱèfl·yŘ
/èōŜNƱtl·ŭNƱλƨŭ	/èōŜNƱŘŜŦŜyãŜ /ƨYˇLJŜŭλŭλƨyˇ	!λNƱ CƨNƱŎŜ !ăăƨŎλl·ŭλƨyˇ	lλƳK {ŎKƨƨf ăŭdzŘŜyŭăκ LyŭŜNƱyl·ŭλƨyl·f	hyfλyŜ ç bl·ŭλƨyl·fă KŜfŘ λyˇ ² l·ăKλyƳŭƨyˇ 5Φ/Φ
hØŜNƱ ŭKŜ ² λNƱŜ	[l·ŘŘŜNƱ {ŭèfŜ tNƱƨōfŜYˇ {Ŝŭ	±ƨfdzyŭŜŜNƱă	/λØλfλl·yã	hyfλyŜ
5/o 5λƳλŭl·f CƨNƱŜyãλŎă	[l·ŘŘŜNƱ {ŭèfŜ tNƱƨōfŜYˇ {Ŝŭ	5ŜLJl·NƱŭYˇŜyŭ ƨŦ 5ŜŦŜyãŜ /èōŜNƱ /NƱλYˇŜ /ŜyŭŜNƱ	DŜyŜNƱl·f tdzōfλŎ	hyfλyŜ π LyŭŜNƱyl·ŭλƨyl·f

Table 2: Cyber Competitions

¢KŜNJŜ I·NJŜ ŘλŦŦŜNJŜyűűèLJŜă 2Ŧ ŎèōŜNJ ŘŜŦŜyãŜ Ŏ2ϒLJŜűλűλ2yãΦ hyŜ λă ŎI·ftŜŘ LyŘλØλŘdzI·f [I·ŘŘŜNJ {űèfŜ tNJ2ōfŜϒ {Ŝűă¤ ¢Kλă Ŏ2ϒLJŜűλűλ2yϒI·ff2øă űKŜ Ŏ2ϒLJŜűλű2NJă ű2 ø2NJ] λyŘλØλŘdzI·ffèΣ LJI·Ŏλy∃ űKŜϒăŜfØŜă I·yŘ I·ŘØI·yŎλy∃ ű2 űKŜ yŜÈű LJNJ2ōfŜϒ øKŜyϒűKŜ ŎdzNJNJŜyű LJNJ2ōfŜϒ ōŜλy∃ ø2NJ]ŜŘ 2yϒλă Ŏ2ϒLJfŜűŜΦ ¦ ădzI·ffè λyϒűKλă űèLJŜ 2Ŧ Ŏ2ϒLJŜűλűλ2yΣ űKŜ Ŏ2ϒLJŜűλű2NJ¤ă 2yfè ŦŜŜŘōI·Ŏ] ŘdzNJλy∃ űKŜ Ŏ2ϒLJŜűλűλ2yϒλă űKŜ I·ŘØI·yŎŜϒŜyű ű2 űKŜ yŜÈű LJNJ2ōfŜϒΦ ¢Kλă Ŏ2ϒLJŜűλűλ2yϒNJŜfλŜă 2yϒűKŜ Ŏ2ϒLJŜűλű2NJ¤ă LJNJλ2NJ]y2øfŜŘ∃ŜΣ I·ă λyãűNJdzŎűλ2yã I·NJŜ y2ű dzădzI·ffè ∃λØŜyϒŘdzNJλy∃ űKŜ Ŏ2ϒLJŜűλűλ2yϒó9I·∃fŜΣ нлмоúΦ 9ÈI·ϒLJfŜă 2Ŧ űKλă űèLJŜ 2Ŧ Ŏ2ϒLJŜűλűλ2yϒI·NJŜ hØŜNJ űKŜ ² λNJŜ I·yŘ 5/o 5λ∃λűI·f C2NJŜyãλŎă óăŜŜ űI·ōfŜ нúΦ

!y2űKŜNJ űèLJŜ 2Ŧ Ŏ2ϒLJŜűλűλ2yϒλă {Ŏ2NJŜŘΣ tNJ2ōfŜϒπ.I·ăŜŘ /2ϒLJŜűλűλ2yãΦ hŦűŜyϒűKλă űèLJŜ 2Ŧ Ŏ2ϒLJŜűλűλ2yϒλă NJŜŦŜNJNJŜŘ ű2 I·ă WŜ2LJI·NJŘèπăűèfŜΣ I·ă űKŜ fI·è2dzű 2Ŧ űKŜ Ŏ2ϒLJŜűλűλ2yϒλă Ŏf2ăŜfè NJŜfI·űŜŘ ű2 űKŜ űŜfŜØλăλ2yϒ∃I·ϒŜ ăK2ø øλűK űKŜ ăI·ϒŜ yI·ϒŜΦ Lyϒűkλă űèLJŜ 2Ŧ Ŏ2ϒLJŜűλűλ2yΣ I· ăŜű ydzϒōŜNJ 2Ŧ LJNJ2ōfŜϒă I·NJŜ I·ăăλ∃yŜŘ űKI·ű I·NJŜ ŜI·ŎK ∃λØŜyϒI· ăŎ2NJŜ ōŜŦ2NJŜ űKŜ Ŏ2ϒLJŜűλűλ2yϒōŜ∃λyã¤ ¢KŜ øλyŷŜNJă I·NJŜ űK2ăŜ øK2 ăŎ2NJŜ űKŜ ϒ2ăű LJ2λyűă¤ WŜ2LJI·NJŘèπ ăűèfŜ Ŏ2ϒLJŜűλűλ2yã Ř2 y2ű dzădzI·ffè λyŎfdzŘŜ ŦŜŜŘōI·Ŏ] Ŧ2NJ űKŜ Ŏ2ϒLJŜűλű2NJă ó9I·∃fŜΣ нлмоúΦ 9ÈI·ϒLJfŜă 2Ŧ űKλă űèLJŜ 2Ŧ Ŏ2ϒLJŜűλűλ2yϒI·NJŜ űKŜ IjdzI·fλŦλŎI·űλ2yϒNJ2dzyŘă 2Ŧ 59C/hb I·yŘ λ/¢C óăŜŜ űI·ōfŜ нúΦ

¢ŜI·ϒπ.I·ăŜŘ /I·LJűdzNJŜ űKŜ CfI·∃ ó/¢Cú λă I·y2űKŜNJ űèLJŜ 2Ŧ ŎèōŜNJ ŘŜŦŜyãŜ Ŏ2ϒLJŜűλűλ2y¤ áhNJ∃I·yλÎŜNJă LJNJ2ØλŘŜ I· Ŏf2ăŜŘ yŜűø2NJ] I·yŘ I· űŜI·ϒ 2Ŧ LJI·NJűλŎλLJI·yűă ű2 I·űűI·Ŏ] 2űKŜNJ űŜI·ϒă øKλfŜ ăλϒdzfűI·yŜ2dzăfè űNJèλy∃ ű2 ŘŜŦŜyŘ λűăŜfŦ I·∃I·λyãű 2LJLJ2yŜyűă¤ I·űűI·Ŏ]ă¤ 9I·ŎK I·űűI·Ŏ] I·λϒă ű2 ăűŜI·f I· LJλŜŎŜ 2Ŧ λyŦ2NJϒI·űλ2yΣ 2ŦűŜyϒŎI·ffŜŘ I· ŦfI·∃Σ I·yŘ ădzōϒλű λű ű2 űKŜ 2NJ∃I·yλÎŜNJăΣ øK2 ŘŜűŜNJϒλyŜ øKŜűKŜNJ λűă ØI·fλŘé ó9I·∃fŜΣ нлмоúΦ ¢ŜI·ϒă I·NJŜ ∃λØŜyϒLJ2λyűă Ŧ2NJ ăűŜI·fλy∃ I· ØI·fλŘ ŦfI·∃ I·yŘ LJ2λyűă ŎI·yϒōŜ f2ăű λŦ ŦfI·∃ă I·NJŜ ăű2fŜy¤ ¢KŜ űŜI·ϒ øλűK űKŜ ϒ2ăű

ŦfI·∃ă űKI·ű I·fă2 KI·ă f2ăű űKŜ fŜI·ăű I·Y˘2dzyű 2Ŧ ŦfI·∃ă I·ű űKŜ ŜyŘ 2Ŧ Ŏ2Y˘LJŜűλűλ2y˘ øλyã ó9I·∃fŜΣ нлмоúΦ 9ÈI·Y˘LJfŜă 2Ŧ űKλă űèLJŜ 2Ŧ Ŏ2Y˘LJŜűλűλ2y˘ I·NJŜ /¢C I·yŘ λ/¢C óăŜŜ űI·ōfŜ нúΦ

/èōŜNJ 5ŜŦŜyãŜ /2Y˘LJŜűλűλ2yã I·NJŜ I· fI·NJ∃ŜNJ ăŎI·fŜ Ŏ2Y˘LJŜűλűλ2y˘űKI·y˘űKŜ Ŏ2Y˘LJŜűλűλ2yã LJNJŜØλ2dzăfè Y˘Ŝyűλ2yŜŘΦ /2Y˘LJŜűλű2NJă I·NJŜ NJŜIjdzλNJŜŘ ű2 LJNJ2űŜŎű I· ăŜNJØŜNJT ŜλűKŜNJ LJNJ2ØλŘŜŘ ōè űKŜ 2NJ∃I·yλÎŜNJă ó/ / 5 / ú 2NJ ŎNJŜI·űŜŘ űKŜY˘ăŜfØŜă ó/ 5 · úΣ ŦNJ2Y˘ I·űűI·Ŏ] Ŏ2Y˘λy∃ ŦNJ2Y˘ Ly˘Ŧ2NJY˘I·űλ2y˘ {ŜŎdzNJλűè LJNJ2ŦŜăăλ2yI·fă Φ hŦűŜy˘Ŏ2Y˘LJŜűλű2NJă I·NJŜ ∃λØŜy˘ăLJŜŎλI·f ű I·ă] ă ű2 Ŏ2Y˘LJfŜűŜ øKλfŜ LJNJ2űŜŎűλy∃ űKŜλNJ ŜyØλNJ2yY˘Ŝyű ó9I·∃fŜΣ нлмоúΦ 9ÈI·Y˘LJfŜă 2Ŧ űKλă űèLJŜ 2Ŧ Ŏ2Y˘LJŜűλűλ2y˘ I·NJŜ /2ffŜ∃λI·ûŜ /èōŜNJ 5ŜŦŜyãŜ /2Y˘LJŜűλűλ2yã ó/ / 5 / úΣ /èōŜNJ 5ŜŦŜyãŜ 9ÈŜNJŎλăŜ ó/ 5 · úΣ I·yŘ /èōŜNJt I·ûNJλ2ű óăŜŜ űI·ōfŜ нúΦ

Yλy∃ 2Ŧ űKŜ I λff λă I·y2ûKŜNJ ûèLJŜ 2Ŧ ŎèōŜNJ ŘŜŦŜyãŜ Ŏ2Y˘LJŜűλűλ2yΦ t2λyűă I·NJŜ ŜI·NJyŜŘ I·ă ûŜI·Y˘ă Y˘I·λyűI·λy˘ăŜNJØλŎŜă Ŧ2NJ I· ŎŜNJűI·λy˘ I·Y˘2dzyű 2Ŧ ûλY˘ŜΦ b2 LJ2λyűă I·NJŜ ∃λØŜy˘Ŧ2NJ 2ŦŦŜy˘ăλØŜ I·ûűI·Ŏ]ăΦ ¢KŜ ∃2I·f λă ű2 ûI·]Ŝ Ŏ2yűNJ2f 2Ŧ ŎŜyűNJI·f NJŜă2dzNJŎŜă 2Ŧ 2ûKŜNJ ûŜI·Y˘ă I·yŘ Ŏ2Y˘LJŜűλűλ2NJă I·NJŜ y˘2ű I·ff2øŜŘ ű2 I·ûűI·Ŏ] ó ² KλûŜ ϑ ² λffλI·Y˘ăΣ нлммúΦ !y˘ŜÈI·Y˘LJfŜ 2Ŧ ûKλă ûèLJŜ 2Ŧ Ŏ2Y˘LJŜűλűλ2y˘λă t I·yI·LJ2fè óăŜŜ ûI·ōfŜ нúΦ

Competition History

Cyber Competition Timeline							
мффс /I·LJûdzNJŜ ûKŜ CfI·∃	нллм /èōŜNJ 5ŜŦŜyãŜ 9ÈŜNJŎλăŜ	нллп LyûŜNJyI·ûλ2yI·f /I·LJûdzNJŜ ûKŜ CfI·∃	нллр /2ffŜ∃λI·ûŜ /èōŜNJ 5ŜŦŜyãŜ /2Y˘LJŜűλűλ2y˘	нллс 5/o 5λ∃λûI·f C2NJŜyãλŎă	нллф /èōŜNJt I·ûNJλ2ű	нлмл t I·y2LJfè	KK hØŜNJ ûKŜ ² λNJŜ

Table 3: Cyber Competition Timeline

/èōŜ∃I·YŜă KI·ØŜ ōŜŜyI·2dzyŘ Ŧ2 YI·yè èŜI·ă I·yŘ ŭKŜ Ŧ∧ăŭ ØŜŜ KŜfŘ ŷŭKŜ YŷfŷŭI·èΦ a ŷfŷŭI·è I·ŏI·ŘŜYŷŜă ØŜŜ ŭKŜ Ŧ∧ăŭ ŭ2 ŷŭ2ŘdzŏŜ Ŏ2ffŜ∃ŷI·ŭŜ Ŏ2YLJŜŭŷŭŷ2yã ó/KdzΣ Ŝŭ I·fΦΣ нллтúΦ ² KŷfŜ ŭKŜŜ I·Ŝ YI·yè ŏèōŜ ŘŜŦŜyãŜ Ŏ2YLJŜŭŷŭŷ2yãΣ ŭKŷă ŜăŜI·ŏK Øŷff Ŧ2Ŏdză 2y ŭKŜ YI·ƨ2 Ŏ2YLJŜŭŷŭŷ2yã I·yŘ ∃ŷØŜ I· ōŷŜŦ Kŷăŭ2è I·yŘ ŜÈLJfI·yI·ŭŷ2y 2Ŧ ŭKŜY a 2ăŭ Ŏ2YLJŜŭŷŭŷ2yã I·Ŝ KŜfŘ I·ŭ ŭKŜ Ŏ2ffŜ∃ŷI·ŭŜ fŜØŜfΦ C2 I· Ŏ2YLJfŜŭŜ fŷăŭŷ∃ 2Ŧ Ŏ2YLJŜŭŷŭŷ2yã KŜfŘ Øŷăŷŭ KŭŭLJăYккØØØΦYŎŎèōŜØI·ŭŎKΦŎ2YкŜă2dzŎŎŜăkŜØŜyŭăkŎ2YLJŜŭŷŭŷ2yãкнтπŎèōŜπ Ŏ2YLJŜŭŷŭŷ2yãπYI·ăŭŜπfŷăŭΦ

Capture the Flag

¢KŜ Ŧ∧ăŭ YI·ƨ2 ŎŷØŷfŷI·y Ŏ2YLJŜŭŷŭŷ2y Ø I·ă KŜfŘ I·ŭ 59C /hbΣ I· Ŏ2YLJdzŭŜ KI·Ŏ]ŷy∃ Ŏ2YLJŜŭŷŭŷ2yΣ ŷy мффс óăŜŜ ŭI·ōfŜ oúΦ ¢Kŷă Ŏ2YLJŜŭŷŭŷ2y ŷă KŜfŘ ŷy [I·ă ±Ŝ∃I·ăΣ bŜØI·ŘI· I·ŭ ŭKŜ Ŧ∧ăŭ LJI·ăŭ 2Ŧ WdzyŜ ó ² KŷŭŜ ƻ ² ŷffŷI·YăΣ нлммú óăŜŜ ŭI·ōfŜ нúΦ ¢KŜ Ŏ2YLJŜŭŷŭŷ2y KI·ă ŎKI·y∃ŜŘ I·yŘ YI·ŭdz∧ŜŘ 2ØŜ ŭKŜ èŜI·ă I·yŘ ŷă y2Ø ă2 fI·∃Ŝ ŭKI·ŭ I· álJdzI·fŷŦèŷy∃ε ØŜŜ]ŜyŘ ŷă KŜfŘ ōŜŦ2ŜŭKŜ Ŏ2yŦŜŜyŎŜ I·yŘ ŭKŜ ŭŜI·Yă Øŷŭ K ŭKŜ Y2ăŭ LJ2ŷyŭă I·ŜŜ ŷyØŷŭŜŘ ŭ2 Ŏ2YLJŜŭŜ ŷy LJŜăŷ2y I·ŭ 59C /hbΦ áwŜŎŜyŭ 2∃I·yŷÎŜă KI·ØŜ ŎK2ăŜy ŭ2]ŜŜLJ ŭKŜ ∃I·YŜ fI·è2dzŭ ăŜŎŜŭ dzyŭŷf ŭKŜ ∃I·YŜ ăŭI·ŭăΣ LJI·ŭŷŎŷLJI·yŭă Ř2 y2ŭ yŜŎŜăăI·ŷfè]y2Ø ŭKŜ ăŎ2ŷy∃ I·f∃2ŷŭKYΣ yŜŭØ2]ăŭdzŎŭdz∧ŜΣ 2 2LJŜI·ŭŷy∃ ăèăŭŜYă ŷyØ2fØŜŘΦ !ŭ ŷŭă Ŏ2Ŝ /¢C ŷă YŜI·yŭ ŭ2 ŭŜăŭ Ŏ2YLJdzŭŜ I·yŘ yŜŭØ2]ăŜŎdz∧ŷŭèε ó55¢ŜŎúΦ ¢KŜ LJ∧ŜYŷăŜ 2Ŧ ŭKŷă ŜØŜyŭ ŷă Ŏ2YLJŜŭŷŭ2ăă YdzăŭŭLJ∧2ŭŜŎŭ ŭKŜYăŜfØŜă ØKŷfŜ I·ŭŭI·Ŏ]ŷy∃ 2ŭKŜ Ŏ2YLJŜŭŷŭ2ăă ó ² KŷŭŜ ƻ ² ŷffŷI·YăΣ нлммúΦ

Cyber Defense Exercise

/èōŜ 5ŜŦŜyãŜ 9ÈŜŎŎŷăŜ ó/5·ú ŷă Ŏ2YLJŜŭŷŭŷ2y KŜfŘ I·yydzI·ffè I·ŭ ŭKŜ ¦yØŜăŷŭè 2Ŧ a I·èfI·yŘ I·yŘ ŭ ăŭI·ŭŜŘ ŷy нллм óăŜŜ ŭI·ōfŜă н ƻ oúΦ ¢Kŷă Ŏ2YLJŜŭŷŭŷ2y ŷă dzy ōè ŭKŜ

b l·ŭλ2y1·f {ŜŎdzNλŭè ! ∃Ŝy0è к / Ŝyŭ№l·f {ŜŎdzNλŭè {ŜNØλŎŜ ób{ ! к / {{úφ ¢KŜ Ŏ2YLJŜŭλŭλ2y˜λă ŦƧŎdzăŜŘ 2y˜Yλfλŭl·Nè LJN2ŦŜăăλ2y1·făφ ¢KŜ áfλØŜέ Ŏ2YLJŜŭλŭλ2y˜λă l· Ŧ2dzN Řl·è ŜØŜyŭ Ŧ2ŎdzăλyƎ 2y˜ ŭKŜ Yλfλŭl·Nèωă N2fŜ λy˜Ly Ŧ2NYl·ŭλ2y˜ ! ăădzNl·yŎŜ l·yŘ K2ø λYLJ2NŭI·yŭ λŭ λă ŭ2 LJN2ŭŜŎŭ ŭKŜ y1·ŭλ2yωă Ŏ2YLJdzŭŜN ăèăŭŜY˜ l·∃l·λyăŭ Ŏèō ŜN l·ŭŭl·Ŏ]ăφ ¢Kλă Ŏ2YLJŜŭλŭλ2y˜Ŏ2yăλăŭă 2Ŧ l· ōfdzŜ ŭŜl·Y˜ l·yŘ l· NŜŘ ŭŜl·Y˜ ó ! Řl·Y˜ăΣ [l·ŎŜèΣ Dl·Ø l·ăΣ ∂ [Ŝōfl·yŎΣ нллфúφ hyŜ ø l·è ŭKλă Ŏ2YLJŜŭλŭλ2y˜ λă ŘλŦŦŜNŜyŭ ŦN2Y˜ ŭKŜ 2ŭKŜN Ŏ2YLJŜŭλŭλ2yă λă λŭ λă l· ăŜYŜăŭŜN f2yƎ Ŏ2YLJŜŭλŭλ2yφ Lŭ λă 2yfè ŘdzNλyƎ áfλØŜέ Ŏ2YLJŜŭλŭλ2y˜ŭKl·ŭ ăŭdzŘŜyŭă l·NŜ l·ŭŭl·Ŏ]ŜŘ ōè ŭKŜ NŜŘ ŭŜl·Y˜ 2Ŧ ŭKŜ b{ ! LJN2ŦŜăăλ2y1·fă ó ² KλŭŜ ∂ ² λffλl·Y˜ăΣ нлммúφ

International Capture the Flag

¢KŜ ¦ yλØŜNăλŭè 2Ŧ / l·fλŦ2Nyλl· l·ŭ {l·yŭl· . l·Nōl·Nl· ó¦ / { . ú ōŜ∃l·y˜ŭKŜ Lyŭ№y1·ŭλ2y1·f / l·LJŭdzNŜ ŭKŜ Cfl·∃ Ŏ2YLJŜŭλŭλ2y˜λy˜нллп óăŜŜ ŭl·ōfŜă н ∂ oúφ ¢Kλă Ŏ2YLJŜŭλŭλ2y˜λă ŘλŦŦŜNŜyŭ ŦN2Y˜ Y˜2ăŭ l·ă ŭŜl·Yă l·NŜ λy˜Ydzŭ̂λLJŭŜ ăλŭŜă Ŏ2YLJŜŭλyƎ l·∃l·λyăŭ Ŝl·ŎK 2ŭKŜNφ ¢Ŝl·Yă Ŏl·y˜ōŜ ŦN2Y˜ yŜŭø2N]ă l·ff 2ØŜN ŭKŜ ø2NŭfŘ ó ² KλŭŜ ∂ ² λffλl·Y˜ăΣ нлммúφ / 2YLJŜŭλŭ2Nă l·NŜ ăŭdzŘŜyŭăφ l λăŭ2NλŎl·ffèΣ ŭKŜ ŦλNăŭ ŭø2 èŜl·Nă 2Ŧ ŭKŜ Ŏ2YLJŜŭλŭλ2y˜ øŜNŜ KŜfŘ f2Ŏl·ffè l·ŭ ¦ / { . φ ¢KŜ ŦλNăŭ ąøλŘŜπl·NŜl·έ Ŏ2YLJŜŭλŭλ2y˜ø l·ă KŜfŘ λy˜нлло øλŭK мп ŭŜl·Yă Ŏ2YLJŜŭλyƎφ Ly˜нлмнΣ уф ŭŜl·Yă LJl·NŭλŎλLJl·ŭŜŘ λy˜ŭKŜ ŜØŜyŭφ tN2Ŧφ Dλ2Ø l·yyλ ±λƎy1· 2Ŧ ŭKŜ 5ŜLJl·NŭYŜyŭ 2Ŧ / 2YLJdzŭŜN {ŎλŜyŎŜ l·ŭ ¦ / { . λă ŭKŜ 2N∃l·yλÎŜN 2Ŧ ŭKλă ŜØŜyŭ KŜfŘ l·ŭ ŭKŜ ōŜ∃λyyλyƎ 2Ŧ 5ŜŎŜYōŜN l·yydzl·ffè ó±λƎy1·úφ

National Collegiate Cyber Defense Competition

Ly˜нллп l· ∃N2dzLJ YŜŭ ŭ2 ŘλăŎdzăă ŭKŜ LJ2ăăλōλfλŭè 2Ŧ K2fŘλyƎ l·yydzl·f ŎèōŜN ŘŜŦŜyăŜ Ŏ2YLJŜŭλŭλ2yă l·ŭ ŭKŜ Ŏ2ffŜ∃λl·ŭŜ fŜØŜfφ ¢KŜ LJdzNLJ2ăŜ 2Ŧ ŭKλă YŜŜŭλyƎ ø l·ă ŭ2 ŎNŜl·ŭŜ

ă2Y ŜűKλyƎ ăλY λfI·₦ ű2 űKŜ /5· űKI·ű ø2dztŘ ōŜ I·ØI·λfI·ōfŜ ₮2₦ ŎλØλfλI·y˘λyãűλűdzűλ2yãΦ D₦ŜƎ2₦è

² KλűŜΣ I· LJ₦2₮Ŝăă2₦ I·ű ¦ yλØŜ₦ăλűè 2₮ ¢ŜÈI·ă λy˘{I·y˘ ! yű2yλ2Σ øI·ă λy˘I·űűŜyŘI·yŎŜ I·ű űKλă

Y ŜŜűλyƎ I·yŘ ű2fŘ ŜØŜ₦è2yŜ űKI·ű KŜ øI·ă LJ₦Ŝűűè Ŏ2y₮λŘŜyű KŜ Ŏ2dztŘ ō₦λyƎ űKλă Ŏ2Y LJŜűλűλ2y˘

ű2ƎŜűKŜ₦Φ 5₦Φ ² KλűŜ Ŏ2yűI·ŎűŜŘ 2űKŜ₦ tK5Ωă ₮₦2Y˘ űKŜ I·₦ŜI· øK2 LJ₦2ØλŘŜŘ KŜfLJ I·yŘ űŜI·Y ă

ű2 Ŏ2Y LJŜűŜ ó ² λffλI·Y ăΣ нлмпúΦ ¢KŜ ₮λ₦ăű //5/ øI·ă KŜfŘ λy˘ a I·è 2₮ нллр I·ű űKŜ ¦ yλØŜ₦ăλűè 2₮

¢ŜÈI·ă λy˘{I·y˘ ! yű2yλ2 óăŜŜ űI·ōfŜă н ϑ oú óнлмо {2dzűKŜI·ăű /2ffŜƎλI·űŜ /èōŜ₦ 5Ŝ₮ŜyãŜ

/2Y LJŜűλűλ2y˘ó{9//5/ú ¢ŜI·Y˘ tI·Ŏ]ŜűΣ нлмоúΦ ¢KŜ yŜÈű èŜI·₦ λy˘нллсΣ ₮2dz₦ ₦ŜƎλ2yI·f űŜI·Y ă

ŎI·Y Ŝ ű2ƎŜűKŜ₦ ű2 Ŏ2Y LJŜűŜ I·ű űKŜ ₮λ₦ăű bI·űλ2yI·f /2ffŜƎλI·űŜ /èōŜ₦ 5Ŝ₮ŜyãŜ /2Y LJŜűλűλ2y˘

ób//5/ú ó ² λffλI·Y ăΣ нлмпúΦ ¢Kλă Ŏ2Y LJŜűλűλ2y˘KI·ă y2ø ŜØ2fØŜŘ λyű2 űŜy˘ŘλF₮Ŝ₦ŜyŰ ₦ŜƎλ2yI·f

Ŏ2Y LJŜűλűλ2yã űK₦2dzƎK2dzű űKŜ ¦ yλűŜŘ {űI·űŜăΦ 9I·ŎK ₦ŜƎλ2y˘Ŏ2Y LJŜűŜă I·yŘ űKŜ ōŜăű űŜI·Y ă

I·₦Ŝ ăŜyű ű2 űKŜ b//5/ KŜfŘ λy˘{I·y˘ ! yű2yλ2Σ ¢ŜÈI·ă I·ű űKŜ ŜyŘ 2₮ ! LJ₦λf óbI·űλ2yI·f /2ffŜƎλI·űŜ

/èōŜ₦ 5Ŝ₮ŜyãŜ /2Y LJŜűλűλ2yΣ нлмпúΦ

DC3 Digital Forensics

Ly˘нллсΣ űKŜ 5/o 5λƎλűI·f C2₦ŜyãλŎă Ŏ2Y LJŜűλűλ2y˘ øI·ă ăűI·₦ûŜŘ óăŜŜ űI·ōfŜ oúΦ ¢Kλă

Ŏ2Y LJŜűλűλ2y˘ øI·ă ăLJ2yã2₦ŜŘ ōè űKŜ 5ŜLJI·₦ûY Ŝyű 2₮ 5Ŝ₮ŜyãŜ /èōŜ₦ /₦λY Ŝ /ŜyűŜ₦ I·yŘΣ

I·ŎŎ2₦ŘλyƎ ű2 űKŜ Ŏ2Y LJŜűλűλ2y˘ øŜōăλűŜΣ űKŜ fI·ăű 2yŜ øI·ă KŜfŘ λy˘нлмо óнлмпúΣ ŘdzŜ ű2

₮dzyŘλyƎΦ 5λƎλűI·f C2₦ŜyãλŎă øI·ă űKŜ ₮2Ŏdză 2₮ űKλă Ŏ2Y LJŜűλűλ2y˘ I·yŘ LJ₦2ōfŜY ă øŜ₦Ŝ fŜØŜfŜŘ

₮₦2Y˘ y2ØλŎŜ ű2 ŜÈLJŜ₦ûΦ /2Y LJŜűλű2₦ă λy˘ûKλă Ŏ2Y LJŜűλűλ2y˘ øŜ₦Ŝ ŎλØλfλI·yãΣ Y λfλûI·₦è

LJŜ₦ă2yŷŜfΣ 2₦ λyűŜ₦yI·űλ2yI·f ûŜI·Y ăΦ ¢Kλă Ŏ2Y LJŜűλűλ2y˘ øI·ă I·y˘2yfλyŜ Ŏ2Y LJŜűλűλ2y˘ónлмпú

ó ² KλűŜ ϑ ² λffλI·Y ăΣ нлммúΦ

CyberPatriot

! fűK2dz∃K Ŏèōŝ№ ŘŝŦŝŷãŝ Ŏ2Y˙LJŝűλűλ2yã l·№ŝ ∃№ŝl·ű ø l·èă ű2 ∃ŝű ăŝŏdz№λűè LJ№2Ŧŝăăλ2y1·fă l·yŘ ăűdzŘŝyűă №ŝl·Řè Ŧ2№ űKŝ ø2№ţŦ2№ŏŝΣ ăűdzŘλŝă ăK2ø Ŏ2Y˙LJŝűλűλ2yã l·№ŝ y2ű №ŝŏ№dzλűλy∃ yŝø LJŝ2LJfŝ ű2 űKŝ ŦλŝfŘΦ Ly˙fλ∃Kű 2Ŧ űKλăΣ Ŏèōŝ№ ŘŝŦŝŷãŝ Ŏ2Y˙LJŝűλűλ2yã Kl·Øŝ ăűl·№ŝŘ 2y˙l· Kλ∃K ăŏK22f fŝØŝf l·ă øŝffΦ /èōŝ№t l·ű№λ2ű λă l· Kλ∃K ăŏK22f Ŏ2Y˙LJŝűλűλ2y˙űKl·ű ōŝ∃l·y˙λy˙нллф fŝŘ ōè űKŝ ! λ№ C2№ŏŝ ! ăă2ŏλl·űλ2y˙óăŝŝ ű l·ōfŝă н ϑ oúΦ ¢Kλă Ŏ2Y˙LJŝűλűλ2y˙ ű l·№∃ŝűă Kλ∃K ăŏK22f ăűdzŘŝyűă øK2 Kl·ØŝyΩű yŝŏŝăăl·№λfè ŏK2ăŝy˙l· ŏl·№ŝŝ№ LJl·űK øλűK űKŝ K2LJŝ ű2 ăøl·è űKŝY˙ ű2 Ŏèōŝ№ ăŝŏdz№λűè l·ă l· ŏK2ăŝy˙ŦλŝfŘ l·yŘ LJ№2Ŧŝăăλ2y˙ó ² Kλűŝ˙ ² λffλl·Y˙ăΣ ϑ l l·№№λă2yΣ {ŝLJűŝY˙ōŝ№khŏű2ōŝ№ нлмлúΦ h№∃l·yλÎŝ№ă 2Ŧ űKλă Ŏ2Y˙LJŝűλűλ2y˙№ŝl·fλÎŝŘ űKl·ű l·y˙ λY˙LJ2№ű l·yű Ŏ2Y˙LJ2yŝyű 2Ŧ l· Kλ∃K ăŏK22f Ŏ2Y˙LJŝűλűλ2y˙λă ŝŘdzŏl·űλ2yΦ a 2ăű fλţŝfèΣ Kλ∃K ăŏK22f űŝl·ŏKŝ№ă øλffy2ű Kl·Øŝ l·y˙ŝÈűŝyãλØŝ Ŏèōŝ№ ăŝŏdz№λűè ōl·ŏţ∃№2dzyŘΣ ă2 2№∃l·yλÎŝ№ă LJfl·y˙l·y˙ ŝŘdzŏl·űλ2y1·f Ŏ2Y˙LJ2yŝyű λyű2 űKŝ Ŏ2Y˙LJŝűλűλ2yΦ ¢Kλă λă ŘλŦŦŝ№ŝyű Ŧ№2Y˙ űKŝ b / / 5 / 2y˙űKŝ Ŏ2ffŝ∃λl·űŝ fŝØŝf ōŝŏl·dzăŝ űKŝè l·ăădzY˙ŝ űKŝ Ŏ2Y˙LJŝűλű2№ă Kl·Øŝ Ŏèōŝ№ ăŝŏdz№λűè ű№l·λyλy∃ λy˙ űKŝλ№ Ŏ2ffŝ∃ŝ Ŏ2dz№ăŝă ó ² Kλűŝ˙ ² λffλl·Y˙ăΣ ϑ l l·№№λă2yΣ {ŝLJűŝY˙ōŝ№khŏű2ōŝ№ нлмлúΦ ¢Kλă Ŏ2Y˙LJŝűλűλ2y˙Kl·ă ∃№2øy˙Ŧ№2Y˙ Kl·øλy∃ нлл űŝl·Y˙ă űKŝ ăŝŏ2yŘ èŝl·№ óнлмлú ű2 мΣрлл űKλă èŝl·№ óнлмпúΦ ¢ŝl·Y˙ă Ŧ№2Y˙ Wl·LJl·yΣ {2dzűK Y2№ŝl·Σ l·yŘ / l·yl·Řl· y2ø Ŏ2Y˙LJŝűŝΦ ¢Kŝ Ŏ2Y˙LJŝűλűλ2y˙Kl·ă l·fă2 ōŝŝy˙2LJŝyŝŘ ű2 K2Y˙ŝăŏK22fŝŘ ăűdzŘŝyűăΣ ăŏ2dzű ű№22LJăΣ l·yŘ . 2èă ϑ Dλ№fă / fdzōăΦ /èōŝ№t l·ű№λ2ű λă l·y˙2yfλyŝ Ŏ2Y˙LJŝűλűλ2y˙øλűK ăŝY˙λπŦλyl·fă Kŝ fŘ λy˙Cf2№λŘl· l·yŘ Ŧλyl·fă λy˙ ² l·ăKλy∃ű2y˙5Φ/ ó l λăű2№èúΦ

Panoply

t l·y2LJfè ōŝ∃l·y˙λy˙нлмл l·yŘ λă 2№∃l·yλÎŝŘ ōè űKŝ / ŝyűŝ№ Ŧ2№ LyŦ№l·ăű№dzŏűdz№ŝ ! ăădz№l·yŏŝ l·yŘ {ŝŏdz№λűè ó / L ! {ú óăŝŝ ű l·ōfŝ múΦ ¢Kλă Ŏ2Y˙LJŝűλűλ2y˙λă l· űλY˙ŝŘ ŝØŝyűΦ ! ff

Ŏ2ϒLJŜűλűƨNJă KI·ØŜ I·ŎŎŜăă űƨ Ŏ2ϒϒƨϒNJŜăƨdzNJŎŜăΦ ¢ŜI·ϒă ØƨNJ] űƨ ŎfI·λϒ ƨØyŜNJăKλLJ ƨŦ I·

NJŜăƨdzNJŎŜ ōè ŦfI·ƎƎλyƎ λűΦ hyŎŜ I· NJŜăƨdzNJŎŜ KI·ă ōŜŜϒăŜŎdzNJŜŘ ōè I· űŜI·ϒΣ űKŜ űŜI·ϒ ϒdzăű

ŘŜŦŜyŘ űKŜ NJŜăƨdzNJŎŜ ŦNJƨϒ ƨűKŜNJ űŜI·ϒăΦ {Ŏ2NJŜă I·NJŜ ŎKŜŎ]ŜŘ I·ű NJI·yŘƨϒ űλϒŜă I·yŘ űŜI·ϒă

I·NJŜ ƎλØŜϒ I· ăŎ2NJŜ ōI·ăŜŘ ƨϒKƨØ ϒI·yè ŎNJλűλŎI·f ăŜNJØλŎŜă űKŜ űŜI·ϒ KI·ă ăŜŎdzNJŜŘ I·yŘ λă

ϒI·λyűI·λyλyƎ ó ² ŜfŎ2ϒŜ űƨ tI·yƨLJfèúΦ Lϒ I·yϒλyűŜNJØλŜØ ØλűK 5ØI·èyŜ ² λffλI·ϒăΣ ŘλNJŜŎűƨNJ ƨŦ

tI·yƨLJfèΣ KŜ ăI·λŘΣ αLűΩă I· Ŏ2ϒLJfŜűŜfè ŘλŦŦŜNJŜyű I·yλϒI·fΦ LűΩă ϒƨNJŜ ƨŦ I· ϒλyƎ ƨŦ űKŜ I λff ŜØŜyű

óăŜŜ űI·ōfŜ нúΦ tI·yƨLJfè λă I· LJŜNJϒdzűI·űλƨyϒƨŦ èƨdzNJ űNJI·ŘλűλƨyI·f ŎI·LJűdzNJŜ űKŜ ŦfI·ƎΦ ¢KŜ ƨyŜ ōλƎ

ŘλŦŦŜNJŜyŎŜ λăΣ èƨdz Řƨyűű ƎŜű LJƨλyűă ŦƨNJ ŎI·LJűdzNJλyƎ űKŜ ăèăűŜϒΣ èƨdz ƎŜű LJƨλyűă ŦƨNJ

ϒI·λyűI·λyλyƎ űKŜ ăèăűŜϒ I·yŘ]ŜŜLJλyƎ ŜØŜNJèƨyŜ ŜfăŜ ƨdzűε ó ² λffλI·ϒăΣ нлмпúΦ tI·yƨLJfè ōŜƎI·yϒ

I·ă I· ƨdzăű ŦƨNJ ŦdzyϒŎ2ϒLJŜűλűλƨyϒ øλűK ăƨϒŜ ŜŘdzŎI·űλƨyI·f øI·fdzŜΣ ōdzű űKŜ ƎNJŜI·űŜăű LJdzNJLJƨăŜ øI·ă

űƨ LJNJƨØλŘŜ I·yϒƨdzűfŜű ŦƨNJ LJŜƨLJfŜ λyϒűKŜ LyŦƨNJϒI·űλƨyϒ{ŜŎdzNJλűè óLbCh{9/ú Ŏ2ϒϒdzyλűèΦ ¢KŜ

Ŏ2ϒLJŜűλűλƨyϒKI·ă ōŜŜyϒLJI·NJűű ƨŦ .fI·Ŏ] I I·ű ŦƨNJ I· ŦŜø èŜI·NJă I·yŘ KI·ă Ǝƨ2yŜ űƨ !dzăűNJI·fλI·Φ ¢KŜ

Ǝƨ2I·f λă űƨ ϒI·]Ŝ λűϒ I·yϒƨ2yfλyŜ Ŏ2ϒLJŜűλűλƨyϒKŜfŘ λyϒűKŜ ŦI·ff ó ² λffλI·ϒăΣ нлмпúΦ

Over the Wire

¢KŜ hØŜNJ űKŜ ² λNJŜ Ŏ2ϒLJŜűλűλƨyϒƨNJ øI·NJƎI·ϒŜă I·NJŜ λyŘλØλŘdzI·fΣ fI·ŘŘŜNJπăúèfŜ LJNJƨōfŜϒ

ăŜűă ó9I·ƎfŜΣ нлмоúΦ ¢Kλă Ŏ2ϒLJŜűλűλƨyϒλă I·yϒƨ2yfλyŜ Ŏ2ϒLJŜűλűλƨyϒŦƨNJ ŎλØλfλI·yăΣ øKλŎK KI·ă

ōŜŜyϒƎƨ2λyƎ ŦƨNJ I· ŦŜø èŜI·NJăΣ I·fűKƨdzƎK űKŜ ŜÈI·Ŏű yϒdzϒōŜNJ ƨNJ ăűI·NJű ŘI·űŜ λă dzyI·ØI·λfI·ōfŜ óăŜŜ

űI·ōfŜă н ɜ oúΦ áΦKŜ øI·NJƎI·ϒŜă ƨŦŦŜNJŜŘ ōè hØŜNJ¢KŜ ² λNJŜ Ŏ2ϒϒdzyλűè ŎI·yϒKŜfLJ èƨdz űƨ fŜI·NJyϒ

I·yŘ LJNJI·ŎűλŎŜ ăŜŎdzNJλűè Ŏƨ2yŎŜLJűă λyϒűKŜ ŦƨNJϒ ƨŦ ŦdzyπŦλffŜŘ ƎI·ϒŜăΦ ¢ƨ ŦλyŘ ƨdzű ϒƨNJŜ I·ōƨdzű I·

ŎŜNJűI·λyϒ øI·NJƎI·ϒŜΣ ƨdzăű ØλăλűΩ λűă LJI·ƎŜ fλy]ŜŘ ŦNJƨϒ űKŜ ϒŜyϒdz ƨyϒűKŜ fŜŦűε óhØŜNJ¢KŜ ² λNJŜ π

² I·NJƎI·ϒŜăúΦ DI·ϒŜă I·NJŜ fλăúŜŘ ƨyϒűKŜ øŜōăλűŜ I·yŘ I· Ŏ2ϒLJŜűλűƨNJ ŎI·yϒŎfλŎ] űKŜ fλy] űƨ ōŜƎλyϒ

Ŏ2Y˜LJŜűλyƎ λy˜l· LJl·NŭλŎdztl·NJ Ǝl·Y˜Ŝφ hØŜNJ¢KŜ ² λNJŜ dzăŜă ² Ŝ/Kl·ff ăŎ2NJλyƎ ŏhØŜNJ¢KŜ ² λNJŜ π

² l·NJƎl·Y˜Ŝăŭφ

Collegiate Cyber Security Championship Cup

!y˜λyűŜNJŜăűλyƎ Ŏ2yŎŜLJű λyűNJ2ŘdzŎŜŘ ōè DNJŜƎ2NJè ² KλűŜ l·yŘ 5ø l·èyŜ ² λffλl·Y˜ă λă l· /2ffŜƎλl·űŜ /èōŜNJ {ŜŎdzNJλűè /Kl·Y˜LJλ2yãKλLJ /dzLJφ ¢KŜ l·dzűK2NJă Ŏ2Y˜LJl·NJŜŘ űKŜ λŘŜl· ű2 b!{/!w 2NJ b/!! ŎKl·Y˜LJλ2yãKλLJăφ ¢KŜ K2LJŜ Ŧ2NJ űKŜ Ŏ2Y˜LJŜűλűλ2y˜ø l·ă ű2 NJl·λăŜ l·ø l·NJŜyŜăă 2Ŧ /èōŜNJ {ŜŎdzNJλűèφ !dzűK2NJă Y˜Ŝyűλ2yŜŘ űKl·ű λű ø2dztŘ ōŜ l· f2yƎ LJNJ2ŎŜăă ű2 Ŝăűl·ōfλăK l·yŘ ø2dztŘ ű l·ţŜ ăŜØŜNJl·f èŜl·NJă ű2 λY˜LJfŜY˜Ŝyűφ ¢KŜ LJfl·y˜ø l·ă ű2 ăűl·NJű ōè Y˜ŜŜűλyƎ øλűK 2NJƎl·yλÎŜNJă ŦNJ2Y˜ űKŜ ŘλŦŦŜNJŜyű Ŏ2Y˜LJŜűλűλ2yã l·NJ2dzyŘ űKŜ Ŏ2dzyűNJè l·yŘ ăŜŜ λŦ űKλă Ŏ2dztŘ ōŜŎ2Y˜Ŝ l· NJŜl·fλűèφ ¢KŜ l·dzűK2NJă K2LJŜŘ ű2 ăŜŜ ŎèōŜNJ ŘŜŦŜyãŜ Ŏ2Y˜LJŜűλűλ2yã l·λNJŜŘ 2y˜űŜfŜØλăλ2y˜λy˜űKŜ Ŧdzűdz˜NJŜ l·ă øŜffφ Lű λă l·y˜λyűŜNJŜăűλyƎ λŘŜl· l·yŘ űKŜ l·dzűK2NJă ŦŜŜf űKl·ű λŦ λű Kl·LJLJŜyãΣ λű øλff ŎNJŜl·űŜ l· ăŜyãŜ 2Ŧ dzyλűè l·Y˜2yƎ űKŜ Ŏ2Y˜LJŜűλűλ2yã ó ² KλűŜ ϑ ² λffλl·Y˜ăΣ нлммúφ 5ø l·èyŜ ² λffλl·Y˜ă űl·fţŜŘ l·ō2dzű űKλă λy˜l· NJŜŎŜyű λyűŜNJØλŜøY ά¢KŜ λyλűλl·f l·fƎ2NJλűKY˜ λă űKŜNJŜΣ λűΩă ōŜŜy˜2dzű űKŜNJŜ Ŧ2NJ l· fλűűfŜ øKλfŜ l·yŘ øŜΩØŜ l·ăţŜŘ LJŜ2LJfŜ ű2 Ŏ2Y˜Y˜Ŝyű 2y˜λű l·yŘ ădzƎƎŜăű ŎKl·yƎŜă ű2 λűφ ² ŜΩNJŜ λy˜ űKŜ LJNJ2ŎŜăă y2ø 2Ŧ f22ţλyƎ űKNJ2dzƎK űKŜ ăLJŜŎűNJdzY˜ 2Ŧ øKl·ű Ŏ2Y˜LJŜűλűλ2yã l·NJŜ 2dzű űKŜNJŜ l·yŘ λyØλűλyƎ űKŜY˜ ű2 ăŜyŘ NJŜădztűă ű2 dzăε ó ² λffλl·Y˜ăΣ нлмпúφ ¢KŜλNJ Ǝ2l·f λă ű2 LJNJ2ØλŘŜ NJŜŎ2Ǝyλűλ2y˜Ŧ2NJ Ŏ2Y˜LJŜűλűλ2yãφ a l·yè ăY˜l·ff l·yŘ f2Ŏl·f Ŏ2Y˜LJŜűλűλ2yã l·NJŜ ƎNJŜl·ű l·yŘ øλűK l· fλűűfŜ NJŜŎ2Ǝyλűλ2y˜Ŏ2dztŘ ōŜŎ2Y˜Ŝ yl·űλ2yl·f ŜØŜyűăφ ¢Kλă ŎKl·Y˜LJλ2yãKλLJ ŎdzLJ ø2dztŘ l·ű fŜl·ăű ƎλØŜ NJŜŎ2Ǝyλűλ2y˜ű2 űKŜăŜ Ŏ2Y˜LJŜűλűλ2yã ó ² λffλl·Y˜ăΣ нлмпúφ

b2ű Y˜dzŎK Kl·ă ōŜŜy˜øNJλűűŜy˜2y˜űKŜ ădzō?ŜŎű 2Ŧ λy?ŜŎűăφ ¢KŜ Y˜l·λy˜ō2Řè 2Ŧ ţy2øfŜŘƎŜ Ŏ2Y˜Ŝă ŦNJ2Y˜ űKŜ //5/ Ř2ŎdzY˜Ŝyűă űKŜY˜ăŜfØŜăΣ øKλŎK 2yfè l·ffdzŘŜ ű2 λy?ŜŎűăΣ ōdzű yŜØŜNJ Ŏ2yŎNJŜűŜfè ŘŜŦλyŜ øKl·ű l·y˜λy?ŜŎű λăφ ¢Kλă λă ă2Y˜ŜøKl·ű ădzNJLJNJăλyƎΣ ƎλØŜy˜K2ø

λΥLJ2NŭI·yŭ I· ŭ22f ŭKŜ λy?ŜŎŭ λă Ŧ2N ŜØI·fdzI·ŭλ2y˜2Ŧ I· ŭŜI·Y˜ă ˥y2øfŜŘƎŜ 2Ŧ yŜŭø2N˥λyƎ I·yŘ ăŜŎdzNλŭè λăădzŜăΦ ² λŭK2dzŭ I· ŘŜŦλyλŭλ2y˜I·yŘ ŎfŜI·N ŘλNŜŎŭλ2yΣ ŭ2dzNyI·Y˜Ŝyŭ Ø2fdzyŭŜŜNă øK2 ø2N˥ ŭ2 ŎNŜI·ŭŜ I·LJLJN2LJNλI·ŭŜΣ ŎKI·ffŜyƎλyƎ λy?ŜŎŭă Ŧ2N f2ŎI·f Ŏ2Y˜LJŜŭλŭλ2yã ŦλyŘ ŭKŜ ŭI·ă˥ ŘλŦŦλŎdzfŭ I·yŘ LJN2ōfŜY˜I·ŭλŎΦ Ly˜I·ŘŘλŭλ2yΣ ŭKŜλN Ŧλy1·f λy?ŜŎŭă ØI·Nè λy˜Ŏ2Y˜LJfŜÈλŭè ŦN2Y˜ Ŏ2Y˜LJŜŭλŭλ2y˜ŭ2 Ŏ2Y˜LJŜŭλŭλ2yΦ [I·Ŏ˥λyƎ I·yè ŎfŜI·N ŘŜŦλyλŭλ2yãΣ λyãŭNdzŎŭλ2yãΣ 2N ƎdzλŘŜfλyŜăΣ 2ŭKŜN LJŜŘI·Ǝ2ƎλŎ Y˜ŜŭK2Ř2f2ƎλŜă øŜNŜ ŜÈLJf2NŜŘ ŭ2 ŘŜŭŜNY˜λyŜ øKI·ŭ Ŏ2dzfŘ ōŜ ƎfŜI·yŜŘ ŦN2Y˜ fλŭŜNI·ŭdzNŜ ŭKI·ŭ LJI·NI·ffŜfă ŭKŜ Ŏ2yŎŜLJŭ 2Ŧ I·y˜λy?ŜŎŭΦ

Simulations

{λY˜dzfI·ŭλ2yã KI·ØŜ ōŜŜy˜dzŭλfλÎŜŘ λy˜ØI·Nλ2dză λyŘdzăŭNλŜă Ŧ2N ŘŜŎI·ŘŜăΦ {λY˜dzfI·ŭλ2yã ØI·Nè λy˜ăλÎŜ I·yŘ Ŏ2Y˜LJfŜÈλŭèΦ 9ÈŜNŎλăŜă NI·yƎŜ ŦN2Y˜ ăλY˜LJfŜ N2fŜ LJfI·è λy˜ŭŜI·Y˜ ōdzλfŘλyƎ ăŜY˜λyI·Nă ŭ2 øI·N ƎI·Y˜Ŝă ōŜŭøŜŜy˜I·ffλŜŘ yI·ŭλ2yãΦ !ŭŭŜyŭλ2y˜ŭ2 ŘŜŭI·λfΣ 2N ŦλŘŜfλŭèΣ ŎI·y˜ōŜ I·ă ăλY˜LJfŜ I·ă I· ō2È øλŭK ă2Y˜Ŝ ăøλŭŎKŜă ŭ2 Y˜λY˜λŎ I· ŦfλƎKŭ λyãŭNdzY˜Ŝyŭ LJI·yŜf ŭ2 I· Ŏ2Y˜LJfŜŭŜ ?Ŝŭ Ŏ2Ŏ˥LJλŭ ŭKI·ŭ Y˜2ØŜăΦ {ŭdzŘλŜă KI·ØŜ y2ŭ ōŜŜy˜I·ōfŜ ŭ2 LJN2ØŜ ŭKI·ŭ KλƎKŜN ŦλŘŜfλŭè ăλY˜dzfI·ŭλ2yã ŜIjdzI·ŭŜ ŭ2 I· KλƎKŜN ŭNI·yãŦŜN 2Ŧ ˥y2øfŜŘƎŜ ó[2yƎNλŘƎŜΣ .dzN˥λπ/2KŜyΣ D2Σ ϑ YŜyŘNI·Σ нллмú ó I I·ffΣ нлмоúΦ !yŘ I·ă ăŎI·fŜ I·yŘ ŦλŘŜfλŭè λyŎNŜI·ăŜΣ ă2 Ř2Ŝă Ŏ2ăŭΦ

YŜØλy˜Ydzy˥fŜN ŘŜăŎNλōŜŘ ŭKŜ ōŜyŜŦλŭă 2Ŧ dzăλyƎ ăλY˜dzfI·ŭ2Nă λy˜ŭNI·λyλyƎ I·ă ćλY˜LJN2ØŜŘ ŜŘdzŎI·ŭλ2yI·f ŜÈLJŜNλŜyŎŜT λyŎNŜI·ăŜŘXăI·ŦŜŭèT Ŏ2ăŭ ŜŦŦλŎλŜyŎèT I·yŘ 2yƎ2λyƎ ŭNI·λyλyƎ 2LJLJ2NŭdzyλŭλŜăé óYdzy˥fŜNΣ нлсΣ LJΦ нлсúΦ {ŭdzŘλŜă KI·ØŜ I·fă2 ăK2øy˜λY˜LJN2ØŜYŜyŭ λy˜ăŭdzŘŜyŭă øK2 ŭNI·λyŜŘ dzăλyƎ I· ăλY˜dzfI·ŭ2N ØŜNăŜă ŭK2ăŜ øK2 ŘλŘ y2ŭΦ ! ăŭdzŘè ōè I Ŝy˥è ¢I·èf2N I·yŘ I·ăă2ŎλI·ŭŜă ŘŜY˜2yãŭNI·ŭŜŘ ŭKI·ŭ Ŏ2dzNăŜ Ŏ2Y˜LJfŜŭλ2y˜ŭλY˜Ŝă øŜNŜ ăλƎyλŦλŎI·yŭfè f2øŜN Ŧ2N yŜø LJλf2ŭă LJNI·ŎŭλŎλyƎ 2y˜I· ŘŜă˥ŭ2LJ Ŏ2Y˜LJdzŭŜN ăλY˜dzfI·ŭ2N λy˜I·ŘŘλŭλ2y˜ŭ2 fŜăă2yã λy˜ŭKŜ I·λNLJfI·yŜ ŭKI·y˜ŭ2 ŭKŜ Ŏ2yŭN2f ƎN2dzLJ øK2 2yfè LJNI·ŎŭλŎŜŘ λy˜ŭKŜ LJfI·yŜ ó¢I·èf2NΣ Ŝŭ I·fΦΣ мфффúΦ

/èōŜŃ Ŏ2ϒLJŜŭλŭλ2ỵã I·ŃŜ ŜŦŦŜŎŭλØŜ ăλϒdzfI·ŭλ2ỵã λỵ˙L¢ ăŜŎdzŃλŭè 2LJŜŃI·ŭλ2ỵã λỵ˙I· ăϒ˙I·ff ōdzăλỵŜăă ŜỵØλŃ2ỵϒŜỵŭΦ /2ỵŎfdzăλ2ỵã ŎI·ỵ˙ōŜ ŘŃI·øỵ˙ōŜŭøŜŜỵ˙ăŭdzŘλŜă 2ỵ˙ŭKŜ ŜŦŦŜŎŭλØŜỵŜăă 2Ŧ ăλϒdzfI·ŭλ2ỵã λỵ˙2ŭKŜŃ λỵŘdzăŭŃλŜă I·ỵŘ ŎèōŜŃ Ŏ2ϒLJŜŭλŭλ2ỵãΦ ¢ø2 2Ŧ ŭKŜ λỵŘdzăŭŃλŜă ŭKI·ŭ dzăŜ ăλϒdzfI·ŭλ2ỵã ŜÈŭŜỵãλØŜfè I·ŃŜ ŭKŜ ϒŜŘλŎI·f I·ỵŘ I·ØλI·ŭλ2ỵ˙ăŜŎŭ2ŃăΦ ¢KŜăŜ ŭø2 λỵŘdzăŭŃλŜă KI·ØŜ fŜI·ŃỵŜŘ ŦŃ2ϒ ŜI·ŎK 2ŭKŜŃ λỵ˙ăλϒdzfI·ŭ2Ń ŭŜŎKỵ2f2∃è I·ỵŘ ϒŜŭK2Řă ó5I·øă2ỵΣ нллсúΦ

Medical

¢KŜ ŦλŃăŭ ϒŜŘλŎI·f ăλϒdzfI·ŭ2Ńă øŜŃŜ ăKŜŜLJ fdzỵ∃ă I·ỵŘ fλØŜŃăΣ dzăŜŘ λỵ˙ a Ŝă2LJ2ŭI·ϒλI· Ŧ2Ń ŭKŜ λỵãŭŃdzŎŭλ2ỵ˙2Ŧ ăŭdzŘŜỵŭăΦ ! DŃŜŜ˥ LJKèăλŎλI·ỵ˙ỵI·ϒŜŘ DI·fŜỵ˙ŭKŜỵ˙ŘŜØŜf2LJŜŘ I· ϒ2ŘŜf 2Ŧ ŭKŜ KdzϒI·ỵ˙ō2Řè ŭKI·ŭ øI·ă fI·ŭŜŃ ŘλăLJŃ2ØŜŘ I·ỵŘ λϒLJŃ2ØŜŘ dzLJ2ỵ˙ōè 5I· ±λỵŎλΣ ±ŜăI·fλdză I·ỵŘ 2ŭKŜŃăΦ Lŭ øI·ăỵŲŭ dzỵŭλf мсну ŭKI·ŭ I·ỵ˙I·ŎŎdzŃI·ŭŜ ϒ2ŘŜf 2Ŧ ŭKŜ ŎλŃŎdzfI·ŭλ2ỵ˙2Ŧ ōf22Ř øI·ă ŘŜØŜf2LJŜŘ ōè ² λffλI·ϒ I I·ŃØŜèΦ Lỵ˙ŭKŜ нлŭK ŎŜỵŭdzŃèΣ ϒ2ŘŜfă KI·ØŜ ōŜŜỵ˙ŘŜØŜf2LJŜŘ Ŧ2Ń I·ff LJI·Ńŭă 2Ŧ ŭKŜ ō2ŘèΣ I·ff2øλỵ∃ ăŭdzŘŜỵŭă ŭ2 LJŃI·ŎŭλŎŜ / tw óŎI·ŃŘλ2 LJdzfϒ2ỵI·Ńè ŃŜădzăŎλŭI·ŭλ2ỵŭ 2Ń ŘŃI·øλỵ∃ ōf22ŘΦ ² λŭK ŭKŜ I·ŘØŜỵŭ 2Ŧ Ŏ2ϒLJdzŭŜŃăΣ ϒ2ŃŜ I·ŎŎdzŃI·ŭŜ I·ỵŘ fλŦŜπfλ˥Ŝ ϒ2ŘŜfă ŭKI·ỵ˙ ŜØŜŃ ōŜŦ2ŃŜ KI·ØŜ ōŜŜỵ˙ŎŃŜI·ŭŜŘ ŭ2 ŭŜI·ŎK I·ỵŘ ŭŃI·λỵ˙ỵŜø Ř2Ŏŭ2Ńă óYdzỵ˙˥fŜŃΣ нлсúΦ

a ŜŘλŎI·f LJŃ2ŎŜŘdzŃŜă KI·ØŜ ∃2ŭŭŜỵ˙ϒ2ŃŜ I·ỵŘ ϒ2ŃŜ Ŏ2ϒLJfλŎI·ŭŜŘ 2ØŜŃ ŭKŜ LJI·ăŭ ŦŜø èŜI·ŃăΦ hỵŜ ădzŎK ŜÈI·ϒLJfŜ λă ŭKŜ LJfI·ŎŜϒŜỵŭ 2Ŧ ăŭŜỵŭă λỵ˙ŭKŜ I·ŃŭŜŃλŜă ŭ2 LJŃŜØŜỵŭ ăŭŃ2˥ŜăΦ Lỵ˙ нллп I· Ŏ2ϒLJI·ỵèLJŃ2ŘdzŎŜŘ I· ŎI·Ń2ŭλŘ ăŭŜỵŭ ŭKI·ŭ ø2dzfŘ 2LJŜỵ˙dzLJ ŭKŜ I·ŃŭŜŃλŜă ŭKI·ŭ I·ff2ø ōf22Ř ŭ2 Ŧf2ø ŭ2 ŭKŜ ōŃI·λỵΦ ¢KŜ C22Ř I·ỵŘ 5ŃdzΣ ! ŘϒλỵλăŭŃI·ŭλ2ỵ˙óC5 ! ú ŘŜŭŜŃϒλỵŜŘ ŭKI·ŭ ŭKŜ LJŃ2ŎŜŘdzŃŜ øI·ă ă2 Ńλă˥è ŭKI·ŭ ŭKŜ LJKèăλŎλI·ỵ˙øI·ă ŃŜIjdzλŃŜŘ ŭ2 ŘŜϒ2ỵãŭŃI·ŭŜ LJŃ2ŦλŎλŜỵŎè 2ỵ˙I· ăλϒdzfI·ŭ2Ń ōŜŦ2ŃŜ ŭKŜ ăŭŜỵŭ Ŏ2dzfŘ ōŜ LJdzŃŎKI·ăŜŘ ó5I·øă2ỵΣ нллсúΦ ¢Kλă ŘŜϒ2ỵãŭŃI·ŭŜă K2ø ăλϒdzfI·ŭλ2ỵã ŎI·ỵ˙ōŜ dzăŜŘ Ŧ2Ń ō2I·ŃŘ ŜÈI·ϒλỵI·ŭλ2ỵΣ ŎŃŜŘŜỵŭλI·fλỵ∃ I·ỵŘ LJŃ2ŎŜŘdzŃI·f ŃŜKŜI·Ńăl·fΣ ϒλỵλϒλÎλỵ∃ ŭKŜ Ńλă˥ ŭ2 LJI·ŭλŜỵŭă I·ỵŘ ϒ˙I·fLJŃI·ŎŭλŎŜ ădzλŭăΦ

W2Ky˝ t l·λƎŜ l·yŘ ăŜØŜNJl·f 2Ŧ Kλă Ŏ2ftŜl·ƎdzŜă ŘŜY˝2y˝ăŭNJl·ŭŜŘ ŭKŜ dzăŜ 2Ŧ λyŭŜNJŘλăŎλLJfλy1·NJè ŭŜl·Y˝ ōdzλfŘλyƎ l·yŘ Ŏ2Y˝Y˝dzyλŎl·ŭλ2y˝ øλŭK ŭKŜ dzăŜ 2Ŧ ăλY˝dzfl·ŭŜŘ ădzNJƎŜNJèΦ {ŭdzŘλŜă Kl·Ř ăK2øy˝ŭKl·ŭ Y˝λăŭl·˥Ŝă øŜNJŜ ōŜλyƎ Yl·ŘŜ ōŜŎl·dzăŜ 2Ŧ l· fl·Ŏ˥ 2Ŧ Ŏ2Y˝Y˝dzyλŎl·ŭλ2y˝ l·yŘ dzyŘŜNJăŭl·yŘλyƎ 2Ŧ ŭKŜ 2ŭKŜNJ Y˝ŜY˝ōŜNJăΩ NJ2fŜă 2y˝ŭKŜ ădzNJƎλŎl·f ăŭl·ŦŦΦ ±2fdzyŭŜŜNJă øŜNJŜ ă2dzƎKŭ l·yŘ ăŜfŜŎŭŜŘ ŦNJ2Y˝ l·ØI·λfl·ōfŜ Y˝ŜY˝ōŜNJă 2Ŧ ăŭl·ŦŦ l·ŭ ŭKŜ K2ăLJλŭl·fΣ Ŏ2yãλăŭλyƎ 2Ŧ l· ăŜyλ2NJ ƎŜyŜNJl·f ădzNJƎŜNJè NJŜăλŘŜyŭΣ l· ŎŜNJŭλŦλŜŘ NJŜƎλăŭŜNJŜŘ yƫzNJăŜ l·yŜăŭKŜŭλăŭΣ l·yŘ l· ŎλNJŎdzfl·ŭλyƎ NJŜƎλăŭŜNJŜŘ yƫzNJăŜΦ ¢Kλă ƎNJ2dzLJ NJl·y˝ŭKNJ2dzƎK ŭKŜ ădzNJƎŜNJè ăλY˝dzfl·ŭλ2yΦ ¢KNJ2dzƎK ŭKŜ øK2fŜ LJNJ2ŎŜŘdzNJŜΣ ŭKŜ ŭŜl·Y˝ øl·ă ōŜλyƎ NJŜŎ2NJŘŜŘ ō2ŭK l·dzŘλōfè l·yŘ Øλădzl·ffèΦ !ŦŭŜNJ ŭKŜ LJNJ2ŎŜŘdzNJŜΣ ŭKŜ ŭŜl·Y˝ ØλŜøŜŘ ŭKŜ NJŜŎ2NJŘλyƎ l·yŘ LJl·NJŭλŎλLJl·ŭŜŘ λy˝l· ŘŜōNJλŜŦλyƎ ăŜăăλ2y˝ ŘŜăλƎyŜŘ ŭ2 ŘλăŎdzăă ŭŜl·Yø2NJ˥ l·yŘ Ŏ2Y˝Y˝dzyλŎl·ŭλ2yΦ Ly˝l· ădzNJØŜè Ŧ2ff2øλyƎ ŭKŜ ŘŜōNJλŜŦ ăŜăăλ2yΣ l·ff LJl·NJŭλŎλLJl·yŭă NJŜăLJ2yŘŜŘ LJ2ăλŭλØŜfè ŭ2 Ř2λyƎ ŭKŜ ăλY˝dzfl·ŭλ2y˝l·Ǝl·λy˝l·yŘ y£ăl·λŘ ŭKl·ŭ λŭ ø2dzfŘ ŎKl·yƎŜ LJŜNJŦ2NJY˝l·yŎŜ λy˝ŭKŜ 2LJŜNJl·ŭλyƎ NJ22YΦ ¢Kλă ˥λyŘ 2Ŧ l·ŘØl·yŎŜŘ ă˥λff ŭNJl·λyλyƎ ø2dzfŘ ōŜ dzyøλăŜ l·yŘ Kl·NJŘ ŭ2 ăŜŭ dzLJ λy˝l·y˝l·Ŏŭdzl·f 2LJŜNJl·ŭλ2y˝ ót l·λƎŜΣ Ŝŭ l·fΦΣ нллтúΦ

Aviation

¢KŜ ŦλNJăŭ ŦfλƎKŭ ăλY˝dzfl·ŭ2NJ øl·ă λyØŜyŭŜŘ ōè 9Řøl·NJŘ [λy˝˥ λy˝мфнф ŭ2 KŜfLJ λyãŭNJdzŎŭ2NJă ŜØl·fdzl·ŭŜ ŭKŜ LJŜNJŦ2NJY˝l·yŎŜ 2Ŧ ăŭdzŘŜyŭăΦ Lŭ øl·ă y2ŭKλyƎ Y˝2NJŜ ŭKl·y˝l· ōfdzŜ ō2È øλŭK l· ăŭλŎ˥Σ Y˝2ŘŜf øλyƎă l·yŘ l· ŭl·λfΦ l λă ăλY˝dzfl·ŭ2NJ øl·ăyΩŭ ØŜNJè ădzŎŎŜăăŦdzf dzyŭλf ² 2NJfŘ ² l·NJ LL øKŜy˝ŭKŜ ¦yλŭŜŘ {ŭl·ŭŜă !NJY˝è !λNJ C2NJŎŜ øl·ă Kl·ØλyƎ l· Kλ˝ƎK LJλf2ŭ f2ăă NJl·ŭŜ ŘdzŜ ŭ2 yλƎKŭŭλY˝Ŝ Ŏl·NJNJλŜNJ fl·yŘλyƎăΦ !ŦŭŜNJ λyŎ2NJLJ2NJl·ŭλyƎ [λy˝˥Ωă ăλY˝dzfl·ŭ2NJΣ LJλf2ŭ ŘŜl·ŭKă ŘNJ2LJLJŜŘ ōè φ£ăl·ó5l·øă2yΣ нллсúΦ

{ŜØŜNJl·f Y˝ŜŭK2Řă Kl·ØŜ ōŜŜy˝LJdzōfλăKŜŘ 2y˝λY˝LJNJ2ØλyƎ ŭKŜ LJŜNJŦ2NJY˝l·yŎŜ λy˝ŭKŜ Ŏ2Ŏ˥LJλŭ ŭKNJ2dzƎK ŭKŜ dzăŜ 2Ŧ ăλY˝dzfl·ŭ2yãΦ .Ŝl·NJŘΣ {l·fl·ă l·yŘ tNJλyŎŜ 2dzŭfλyŜŘ ƎdzλŘŜfλyŜă Ŧ2NJ

dzăλy∃ ℕ2fŜπLJfl·è űƨ λY˙LJℕƨØŜ ŎℕŜø ℕŜăƨdzℕŎŜ Y˙l·yl·∃ŜY˙Ŝyűƨ ōŜKl·Øλƨℕă ó . Ŝl·ℕŘΣ {l·fl·ăΣ ɜ

tℕλyŎŜΣ мфφpúΦ Cƨøf˥ŜăΣ 5øèŜℕΣ hăŜℕ l·yŘ {l·fl·ă LJℕƨLJƨăŜŘ dzăλy∃ ăLJŜŎλŦλŎ ŜØŜyűă űƨ LJℕƨØλŘŜ

ƨLJLJƨℕűdzyλűλŜă űƨ ƨōăŜℕØŜ ăLJŜŎλŦλŎ ōŜKl·ØλƨℕăΣ ℕŜŦŜℕℕŜŘ űƨ l·ă 9ØŜyűπ . l·ăŜŘ ! LJLJℕƨl·ŎK űƨ

¢ℕl·λyλy∃Σ űKl·ű λyăűℕdzŎűƨℕă øl·yűŜŘ űƨ ƨōăŜℕØŜΦ Ly˙ƨyŜ ŜÈl·Y˙LJfŜΣ l· űƨøŜℕ ∃l·ØŜ Ŧl·făŜ

øŜl·űKŜℕ λyŦƨℕY˙l·űλƨy˙Ŧƨℕ űl·˥ŜƨŦŦ űƨ ăŜŜ λŦ űKŜ LJλfƨűØƨdzfŘ ŘŜY˙ƨyăűℕl·űŜ l·∃∃ℕŜăăλØŜyŜăă

l·yŘ ljdzŜăűλƨy˙űKŜ λyŦƨℕY˙l·űλƨy˙óCƨøf˥ŜăΣ 5øèŜℕΣ hăŜℕΣ ɜ {l·fl·ăΣ мфφyúΦ tℕλyŎŜΣ hăŜℕΣ {l·fl·ă

l·yŘ ² ƨƨŘℕdzŦŦ ŘŜØŜfƨLJŜŘ l· ∃dzλŘŜ űƨ ŘŜØŜfƨLJλy∃ ăŎŜyl·ℕλƨă Ŧƨℕ űℕl·λyλy∃ l·λℕŎℕŜøă ó tℕλyŎŜΣ

hăŜℕΣ {l·fl·ăΣ ɜ ² ƨƨŘℕdzŦŦúΦ

¢KŜăŜ ăűdzŘλŜăΣ ōƨűK Y˙ŜŘλŎl·f l·yŘ l·Ŝℕƨyl·dzűλŎl·fΣ Ŏl·y˙ōŜ l·LJLJfλŜŘ űƨ űKŜ ŎℕŜl·ûλƨy˙ƨŦ

λy?ŜŎûă ōŜŎl·dzăŜ ŎèōŜℕ ŘŜŦŜyăŜ Ŏƨ˙Y˙LJŜûλûλƨyã l·ℕŜ l· ûèLJŜ ƨŦ ℕƨfŜ LJfl·èΦ Ly?ŜŎûăΣ fλ˥Ŝ

ăλY˙dzfl·ûλƨyãΣ l·ℕŜ ŎℕŜl·ûŜŘ űƨ ăŜŜ øKl·ű Ŏƨ˙Y˙LJŜûλûƨℕă øλfff Řƨ øKŜy˙LJfl·ŎŜŘ λy˙ŎŜℕûl·λy˙

ăλűdzl·ûλƨyãΦ

Learning theories

² λűK ƨyŜ ƨŦ űKŜ ∃ƨl·fă ƨŦ ŎèōŜℕ Ŏƨ˙Y˙LJŜûλûλƨyã ōŜλy∃ ŜŘdzŎl·ûλƨyΣ ăLJŜŎλŦλŎl·ffè Kl·yŘăπ

ƨy˙fŜl·ℕyλy∃Σ űKŜℕŜ λă yƨ ădzℕLJℕλăŜ űKl·ű ăűdzŘλŜă ƨy˙ŜŘdzŎl·ûλƨy˙ℕŜfl·ûŜ űƨ űKλă ŦλŜfŘΦ ¢KŜℕŜ l·ℕŜ

ăŜØŜℕl·f fŜl·ℕyλy∃ űKŜƨℕλŜă űKl·ű ŎèōŜℕ ŘŜŦŜyăŜ Ŏƨ˙Y˙LJŜûλûλƨyã ădzLJLJƨℕűΦ Cƨff2øλy∃ λă l· fλăű ƨŦ

űKŜ fŜl·ℕyλy∃ űKŜƨℕλŜă l·yŘ űKŜ øl·è űKŜè ℕŜfl·ûŜ űƨ Ŏƨ˙Y˙LJŜûλûλƨyãΦ

Bloom’s Taxonomy

áLy˙мфpcΣ . Ŝy?l·Y˙λy˙ . f22Y˙ KŜl·ŘŜŘ l· ∃ℕƨdzLJ ƨŦ ŜŘdzŎl·ûλƨyl·f LJăèŎKƨf2∃λăűă øKƨ

ŘŜØŜfƨLJŜŘ l· Ŏfl·ăăλŦλŎl·ûλƨy˙ƨŦ fŜØŜfă ƨŦ λyűŜffŜŎûdzl·f ōŜKl·Øλƨℕ λY˙LJƨℕûl·yű λy˙fŜl·ℕyλy∃é

óhØŜℕōl·dz∃K ɜ {ŎKdzfûÎúΦ ¢KŜ yl·Y˙Ŝ ƨŦ űKλă űKŜƨℕè λă . f22Y˙Ωă ¢l·È2y?Y˙èΦ . f22Y˙Ωă űKŜƨℕè

[Analyzing] [illegible]

[Evaluating] [illegible]

[Creating] [illegible]

Kolb's Experiential Learning Theory

[illegible]

ă2Y Ŝ Ŏ2Y Y 2y1·ťŭλŜă óY2ťōΣ мфупΣ LJΦ нлúΦ ¢Kλă fŜI·NJyλyƎ Y 2ŘŜť Ŏ2Y LJNJλăŜă ŦƵdzNJ ŜťŜY Ŝyŭă ŦNJ2Y ŭK2ăŜ ŭKŜ2NJλŜăY Ŏ2yŎNJŜŭŜ ŜÈLJŜNJλŜyŎŜΣ 2ōăŜNJØI·ŭλ2y 2Ŧ I·yŘ NJŜŦťŜŎŭλ2y 2y ŭKI·ŭ ŜÈLJŜNJλŜyŎŜΣ Ŧ2NJY I·ŭλ2y 2Ŧ I·ōăŭNJI·Ŏŭ Ŏ2yŎŜLJŭă ōI·ăŜŘ dzLJ2y ŭKŜ NJŜŦťŜŎŭλ2yΣ I·yŘ ŭŜăŭλyƎ ŭKŜ yŜø Ŏ2yŎŜLJŭă ó ! dzƎdzăŭλyŜ ȝ 52ŘƎŜΣ нллсúΦ [ŜI·NJyŜNJă ø2dzťŘ ŭKŜy NJŜLJŜI·ŭ ŭKŜ ăŭŜLJăΦ [ŜI·NJyλyƎ ŏI·y ōŜƎλy I·ŭ I·yè LJKI·ăŜ ōdzŭ dzădzI·ťfè ăŭI·NJŭă øλŭK I· Ŏ2yŎNJŜŭŜ ŜÈLJŜNJλŜyŎŜΦ /èōŜNJ Ŏ2Y LJŜŭλŭλ2yã LJNJ2ØλŘŜ ŭKŜ ăŭdzŘŜyŭă øλŭK I·y 2LJLJ2NJŭdzyλŭè ŭ2 fŜI·NJy øλŭK I·ťf Ŧ2dzNJ Y ŜŭK2Řăφ ¦ ăλyƎ I·ťf Ŧ2dzNJ Y ŜŭK2Řă ƎλØŜă ăŭdzŘŜyŭă I· Ŏ2yŎNJŜŭŜ fŜI·NJyλyƎ ŜÈLJŜNJλŜyŎŜ ó ! dzƎdzăŭλyŜ ȝ 52ŘƎŜΣ нллсúΦ

. ŜťŜ ² 22ŘøI·NJŘ I·yŘ ¢NJI·Øλă ¸2dzyƎ ŦNJ2Y {2dzŭKŜNJy LťťλY2λă ¦ yλØŜNJăλŭè NJŜŘŜăλƎyŜŘ ŎdzNJNJλŎdzťdzY Ŧ2ťť2øλyƎ Y2ťōΩă ŭKŜ2NJè I·yŘ øŜNJŜ I·ōťŜ ŭ2 ăŜyŘ ăŭdzŘŜyŭă øK2 KI·Ř ōŜŜy ŭKNJ2dzƎK ŭKŜ NJŜŘŜăλƎyŜŘ Ŏ2dzNJăŜă ŭ2 I· wŜƎλ2y1·ť /èōŜNJ 5ŜŦŜyãŜ /2Y LJŜŭλŭλ2yΦ ¢KŜ ăŭdzŘŜyŭă øŜNJŜ I·ōťŜ ŭ2 ŜI·ăλťè KI·yŘťŜ ŭKŜ ŘλăNJdzLJŭλ2yã ŭKŜ λy?ŜŎŭă ŎI·dzăŜŘ I·yŘ NJŜI·ŎŭŜŘ λy ŭKŜ I·LJLJNJ2LJNJλI·ŭŜ øI·è ŭ2 ŭKŜ ăλŭdzI·ŭλ2yã øλŭKλy ŭKŜ Ŏ2Y LJŜŭλŭλ2y ōŜŎI·dzăŜ 2Ŧ ŭKŜ KI·yŘăπ2y ŜÈLJŜNJλŜyŎŜă ŭKŜ ŎdzNJNJλŎdzťdzY ŎKI·yƎŜ KI·Ř λyŭNJ2ŘdzŎŜŘΦ t I·NJŭ 2Ŧ ŭKŜ ŎdzNJNJλŎdzťdzY ŎKI·yƎŜ øI·ă ŭKŜ ăŭdzŘŜyŭă øŜNJŜ NJŜljdzNJŜŘ ŭ2 ø2NJ] λy ŭŜI·Yăφ ¢KŜNJŜŦ2NJŜΣ ōŜλyƎ LJI·NJŭ 2Ŧ ŭKŜ ōťdzŜ ŭŜI·Y λy ŭKŜ Ŏ2Y LJŜŭλŭλ2y øI·ă ăŜŎ2yŘ y1·ŭdzNJŜ ŭ2 ŭKŜY ōŜŎI·dzăŜ ŭKŜè KI·Ř ōŜŜy ø2NJ]λyƎ I·ă I· ŭŜI·Y ŘdzNJλyƎ NJŜƎdzťI·NJ Ŏ2dzNJăŜø2NJ]φ ¢KŜ ŭŜI·Y ŭ22] ŦλNJăŭ LJťI·ŎŜ I·ŭ ŭKŜ NJŜƎλ2y1·ť Ŏ2Y LJŜŭλŭλ2y ó ² 22ŘøI·NJŘ ȝ ¸2dzyƎΣ нллтúΦ

Challenge Based Learning

! LJLJťŜ /2Y LJdzŭŜNJ LyŎΦ LJNJ2LJ2ăŜŘ ŎKI·ťŜyƎŜ ōI·ăŜŘ fŜI·NJyλyƎ ó/ . [úΦ ¢KŜ Y ŜŭK2Ř2ť2Ǝè 2Ŧ / . [λă Ŧ2NJ ăŭdzŘŜyŭă ŭ2 dzăŜ ŭKŜλNJ]y2øťŜŘƎŜ I·yŘ I·LJLJťè λŭ ŭ2 NJŜI·ť ø2NJťŘ ăλŭdzI·ŭλ2yãΦ /KI·ťŜyƎŜŘ ōI·ăŜŘ fŜI·NJyλyƎ λă ØŜNJè KI·yŘăπ2y I·yŘ NJŜljdzNJŜă ăŭdzŘŜyŭă ŭ2 Ŏ2ťťI·ō2NJI·ŭŜ øλŭK

2ŭKŜ№ ăŭdzŘŜyŭă ŭ2 ă2ŭØŜ №ŜI·f ø2№ŭŘ LJ№2ōŭŜY˘ă I·yŘ I·LJLJŭè ŭKI·ŭ ˥y2øŭŜŘ∃Ŝ⊕ t I·№ŭ 2Ŧ ŭKλă LJ№2ŎŜăă λă ŭ2 I·ŭă2 ŜØI·ŭdzI·ŭŜ I·ă I· ŭŜI·Y˘ øKŜy˘I· ŭI·ă˥ λă Ŏ2Y˘LJŭŜŭŜΣ I·yŘ ŭ2 ŭI·ŭ˥ I·ō2dzŭ ŭKŜ LJ№2ŎŜăă I·yŘ øKI·ŭ øI·ă Ŏ2№№ŜŎŭ 2№ øKI·ŭ Ŏ2dzŭŘ KI·ØŜ ōŜŜy˘Ř2yŜ ŘλŦŦŜ№Ŝyŭŭè

ó/ . [ψ/ŭI·ăă№22Y˘ψDdzλŘŜмнψнм a bψCλyI·ŭΣ нлммúφ ¢Kλă I·LJLJ№2I·ŎK λă Y˘2№Ŝ ŭλ˥Ŝ ŭKŜ №ŜI·f ø2№ŭŘ I·yŘ ōŜŭŭŜ№ LJ№ŜLJI·№Ŝă ăŭdzŘŜyŭă ŭ2 ø2№˥ yλyŜ ŭ2 ŦλØŜ ⁇2ōă⊕

Active Learning

ó! /Kλy˘ŜăŜ LJKλŭ2ă2LJKŜ№Σ [I·2 ¢Îdz ócc^ŭK /Ŝyŭdz№è . /úΣ ăI·λŘY ψLŦ è2dz ŭŜŭ Y˘ŜΣ L øλŭ ŭλăŭŜy⊕ LŦ è2dz ăK2ø Y˘ŜΣ L øλŭ ăŜŜ⊕ LŦ è2dz ŭŜŭ Y˘Ŝ ŜÈLJŜ№λŜyŎŜΣ L øλŭ ŭŜI·№y⁇ó/2y˥ŭλyΣ нллсúφ ! ŎŭλØŜ ŭŜI·№yλy∃ λă ŭKŜ LJ№ŜY˘λăŜ ōŜKλyŘ ŎèōŜ№ ŘŜŦŜyãŜ Ŏ2Y˘LJŜŭλŭλ2yã⊕ {ŭdzŘŜyŭă KI·ØŜ ŭKŜ 2LJLJ2№ŭdzyλŭè ŭ2 ø2№˥ KI·yŘăπ2y˘λy˘№ŜI·f ø2№ŭŘ ăλŭdzI·ŭλ2yã⊕ ¢KŜ 2ŭKŜ№ I·ăLJŜŎŭ 2Ŧ I·ŎŭλØŜ ŭŜI·№yλy∃ ŭKI·ŭ ŎèōŜ№ ŘŜŦŜyãŜ Ŏ2Y˘LJŜŭλŭλ2yã KŜŭLJ øλŭK λă ŭŜI·Y˘ ø2№˥⊕ /KI·ŭŜy∃Ŝă λy˘ŭKŜ ø2№˥ Ŧ2№ŎŜ øλŭ ōŜ ŭI·№∃Ŝŭè I·ŎŎ2Y˘LJŭλăKŜŘ øλŭK I· ŭŜI·Y˘ 2Ŧ λyŘλØλŘdzI·ŭă⊕ {ŭdzŘŜyŭă I·№Ŝ ōŜŭŭŜ№ LJ№ŜLJI·№ŜŘ ŭ2 Ŏ2ŭŭI·ō2№I·ŭŜ øλŭK 2ŭKŜ№ λyŘλØλŘdzI·ŭă I·yŘ Y˘2№Ŝ 2LJŜy˘ŭ2 ø2№˥ 2y˘I· ŭŜI·Y˘ ŭ2 I·ŎŎ2Y˘LJŭλăK ŭI·ă˥ă I·ŦŭŜ№ Ŏ2Y˘LJŜŭλy∃ λy˘I· ŎèōŜ№ ŘŜŦŜyãŜ Ŏ2Y˘LJŜŭλŭλ2y⊕ ¢ŜI·Y˘ă I·ŭă2 KI·ØŜ ŭ2 LJŜ№Ŧ2№Y˘ ŭI·ă˥ă λy˘I· ŭλY˘Ŝŭè Y˘I·yŷŜ№Σ Y˘I·˥λy∃ IjdzλŎ˥ I·ŎŭλØŜ ŘŜŎλăλ2yã ŭ2 LJ№2ŭŜŎŭ ŭKŜλ№ ŭŜI·Y˘ Ŧ№2Y˘ 2dzŭăλŘŜ ŭK№ŜI·ŭă øKλŭŜ I·ŎŎ2Y˘LJŭλăKλy∃ ŭI·ă˥ă I·ăăλ∃yŜŘ Řdzŭλy∃ ŭKŜ Ŏ2Y˘LJŜŭλŭλ2y˘ ó/2y˥ŭλyΣ нллсúφ

> Ly˘Ŧ2№Y˘I·ŭλ2y˘I·ăădzŭI·yŎŜ λă y2ŭ I·ō2dzŭ Ŧλ№ŜøI·ŭăΣ I·yŭλπØλ№dză ă2Ŧŭø I·№ŜΣ LJ№2È̀è ăŜ№ØŜ№ăΣ ŜŭŎ⊕ Lŭ λă I·ō2dzŭ I·ăădzŭλy∃ ŭKŜ λyŦ2№Y˘I·ŭλ2y˘№ŜIjdzλŭŜŘ ŭ2 Y˘I·˥Ŝ ōŜŭŭŜ№ λyŦ2№Y˘ŜŘ ŘŜŎλăλ2yã ŦI·ăŭŜ№ ŭKI·y˘è2dz№ I·ŘØŜ№ăI·№è ó.2ŭŜy∃ ⁇ {ŎKØŜλŭÎŜ№Σ нлмлúφ

Game-Based Learning

DI·Y˘Ŝπō I·ăŜŘ ŭŜI·№yλy∃ óD. [ú dzăŜă Ŏ2Y˘LJŜŭλŭλ2y˘I·ă Y˘2ŭλØI·ŭλ2y˘Ŧ2№ ŭŜI·№yλy∃ ŎŜ№ŭI·λy˘ 2ō⁇ŜŎŭλØŜă⊕ Ly˘D. [ăŭdzŘŜyŭă ŎI·y˘Ŏ2Y˘LJŜŭŜ λyŘλØλŘdzI·ŭè 2№ øλŭK 2ŭKŜ№ ăŭdzŘŜyŭă⊕ {Ŏ2№λy∃ λă

I·y˝λyűŜƎNJI·f LJI·NJű 2Ŧ ƎI·Y˝ŜπōI·ăŜŘ fŜI·NJyλyƎΣ KŜfLJλyƎ ʮŜŜLJ ăűdzŘŜyűă λyűŜNJŜăűŜŘΦ DI·Y˝ŜπōI·ăŜŘ fŜI·NJyλyƎ ƎλØŜă ăűdzŘŜyűă I·y˝2LJLJ2NJűdzyλűè ű2 ø2NJʮ λy˝λY˝Y˝ŜNJăλØŜ ŜyØλNJ2yY˝ŜyűăΣ øKλŎK Y˝I·ʮŜă fŜI·NJyλyƎ ŘŜűI·λfŜŘΣ ŜyƎI·ƎλyƎΣ I·yŘ λyűŜNJI·ŎűλØŜΦ wŜăŜI·NJŎKŜNJă KI·ØŜ Ŧ2dzyŘ űKI·ű Y˝2ăű 2Ŧ űKŜ űλY˝Ŝ D . [NJŜădztűă λy˝I· ōŜűűŜNJ LJŜNJŦ2NJY˝I·yŎŜ ŦNJ2Y˝ ăűdzŘŜyűăΣ I·yŘ KŜfLJă ăűdzŘŜyűă ű2 KI·ØŜ I· Y˝2NJŜ LJ2ăλűλØŜ I·űűλűdzŘŜ I·ō2dzű űKŜ ădzō?ŜŎű ówè22Σ ¢ŜŎKI·űI·ăăI·yI·ă22yű2NJyΣ [ŜŜΣ ɔ [2űKλI·yΣ нлммúΦ ¢Kλă űèLJŜ 2Ŧ fŜI·NJyλyƎ ŜÈI·Ŏűfè ŘŜŦλyŜă ŎèōŜNJ ŘŜŦŜyãŜ Ŏ2Y˝LJŜűλűλ2yãY ƎI·Y˝Ŝă øλűK I· LJdzNJLJ2ăŜ 2Ŧ űŜI·ŎKλyƎ ŎèōŜNJ ăŜŎdzNJλűè Φ

Evaluation and Testing

! y˝ŜÈI·Y˝LJfŜ 2Ŧ űKŜ 2dzűŎ2Y˝Ŝă 2Ŧ ŘNJλØŜNJΩă űNJI·λyλyƎ I·yŘ ŜŘdzŎI·űλ2y˝ øλff KŜfLJ λffdzăűNJI·űŜ űKŜ yŜŜŘ Ŧ2NJ ŎèōŜNJ ŘŜŦŜyãŜ Ŏ2Y˝LJŜűλűλ2yã I·ă I·y˝ŜØI·fdzI·űλ2y˝ű22f Ŧ2NJ øKI·ű ăűdzŘŜyűă KI·ØŜ fŜI·NJyŜŘ λy˝NJŜƎdzfI·NJ ŎfI·ăăNJ22Y˝ λyãűNJdzŎűλ2y˝I·ă λű Ŏ2Y˝LJI·NJŜă ű2 NJŜI·f ø2NJfŘ ăλűdzI·űλ2yãΦ ¦ fűλY˝I·űŜfèΣ űKŜNJŜ I·NJŜ űKNJŜŜ Ǝ2I·fă űKŜ ŘNJλØŜNJΩă űNJI·λyλyƎ űŜI·ŎKŜNJ KI·ă øKŜy˝űŜI·ŎKλyƎ I· ăűdzŘŜyűΦ ¢KŜ ŦλNJăű ōŜλyƎ űKI·ű űKŜ ăűdzŘŜyű ʮy2øă K2ø ű2 ŘNJλØŜ I·y˝I·dzű2Y˝2ōλfŜŦ ăŜŎ2yŘΣ űKŜ ăűdzŘŜyű ʮy2øă űKŜ NJdzfŜă 2Ŧ űKŜ NJ2I·ŘT I·yŘ űKλNJŘΣ I·yŘ Y˝2ăű λY˝LJ2NJűI·yűfèΣ űKŜ ăűdzŘŜyű ŎI·y˝ ăI·ŦŜfè 2LJŜNJI·űŜ I· ØŜKλŎfŜΦ ¢KŜ ŦλNJăű ű ø2 Ǝ2I·fă ŎI·y˝ōŜ ŜI·ăλfè Y˝ŜI·ădzNJŜŘ I·yŘ ŜØI·fdzI·űŜŘΦ ¢KŜ űKλNJŘ Ǝ2I·f λă KI·NJŘŜNJ ű2 ŜØI·fdzI·űŜΣ ōdzű λű λă űKŜ Y˝2ăű λY˝LJ2NJűI·yű Ǝ2I·f 2Ŧ űKŜ űŜI·ŎKŜNJΦ [Ŝű λű ōŜ y2űŜŘ űKI·ű I· ăűdzŘŜyű Y˝I·è KI·ØŜ ʮy2øfŜŘƎŜ 2Ŧ űKŜ NJ2I·Ř I·yŘ K2ø ű2 ŘNJλØŜ I· ŎI·NJΣ ōdzű Y˝I·è y2ű ʮy2ø K2ø ű2 ŘNJλØŜ űKŜ ØŜKλŎfŜ ăI·ŦŜfè óDNJ2yfdzyŘΣ мфтсúΦ b2NJY˝I·y˝DNJ2yfdzyŘΣ I·dzűK2NJ 2Ŧ a ŜI·ădzNJŜY˝Ŝyű I·yŘ 9ØI·fdzI·űλ2y˝λy˝¢ŜI·ŎKλyƎΣ ăűI·űŜăΣ áYy2øfŜŘƎŜ I·f2yŜ ŎI·yy2ű ōŜ dzăŜŘ I·ă ŜØλŘŜyŎŜ 2Ŧ KI·ØλyƎ I·ŎIjdzλNJŜŘ dzyŘŜNJăűI·yŘλyƎΣ ăʮfăΣ KI·ōλűăΣ I·űűλűdzŘŜăΣ 2NJ I·LJLJNJŜŎλI·űλ2yãΣ ăλyŎŜ űKŜNJŜ Y˝I·è ōŜ fλűűfŜ 2NJ y2 NJŜfI·űλ2yãKλLJ ōŜűøŜŜy˝űKŜ I·ŎIjdzλăλűλ2y˝2Ŧ űKŜăŜ 2dzűŎ2Y˝Ŝă I·yŘ űKŜ I·ŎIjdzλăλűλ2y˝2Ŧ ʮy2øfŜŘƎŜέ óDNJ2yfdzyŘΣ мфтсΣ LJΦ opúΦ ! ăűdzŘŜyű Y˝I·yè KI·ØŜ I· ØI·ăű

ţy2øfŜŘƎŜ 2ŦŜØŜŃèűKλyƎ űKŜŃŜ λă ű2 ţy2ø l·ō2dzű ŘŜŦŜyŘλyƎ l· ăèăűŜY ŦŃ2Y ŏèōŜŃ l·űűl·ŏţăΣ ōdzű øKŜyˇLJdzű λyˇl· ăλűdzl·űλ2yˇű2 ŘŜŦŜyŘ l·yˇl·űűl·ŏţΣ űKŜ ăűdzŘŜyű Yˇl·è y2ű ōŜ l·ōfŜ ű2 ŘŜŦŜyŘ űKŜ ăèăűŜY LJŃ2LJŜŃfèφ

¢KŜ !ăă2ŏλl·űλ2yˇŦ2Ń .dzăλyŜăă {λYˇdzfl·űλ2yˇl·yŘ 9ÈLJŜŃλŜyűλl·f 9ÈŜŃŏλăŜă ó! .{9[ú Kl·ă LJŜŃŦ2ŃYˇŜŘ ăŜØŜŃl·f ăűdzŘλŜă 2yˇűKŜ ŜŦŦŜŏűλØŜyŜăă 2Ŧ Ǝl·YˇŜă λyˇăűŃl·űŜƎλŏ Yˇl·yl·ƎŜYˇŜyű ŏ2dzŃăŜăφ Lyˇ2yŜ LJl·Ńűλŏdzfl·Ń ăűdzŘèΣ űŜăű ăŏ2ŃŜă Ŧ2Ń YˇλŘűŜŃYˇ l·yŘ Ŧλyl·f ŜÈl·Yˇλyl·űλ2yã øŜŃŜ ŏ2YˇLJl·ŃŜŘ ōŜűøŜŜyˇl· Ǝl·YˇŜπŏŜyűŜŃŜŘ ŏ2dzŃăŜ l·yŘ l· űŃl·Řλűλ2yl·f fŜŏűdzŃŜ ăűèfŜ ŏ2dzŃăŜφ ¢KŜ ăűdzŘŜyűă λyˇűKŜ Ǝl·YˇŜπŏŜyűŜŃŜŘ ŏ2dzŃăŜ ăŏ2ŃŜŘ ăűl·űλăűλŏl·ffè KλƎKŜŃ űKl·yˇűKŜ ăűdzŘŜyűă λyˇűKŜ űŃl·Řλűλ2yl·f fŜŏűdzŃŜ ăűèfŜ ŏ2dzŃăŜ óCl·ŃλI·Σ нлллúφ C2ff2øλyƎ űKλă ăűdzŘèΣ !.{9[ŏ2yˇűλyˇdzŜŘ ű2 ŏ2YˇLJl·ŃŜ űKŜ ŜŦŦŜŏűλØŜyŜăă 2Ŧ ōdzăλyŜăă Ǝl·YˇŜă ØŜŃădză Y2ŃŜ űŃl·Řλűλ2yl·f űŜl·ŏKλyƎ ăűŃl·űŜƎλŜăφ bλyŜ ăűdzŘλŜă øŜŃŜ Ř2yŜ 2ØŜŃ űKŜ ŏ2dzŃăŜ 2Ŧ űKŃŜŜ èŜl·Ńă l·yŘ ăűdzŘŜyűă λyˇűKŜ ōdzăλyŜăă Ǝl·YˇŜă 2Ń ăλYˇdzfl·űλ2yã ŘλŘ ōŜűűŜŃ 2yˇŜÈl·Yˇă l·yŘ ŦŜfű űKŜè fŜl·ŃyŜŘ Y2ŃŜ űKl·yˇűKŜ ăűdzŘŜyűă λyˇl· űŃl·Řλűλ2yl·f fŜŏűdzŃŜ ŏfl·ăă λyˇăŜØŜyˇ2Ŧ űKŜ yλyŜ ăűdzŘλŜăφ ¢KŜ 2űKŜŃ űø2 ăK2øŜŘ y2 ŘλŦŦŜŃŜyŏŜă óCl·ŃλI·Σ нлллúφ

> !YˇLJfŜ ŜØλŘŜyŏŜ Kl·ă ōŜŜyˇLJŃŜăŜyűŜŘ l·dzűKŜyűλŏl·űλyƎ űKŜ ŜŦŦŜŏűλØŜyŜăă 2Ŧ ŏ2YˇLJdzűŜŃπōl·ăŜŘ ƎŜyŜŃl·f Yˇl·yl·ƎŜYˇŜyű Ǝl·YˇŜă l·ă ØŜKλŏfŜă Ŧ2Ń űŜl·ŏKλyƎ ăűŃl·űŜƎλŏ Yˇl·yl·ƎŜYˇŜyűφ Lyˇ ŜØŜŃè ăűdzŘè ŏλűŜŘΣ űKŜ LJl·Ńűλŏdzfl·Ń ōdzăλyŜăă Ǝl·YˇλyƎ l·LJLJfλŏl·űλ2yˇ LJŃ2ŘdzŏŜŘ ăλƎyλŦλŏl·yű ţy2øfŜŘƎŜπfŜØŜf λyŏŃŜl·ăŜăφ ² KŜyˇűKŜ ōdzăλyŜăă Ǝl·YˇŜ YˇŜűK2Ř øl·ă LJλűűŜŘ l·Ǝl·λyãű űKŜ ŏl·ăŜ l·LJLJŃ2l·ŏKΣ űKŜ Ǝl·YˇŜ l·LJLJŃ2l·ŏK øl·ă ădzLJŜŃλ2Ń ű2 ŏl·ăŜă λyˇLJŃ2ŘdzŏλyƎ ţy2øfŜŘƎŜ Ǝl·λyã óCl·ŃλI·Σ нлллΣ LJφ yтúφ

LŘl·K2 {űl·űŜ ¦yλØŜŃăλűè dzűλfλÎŜă űKŜ .dzăλyŜăă {űŃl·űŜƎè Dl·YˇŜ l·yŘ tKl·ŃYˇl·{λYˇ λyˇűKŜ a l·ăűŜŃΩă 2Ŧ .dzăλyŜăă !ŘYˇλyˇλăűŃl·űλ2yˇŏdzŃŃλŏdzfdzYˇφ {űdzŘŜyűă ƎŜyŜŃl·ffè Ŝy2è űKŜ ăλYˇdzfl·űλ2yãΣ l·yŘ Yˇl·yè ŦŜfű Y2ŃŜ øl·ă fŜl·ŃyŜŘ λyˇűKŜ ŏfl·ăă ōŜŏl·dzăŜ 2Ŧ űKŜ Ǝl·YˇŜă λyŏfdzŘŜŘ øλűK űKŜ fŜŏűdzŃŜφ

Chapter III: Methodology and Findings

{2 øKl·ű Ř2Ŝă Y l·ţŜ l·y˘ŜŦŦŜŐűλØŜ λy?ŜŐűK ! ŦűŜŃ ŘŜăλƎyλyƎΣ ŐŃŜl·űλyƎΣ l·yŘ ?dzŘƎλyƎ űKŜ t l·ŐλŦλŐ wλY˘ /2ffŜƎλl·űŜ /èōŜŃ 5ŜŦŜyãŜ /2Y˘LJŜűλűλ2y˘Ŧ2Ń űKŜ fl·ăű ű ø2 èŜl·ŃăΣ űKŜ ŃŜăŜl·ŃŐKŜŃ Kl·ă l· Ǝ22Ř űKŜ2Ńè 2Ŧ øKl·ű l·y˘ŜŦŦŜŐűλØŜ λy?ŜŐű λă! y˘ŜŦŦŜŐűλØŜ λy?ŜŐű λă 2yŜ űKl·ű ŃŜŦfŜŐűă l· ŃŜl·f ø2ŃfŘ L¢ ű l·ăţΣ űŜl·ŐKŜă űKŜ ăűdzŘŜyű l·ō2dzű űKŜ L¢ λyŘdzăűŃè l·yŘ ŐKl·ffŜyƎŜă űKŜ ăűdzŘŜyűΦ a l·LJLJλyƎ űKŜ λy?ŜŐű ű2 l· ăűl·yŘl·ŃŘ KŜfLJă ű2 Ø l·fλŘl·űŜ λűT K2øŜØŜŃΣ λű λă y2ű l· ŃŜljdzλŃŜY˘Ŝyűφ

Research

¢2 LJŃ2ØŜ űKŜ ŃŜăŜl·ŃŐKŜŃØă űKŜ2Ńè l·ō2dzű øKl·ű Y l·ţŜă l·y˘ŜŦŦŜŐűλØŜ λy?ŜŐűΣ l· ădzŃØŜè ø l·ă ŘλăűŃλōdzűŜŘ ű2 ăűdzŘŜyűă l·ű űKŜ t l·ŐλŦλŐ wλY˘ /2ffŜƎλl·űŜ /èōŜŃ 5ŜŦŜyãŜ wŜƎλ2yl·f /2Y˘LJŜűλűλ2y˘2y˘ a l·ŃŐK нн l·yŘ ноΣ нлмпφ ¢KŜ ăűdzŘŜyűă øŜŃŜ l·ăţŜŘ øKl·ű l·y˘ŜŦŦŜŐűλØŜ λy?ŜŐű ø l·ăΣ l·ă øŜff l·ă l·ăţŜŘ ű2 Ńl·űŜ űKŜ λy?ŜŐűă λy˘űKŜ Ŏ2Y˘LJŜűλűλ2yΦ ! y˘λyűŜŃØλŜø ø l·ă Ŏ2yŘdzŐűŜŘ øλűK űKŜ ŘλŃŜŐű2Ń 2Ŧ űKŜ b / / 5 / φ ! fă2Σ űKŜ ŃŜăŜl·ŃŐKŜŃ l·yl·fèÎŜŘ λy?ŜŐűă ŦŃ2Y˘ b / / 5 / ŜØŜyűă ŦŃ2Y˘ űKŜ èŜl·Ńă нлмл l·yŘ нлммφ

Student Survey

¢2 l·ăţ űKŜ ăűdzŘŜyűă øKl·ű Y l·ŘŜ l·y˘ŜŦŦŜŐűλØŜ λy?ŜŐűΣ l· ădzŃØŜè ø l·ă ŘλăűŃλōdzűŜŘ ű2 űKŜ нлмп t l·ŐλŦλŐ wλY˘ /2ffŜƎλl·űŜ /èōŜŃ 5ŜŦŜyãŜ /2Y˘LJŜűλűλ2y˘ó t w / / 5 / ú LJl·ŃűλŐλLJl·yűăφ {dzŃØŜè a2y˘ţŜè ø l·ă dzűλfλÎŜŘ Ŧ2Ń űKλă ű l·ăţ l·yŘ űKŜ ŃŜăŜl·ŃŐKŜŃ ø2Ńţ˘ŜŘ øλűK űKŜ LŘl·K2 {ű l·ű Ŝ ¦ yλØŜŃăλűè {ŐK22f 2Ŧ . dzăλyŜăă dzăλyƎ űKŜ ăŐK22fΩă {dzŃØŜè a2y˘ţŜè l·ŐŐ2dzyű ű2 LJdzōfλăK űKŜ ădzŃØŜèφ ¢KŜ űλűfŜ 2Ŧ Ŝl·ŐK λy?ŜŐű ø l·ă 2dzűfλyŜŘ λy˘űKŜ Ŏ2Y˘LJŜűλűλ2y˘ l·yŘ űKŜ LJl·ŃűλŐλLJl·yűă øŜŃŜ l·ăţŜŘ λŦ űKŜè ŦŜfű űKŜ λy?ŜŐű ø l·ă Y˘2ŃŜ űŜŐKyλŐl·f 2Ń LJ2fλŐè 2ŃλŜyűŜŘΣ K2ø ŘλŦŦλŐdzfű űKŜè űK2dzƎKű űKŜ λy?ŜŐű ø l·ăΣ λŦ űKŜè űK2dzƎKű űKŜ λy?ŜŐű ø l·ă l· ŃŜl·f ø2ŃfŘ L¢ ű l·ăţΣ l·yŘ λŦ

ŭKŜè fŜI·NJyŜŘ ă2YˆŜŭKλyƎ ŦNJ2Yˆ ŭKŜ λy?ŜŎŭΦ ¢KŜ ăŭdzŘŜyŭă ØŜNJŜ I·ōfŜ ŭ2 I·yãØŜNJ ŭKŜ IjdzŜăŭλ2yã dzăλyƎ I· ŦλØŜ LJ2λyŭ [λ]ŜNJŭ ăŎI·fŜΦ ¢KŜ ăŭdzŘŜyŭă ØŜNJŜ I·fă2 I·ă]ŜŘ λŦ Ŝy2dzƎK ŭλYˆŜ ØI·ă LJNJ2ØλŘŜŘ ŭ2 Ŏ2YˆLJfŜŭŜ ŭKŜ λy?ŜŎŭă I·yŘ λŦ ŭKŜ ăŭdzŘŜyŭă ŦŜfŭ ŭKŜ Ŏ2YˆLJŜŭλŭλ2yˆKŜfLJŜŘ LJNJŜLJI·NJŜ ŭKŜYˆ Ŧ2NJ ŦdzŭdzNJŜ Ø2NJ] λyˆŭKŜ L¢ Ø2NJ]Ŧ2NJŎŜΦ ¢KŜNJŜ ØŜNJŜ ŭØ2 2LJŜyˆŜyŘŜŘ IjdzŜăŭλ2yã λyŎfdzŘŜŘ λyˆŭKŜ ădzNJØŜè ŭKI·ŭ I·ă]ŜŘ ØKλŎK λy?ŜŎŭ ØI·ă I· ŦI·Ø2NJλŭŜ ŦNJ2Yˆ ŭKŜ Ŏ2YˆLJŜŭλŭλ2yˆ I·yŘ ØKI·ŭ YˆI·]Ŝă I·yˆ ŜŦŦŜŎŭλØŜ λy?ŜŎŭ I·ŎŎ2NJŘλyƎ ŭ2 ŭKŜ ăŭdzŘŜyŭΦ

¢2 ØI·fλŘI·ŭŜ ŭKŜ ădzNJØŜèΣ ŭKŜ NJŜăŜI·NJŎKŜNJ dzăŜŘ ŭKŜ ăI·YˆŜ Ŧ2NJYˆI·ŭ ŭ2 ŎNJŜI·ŭŜ I· ădzNJØŜè Ŧ2NJ I· ăλYˆλfI·NJ ōdzŭ ăYˆI·ffŜNJ Ŏ2YˆLJŜŭλŭλ2yˆKŜfŘ I·ŭ LŘI·K2 {ŭI·ŭŜ ¦yλØŜNJăλŭè ólL{ ¦ŭΦ ¢KŜ ŭλŭfŜă 2Ŧ ŭKŜ λy?ŜŎŭă ØŜNJŜ ŎKI·yƎŜŘ ŭ2 NJŜŦfŜŎŭ ŭKŜ ŘλŦŦŜNJŜyŭ λy?ŜŎŭă NJŜfŜØI·yŭ ŭ2 ŜI·ŎK Ŏ2YˆLJŜŭλŭλ2yΣ ōdzŭ 2ŭKŜNJØλăŜΣ λŭ ØI·ă ŭKŜ ăI·YˆŜ ădzNJØŜèΦ ¢KŜ ăŭdzŘŜyŭă ŦNJ2Yˆ ŭKŜ L{ ¦ Ŏ2YˆLJŜŭλŭλ2yˆ Ŏ2YˆLJfŜŭŜŘ ŭKŜ ădzNJØŜè ØλŭK2dzŭ ăλƎyλŦλŎI·yŭ λăădzŜăΣ ă2 ŭKŜ NJŜăŜI·NJŎKŜNJ YˆØŜŘ Ŧ2NJØI·NJŘ ØλŭK ŭKŜ ădzNJØŜè Ŧ2NJ tw//5/Φ ¢KŜ ădzNJØŜèΣ K2ØŜØŜNJΣ ØI·ă ŘλØλŘŜŘ λyŭ2 ŭKŜ λy?ŜŎŭă ŦNJ2Yˆ ŭKŜ ŭØ2 ŘI·èă 2Ŧ Ŏ2YˆLJŜŭλŭλ2yΣ {I·ŭdzNJŘI·è I·yŘ {dzyŘI·èΦ ! ădzNJØŜè ØI·ă KI·yŘŜŘ 2dzŭ I·ŭ ŭKŜ ŜyŘ 2Ŧ ŭKŜ Ŏ2YˆLJŜŭλŭλ2yˆŜI·ŎK ŘI·èΦ ¢KŜ ădzNJØŜèă ØŜNJŜ ŘŜfλØŜNJŜŘ I·ă I· y2yπăŎ2NJŜŘ λy?ŜŎŭ 2yŜ K2dzNJ ōŜŦ2NJŜ ŭKŜ ŜyŘ 2Ŧ Ŏ2YˆLJŜŭλŭλ2yΦ ! ff λy?ŜŎŭă KI·Ř ōŜŜyˆKI·yŘŜŘ 2dzŭ I·yŘ ăŎ2NJŜŘ ōè ŭKI·ŭ LJ2λyŭ I·yŘ ŭKŜ ădzNJØŜè ŘλŘ y2ŭ λyŭŜNJŦŜNJŜ ØλŭK ŭKŜ Ŏ2YˆLJŜŭλŭλ2yΦ ¢KŜ ădzNJØŜè ØI·ă 2yfè ŜÈLJŜŎŭŜŘ ŭ2 ŭI·]Ŝ ŭŜyˆYˆλydzŭŜă ŭ2 Ŏ2YˆLJfŜŭŜΣ ă2 ŭKλă ƎI·ØŜ ŭKŜ ăŭdzŘŜyŭă I·YˆLJfŜ ŭλYˆŜ ŭ2 Ŏ2YˆLJfŜŭŜ ŭKŜ ŭI·ă]Φ

wŜăLJ2yãŜ ØI·ă y2ŭ I·ă KλƎK I·ă ŭKŜ NJŜăŜI·NJŎKŜNJ KI·Ř K2LJŜŘY oęĝ NJŜăLJ2yŘŜŘ óнф 2yˆ {I·ŭdzNJŘI·èT ол 2yˆ {dzyŘI·èúΦ I2ØŜØŜNJΣ ŭKŜ NJŜăŜI·NJŎKŜNJ ŦŜfŭ ŭKŜ 2dzŭŎ2YˆŜ ØI·ă NJŜfŜØI·yŭ I·yŘ ƎI·ØŜ I·YˆLJfŜ ŜØλŘŜyŎŜ ŭ2 ŘŜŭŜNJYˆλyŜ ăŭdzŘŜyŭăΩ 2LJλyλ2yã 2yˆŜŦŦŜŎŭλØŜ λy?ŜŎŭăΦ 5dzŜ ŭ2 ŭKŜ

ŭŜl·Y˙ yl·ŭdzNJŜ 2Ŧ ŭKŜ Ŏ2Y˙LJŜŭλŭλ2yΣ y2ŭ l·ff ăŭdzŘŜyŭă ø2NJ]ŜŘ 2y˙ŜØŜNJè λy?ŜŎŭT ŭKŜNJŜŦ2NJŜΣ NJŜăLJ2yãŜă l·NJŜ 2yŭtè NJŜŎ2NJŘŜŘ Ŧ2NJ ŭKŜ λy?ŜŎŭă ŭKŜ ăŭdzŘŜyŭă LJŜNJă2yl·ffè ø2NJ]ŜŘ 2yΦ

¢KŜ ădzNJØŜè NJŜădzŭŭă øŜNJŜ l·yl·fèÎŜŘ ōè l·ăăλ∃yλy∃ ydzY˙ŜNJλŎl·f Ø l·fdzŜă ŭ2 ŭKŜ NJŜăLJ2yãŜăΣ ŭKŜy˙ŦλyŘλy∃ ŭKŜ Y˙Ŝl·y˙ l·yŘ ăŭl·yŘl·NJŘ ŘŜØλl·ŭλ2y˙Ŧ2NJ Ŝl·ŎK ljdzŜăŭλ2y˙dzyŘŜNJ Ŝl·ŎK λy?ŜŎŭΦ ¢Kλă l·ff2øŜŘ ŭKŜ NJŜăŜl·NJŎKŜNJ ŭ2 ŜØl·fdzl·ŭŜ K2ø ŭKŜ ăŭdzŘŜyŭă l·ă l· øK2fŜ ŦŜfŭ l·ō2dzŭ ŭKŜ λy?ŜŎŭăΦ ! fă2Σ ŭKŜ ăŭdzŘŜyŭ 2LJλyλ2yã øŜNJŜ l·yl·fèÎŜŘ 2y˙ŭKŜ Řλ∃ŦŜNJŜyŭ ljdzŜăŭλ2yã Ŧ2NJ ŭKŜ øK2fŜ Ŏ2Y˙LJŜŭλŭλ2yΦ ¢KŜ NJŜăLJ2yãŜă øŜNJŜ l·ØŜNJl·∃ŜŘ Ŧ2NJ Ŝl·ŎK ljdzŜăŭλ2y˙l·yŘ NJŜădzŭŭă ăK2øŜŘ ŭKŜ ăŭdzŘŜyŭă ŭK2dz∃Kŭ ŭKŜ Ŏ2Y˙LJŜŭλŭλ2y˙ ø l·ă l· ŭŭfŜ 2y˙ŭKŜ Ŝl·ăè ăλŘŜΦ ¢KŜ ăŭdzŘŜyŭă l·∃NJŜŜŘ ŭKŜ λy?ŜŎŭă NJŜŦfŜŎŭŜŘ l· NJŜl·f L¢ ŭl·ă] λy˙ŭKŜ ø2NJ] ŜyØλNJ2yY˙Ŝyŭ l·yŘ ăŭdzŘŜyŭ l·yãøŜNJă NJŜŦfŜŎŭŜŘ ŭKλy∃ă øŜNJŜ fŜl·NJyŜŘ ŦNJ2Y˙ ŭKŜ λy?ŜŎŭăΦ ¢KŜ l·ØŜNJl·∃Ŝ 2y˙ŭKŜ ljdzŜăŭλ2y˙ŭKl·ŭ l·ă]ŜŘ λŦ ŭKŜ λy?ŜŎŭă øŜNJŜ Y˙2NJŜ ŭŜŎKyλŎl·f 2NJ LJ2fλŎè ø l·ă ăLJfλŭ λy˙ŭKŜ Y˙λŘŘfŜΣ øKλŎK λă y2ŭ ădzNJLJNJăλy∃ ōŜŎl·dzăŜ l·y˙ŜŦŦ2NJŭ ø l·ă Y˙l·ŘŜ ōè ŭKŜ ŘŜăλ∃yλy∃ ŭŜl·Y˙ ŭ2 Y˙l·]Ŝ l·y˙ŜØŜy˙l·Y˙2dzyŭ 2Ŧ LJ2fλŎè l·yŘ ŭŜŎKyλŎl·f λy?ŜŎŭăΦ ¢KŜ Ŧ2ff2øλy∃ ŭl·ōfŜ ŘŜfλyŜl·ŭŜă ŭKŜ NJŜădzfŭă Ŧ2NJ Ŝl·ŎK λy?ŜŎŭΦ

Table 4: Survey Summary

2014 PRCCDC Survey Results									
Inject Number	**Inject Name**	**How difficult was this inject?**	**Standard Deviation**	**Do you think this inject simulated a real world work task for an IT professional?**	**Standard Deviation**	**Did this inject help you to learn about this type of task required while on the job?**	**Standard Deviation**	**Do you feel this inject was more technical or more policy?**	**Standard Deviation**
1	Data Class & Labeling	1.88	0.64	4.00	0.00	3.88	0.99	1.63	0.74
2	Warning Banners Implementation and Check	2.14	0.38	3.86	0.38	4.00	0.00	3.43	0.98
3	MVP Calls in Sick	2.30	1.49	3.70	1.34	3.70	0.82	3.00	0.67
4	Password Policy	1.71	0.76	4.43	0.53	3.57	1.27	2.43	0.79
5	MARC Reactor Update	2.33	1.03	3.67	1.03	3.00	1.26	4.00	0.63
6	Complete Network Map	2.33	0.52	4.33	0.52	3.50	1.22	3.67	1.03
7	Encrypted Blueprints	4.14	0.69	3.86	0.38	3.57	0.79	4.43	0.79
8	Whaling Response and Training	2.11	0.78	3.78	0.67	4.00	0.00	2.33	0.71
9	Disable USB on Computers	2.78	1.30	4.11	0.60	4.00	0.50	4.44	0.53
10	MARC Reactor Logs #1	2.50	0.84	3.83	0.41	4.17	0.41	3.50	1.22
11	Board of Directors - Presentation on BYOD	3.00	1.07	4.38	0.74	3.50	0.93	2.38	0.92
12	User verification over phone	2.17	0.75	4.00	1.10	3.83	0.75	1.50	0.55
13	Change Log #1	2.00	0.89	4.18	0.60	3.82	0.60	1.82	0.87
14	Call Log #1	2.33	0.87	3.22	1.20	3.33	1.12	1.89	0.78
15	Pros and cons of IM Service	2.64	0.81	3.55	0.93	3.36	0.92	2.82	1.17
16	Anonymous FTP Login	2.55	0.82	4.00	0.89	4.00	0.63	3.64	1.21
17	Set up instant messaging service	3.58	0.90	3.83	0.83	3.83	1.03	4.33	0.65
18	FISMA Compliance	2.67	1.03	4.17	0.41	4.17	0.41	1.50	0.55
19	Intrusion Detection	3.30	0.87	4.20	0.60	3.90	0.54	3.60	0.81
20	Recover Data	3.67	1.03	4.00	0.00	4.00	0.63	4.33	0.52
21	MARC Reactor Logs #2	2.11	0.99	3.89	0.32	3.89	0.57	3.44	1.08
22	Honey Pot	3.00	0.86	3.82	0.73	3.82	0.69	4.18	0.63
23	Configure Host ACL	3.00	1.00	4.14	0.69	3.86	0.90	4.14	0.90
24	Move SCADA server off domain	2.22	1.30	4.00	0.50	3.78	0.83	4.00	1.00
25	Asset List and Tech Replacement Plan	2.00	0.00	3.86	0.83	3.86	0.46	2.14	0.53
26	Risk Management	2.33	0.84	3.00	0.84	3.67	0.55	2.00	0.71
27	Change Log #2	2.00	0.85	4.07	0.73	3.87	0.64	1.67	0.82
28	Call Log #2	2.22	1.20	3.89	0.82	3.78	0.82	1.67	0.70
	Average	2.54	0.59	3.92	0.31	3.77	0.26	3.00	1.05
Legend		Very Easy	1	Strongly Disagree	1	Strongly Disagree	1	Strictly Policy	1
		Easy	2	Disagree	2	Disagree	2	More Policy	2
		Neither	3	Neither	3	Neither	3	Neither	3
		Difficult	4	Agree	4	Agree	4	More Technical	4
		Very Difficult	5	Strongly Agree	5	Strongly Agree	5	Strictly Technical	5

¢KŜ 2LJŜy˜ŜyŘŜŘ ℕŜăLJ2yãŜă øŜℕŜ ØŜℕè ŦI·Ø2ℕI·ōfŜΦ ¢KŜ ădzℕØŜè I·ű űKŜ ŜyŘ 2Ŧ űKŜ Ŏ2Y˜LJŜűλűλ2y˜I·ă⌊ŜŘ űKŜ ăűdzŘŜyűă áLy˜è2dzℕ 2LJλyλ2yΣ øKI·ű Y˜I·⌊Ŝă I·y˜ŜŦŦŜŎűλØŜ λy?ŜŎűKε ¢KŜλℕ ℕŜăLJ2yãŜă ∃ŜyŜℕI·ftè Ŧ2ff2øŜŘ űKŜ ℕŜăŜI·ℕŎKŜℕ¤ă űKŜ2ℕè Ŧ2ℕ I·y˜ŜŦŦŜŎűλØŜ λy?ŜŎűΦ ¢KŜ ℕŜăLJ2yãŜă λyŎftdzŘŜŘ űKI·ű I·y˜λy?ŜŎűă ăK2dzftŘ ℕŜŦfŜŎűă I· ℕŜI·f ø2ℕftŘ ăλűdzI·űλ2y˜ áwŜI·f fλŦŜ ăŎŜyI·ℕλ2ă I·føI·èă Y˜I·⌊Ŝ Ŧ2ℕ űKŜ ōŜăűă λy?ŜŎűăŦε áhyŜ ωλy?ŜŎűβ űKI·ű KI·ă è2dz Ř2 øKI·ű ø2dzftŘ ōŜ yŜŜŘŜŘ λy˜űKŜ ?2ōΦε ¢KŜè y2űŜŘ űKI·ű űKŜ λy?ŜŎűă ăK2dzftŘ ōŜ ŎKI·ffŜyƎλyƎΣ á!y˜λyűŜℕŜăűλyƎ fŜI·ℕyλyƎ ŜÈLJŜℕλŜyŎŜ øKλfŜ I·fă2 ōŜλyƎ ă2Y˜ŜøKI·ű ŎKI·ffŜyƎλyƎΣε èŜűLJ2ăăλōfŜ λy˜űKŜ űλY˜Ŝ I·ff2űűŜŘΣ á{2Y˜ŜűKλyƎ űKI·ű Ŏf2ăŜfè ℕŜŦfŜŎűă I· ℕŜI·f ø2ℕftŘ ăλűdzI·űλ2yΣ ōdzű λă ăűλftf LJ2ăăλōfŜ Ŧ2ℕ dză ű2 I·ŎŎ2Y˜LJftλăK λyãλŘŜ 2Ŧ űKŜ űλY˜Ŝ ℕŜăűℕλŎűλ2yΦε 9ŘdzŎI·űλ2yI·f ØI·fdzŜ øI·ă I·fă2 λY˜LJ2ℕűI·yűΣ áI2ø Ydz˜ŎK λű Y˜I·⌊Ŝă è2dz fŜI·ℕyε I·yŘ á¢KŜ I·ōλftűè Ŧ2ℕ űKŜ λy?ŜŎűă ű2 Y˜I·⌊Ŝ è2dz űKλy⌊ 2y˜è2dzℕ ű2Ŝă I·ă øŜff I·ă Y˜I·⌊Ŝ è2dz fŜI·ℕyŦε ŜăLJŜŎλI·ffè K2ø űKŜ ŜŘdzŎI·űλ2yI·f ØI·fdzŜ ℕŜfI·űŜŘ ű2 űKŜ ű22fă űKŜè KI·ØŜ I·ØI·λfI·ōfŜ ű2 űKŜY˜Y á!y˜ŜŦŦŜŎűλØŜ λy?ŜŎűă λă 2yŜ űKI·ű ℕŜIjdzλℕŜă dză ű2 dzűλfλÎŜ ŦŜI·űdzℕŜă 2Ŧ űKŜ LJℕ2∃ℕI·Y˜ă I·yŘ I·ăăŜűă øŜ KI·ØŜ I·ØI·λfI·ōfŜ ű2 dzăΦε ¢KŜè I·fă2 I·LJLJℕŜŎλI·űŜŘ λy?ŜŎűă øK2ăŜ I·yãøŜℕă øŜℕŜ y2ű ℕŜI·Řλfè I·ØI·λfI·ōfŜ ű2 űKŜY˜ á¢Ŝăűă ⌊y2øfŜŘ∃ŜΣ ℕI·űKŜℕ űKI·y˜ ∃22∃fŜπŦdzΦε

¢KŜ ădzℕØŜè I·fă2 I·ă⌊ŜŘ űKŜ ăűdzŘŜyűă á ² KI·ű øI·ă űKŜ Y˜2ăű λyűŜℕŜăűλy∃ λy?ŜŎűℕ2Y˜ ûKλă Ŏ2Y˜LJŜűλűλ2yKε ¢KŜ Y˜2ăű ŦℕŜIjdzŜyű ℕŜăLJ2yãŜă øŜℕŜ ℕŜűℕλŜØλy∃ I· ăŜű 2Ŧ ŜyŎℕèLJűŜŘ ōfdzŜLJℕλyűă 2ŦŦ 2Ŧ I· ûKdzY˜ō ŘℕλØŜ λY˜I·∃Ŝ ăŜűűλy∃ dzLJ I·y˜λyãűI·yű Y˜Ŝăă I·∃λy∃ ăŜℕØλŎŜΣ ăŜűűλy∃ dzLJ I·yŘ Ŏ2yŦλ∃dzℕλy∃ I· K2yŜè LJ2ûΣ I·yŘ Y˜2Øλy∃ ûKŜ {/!5! ăŜℕØŜℕ 2ŦŦ 2Ŧ ûKŜ Ŏ2ℕLJ2ℕI·ûλ2y˜ Ř2Y˜I·λyΦ ¢2 I·yI·fèÎŜ ℕŜăLJ2yãŜăΣ ûKŜ λy?ŜŎűă øŜℕŜ ă2ℕûŜŘ ōè ûKŜ I·ØŜℕI·∃Ŝ ℕI·ûλy∃ă Ŧ2ℕ ŘλŦŦλŎdzfûèΣ ℕŜI·f ø2ℕftŘ L¢ ûI·ă⌊Σ ŜŘdzŎI·ûλ2yI·f ØI·fdzŜΣ I·yŘ ûŜŎKy2f2∃è ØăΦ LJ2fλŎèΦ b2ű ădzℕLJℕλăλy∃fèΣ ûKŜ ℕŜăŜI·ℕŎKŜℕ Ŧ2dzyŘ ûKℕŜŜ 2Ŧ ûKŜ ŦI·Ø2ℕλûŜ λy?ŜŎűă λy˜ûKŜ û2LJ p I·yŘ c 2Ŧ ûKŜ

ŭŜŎKy2f2∃è Øăφ LJ2fλŎè l·yŘ ŘλŦŦλŎdzfŭè fλăŭăΣ ℕŜăLJŜŎŭλØŜfèφ l 2ø ŜØŜℕΣ ŭKŜ λy?ŜŎŭă fλăŭŜŘ l·ă Ŧl·Ø2ℕλŭŜă ŘλŘyΩŭ ŜØŜy˜Y˜l·ʅŜ λŭ λyŭ2 ŭKŜ ŭ2LJ ŭŜy˜2y˜ŭKŜ ℕŜl·f ø2ℕfŘ L¢ ŭl·ăʅ l·yŘ ŜŘdzŎl·ŭλ2yl·f Øl·fdzŜ fλăŭăφ hyŜ 2Ŧ ŭKŜ ℕŜăLJ2yŘŜyŭăΩ Ŧl·Ø2ℕλŭŜ λy?ŜŎŭă τ Y˜2Øλy∃ ŭKŜ { / ! 5 ! ăŜℕØŜℕ 2ŦŦ ŭKŜ Ř2Y˜l·λyπππ 2yfè ăŎ2ℕŜŘ мп ó2dzŭ 2Ŧ олú 2y˜ŭKŜ wŜl·f ² 2ℕfŘ fλăŭ τ l·yŘ λŭ øl·ă ŭKŜ Kλ∃KŜăŭ ăŎ2ℕλy∃ 2Ŧ l·ff ŭK2ăŜ ŭKŜè fλăŭŜŘ l·ă Ŧl·Ø2ℕλŭŜăφ ¢KŜ Kλ∃KŜăŭ ăŎ2ℕλy∃ Ŧl·Ø2ℕλŭŜ 2y˜ŭKŜ 9ŘdzŎl·ŭλ2yl·f fλăŭΣ ăŜŭŭλy∃ dzLJ ŭKŜ Lyăŭl·yŭ a Ŝăăl·∃λy∃ óL a ú ăŜℕØλŎŜΣ ăŎ2ℕŜŘ мр 2dzŭ 2Ŧ олφ ¢KŜℕŜ ăŜŜY˜ă ŭ2 ōŜ ă2Y˜Ŝ ŘλăŎ2yŷŜŎŭ ōŜŭøŜŜy˜ăŭdzŘŜyŭ ℕŜăLJ2yăŜă l·ō2dzŭ ŭKŜ Ŧl·Ø2ℕλŭŜă l·yŘ øKl·ŭ ŭKŜ ăŭdzŘŜyŭă λyŘλŎl·ŭŜŘ Y˜l·ʅŜă l· ∃22Ř λy?ŜŎŭφ ¢KŜ l·yăøŜℕ Ŏ2dzfŘ ōŜ ŭKl·ŭ ŭKŜ ăŭdzŘŜyŭăΩ ŎℕλŭŜℕλl· Ŧ2ℕ øKl·ŭ Y˜l·ʅŜă l·y˜ŜŦŦŜŎŭλØŜ λy?ŜŎŭ ØŜℕădză øKl·ŭ Y˜l·ʅŜă l· Ŧl·Ø2ℕλŭŜ λy?ŜŎŭ l·ℕŜ ŘλŦŦŜℕŜyŭφ ² Kè ŭKλă Yλ∃Kŭ 2ŎŎdzℕ λă ōŜè2yŘ ŭKŜ ăŎ2LJŜ 2Ŧ ŭKλă LJℕ2?ŜŎŭΣ ōdzŭ Ŏ2dzfŘ ōŜ ă2Y˜ŜŭKλy∃ Ŧdzŭdzℕ ℕŜăŜl·ℕŎK Yλ∃Kŭ l·yăøŜℕφ

¢KŜ ℕŜăŜl·ℕŎKŜℕ l·fă2 l·yl·fè ÎŜŘ ŭKŜ ăŭdzŘŜyŭăΩ 2LJλyλ2yă l·ō2dzŭ ŭKŜ øK2fŜ Ŏ2Y˜LJŜŭλŭλ2yφ wŜăLJ2yăŜă øŜℕŜ l·ØŜℕl·∃ŜŘ l·yŘ l· ŭl·ōfŜ øl·ă ŎℕŜl·ŭŜŘ ŭ2 ăK2ø ŭKŜ ℕŜădzfŭăφ

Difficulty			
Rank	Inject #	Inject Description	Score
1	7	Encrypted Blueprints	4.14
2	20	Recover Data	3.67
3	17	Set up instant messaging service	3.58
4	19	Intrusion Detection	3.30
5	23	Configure Host ACL	3.00
6	22	Honey Pot	3.00
7	11	Board of Directors - Presentation on BYOD	3.00
8	9	Disable USB on Computers	2.78
9	18	FISMA Compliance	2.67
10	15	Pros and cons of IM Service	2.64
11	16	Anonymous FTP Login	2.55
12	10	MARC Reactor Logs #1	2.50
13	26	Risk Management	2.33
14	14	Call Log #1	2.33
15	6	Complete Network Map	2.33
16	5	MARC Reactor Update	2.33
17	3	MVP Calls in Sick	2.30
18	28	Call Log #2	2.22
19	24	Move SCADA server off domain	2.22
20	12	User verification over phone	2.17
21	2	Warning Banners Implementation and Check	2.14
22	21	MARC Reactor Logs #2	2.11
23	8	Whaling Response and Training	2.11
24	27	Change Log #2	2.00
25	25	Asset List and Tech Replacement Plan	2.00
26	13	Change Log #1	2.00
27	1	Data Class & Labeling	1.88
28	4	Password Policy	1.71
Legend		Very Easy	1
		Easy	2
		Neither	3
		Difficult	4
		Very Difficult	5

Table 5: Inject Difficulty

Educational Value			
Rank	Inject #	Inject Description	Score
1	10	MARC Reactor Logs #1	4.17
2	18	FISMA Compliance	4.17
3	2	Warning Banners Implementation and Check	4.00
4	8	Whaling Response and Training	4.00
5	9	Disable USB on Computers	4.00
6	16	Anonymous FTP Login	4.00
7	20	Recover Data	4.00
8	19	Intrusion Detection	3.90
9	21	MARC Reactor Logs #2	3.89
10	1	Data Class & Labeling	3.88
11	27	Change Log #2	3.87
12	23	Configure Host ACL	3.86
13	25	Asset List and Tech Replacement Plan	3.86
14	12	User verification over phone	3.83
15	17	Set up instant messaging service	3.83
16	13	Change Log #1	3.82
17	22	Honey Pot	3.82
18	24	Move SCADA server off domain	3.78
19	28	Call Log #2	3.78
20	3	MVP Calls in Sick	3.70
21	26	Risk Management	3.67
22	4	Password Policy	3.57
23	7	Encrypted Blueprints	3.57
24	6	Complete Network Map	3.50
25	11	Board of Directors - Presentation on BYOD	3.50
26	15	Pros and cons of IM Service	3.36
27	14	Call Log #1	3.33
28	5	MARC Reactor Update	3.00
Legend		Strongly Disagree	1
		Disagree	2
		Neither	3
		Agree	4
		Strongly Agree	5

Table 6: Inject Educational Value

Real World Application			
Rank	Inject #	Inject Description	Score
1	4	Password Policy	4.43
2	11	Board of Directors - Presentation on BYOD	4.38
3	6	Complete Network Map	4.33
4	19	Intrusion Detection	4.20
5	13	Change Log #1	4.18
6	18	FISMA Compliance	4.17
7	23	Configure Host ACL	4.14
8	9	Disable USB on Computers	4.11
9	27	Change Log #2	4.07
10	1	Data Class & Labeling	4.00
11	12	User verification over phone	4.00
12	16	Anonymous FTP Login	4.00
13	20	Recover Data	4.00
14	24	Move SCADA server off domain	4.00
15	21	MARC Reactor Logs #2	3.89
16	28	Call Log #2	3.89
17	2	Warning Banners Implementation and Check	3.86
18	7	Encrypted Blueprints	3.86
19	25	Asset List and Tech Replacement Plan	3.86
20	10	MARC Reactor Logs #1	3.83
21	17	Set up instant messaging service	3.83
22	22	Honey Pot	3.82
23	8	Whaling Response and Training	3.78
24	3	MVP Calls in Sick	3.70
25	5	MARC Reactor Update	3.67
26	15	Pros and cons of IM Service	3.55
27	14	Call Log #1	3.22
28	26	Risk Management	3.00
Legend		Strongly Disagree	1
		Disagree	2
		Neither	3
		Agree	4
		Strongly Agree	5

Table 7: Inject Applicability

Technical vs. Policy			
Rank	Inject #	Inject Description	Score
1	9	Disable USB on Computers	4.44
2	7	Encrypted Blueprints	4.43
3	17	Set up instant messaging service	4.33
4	20	Recover Data	4.33
5	22	Honey Pot	4.18
6	23	Configure Host ACL	4.14
7	5	MARC Reactor Update	4.00
8	24	Move SCADA server off domain	4.00
9	6	Complete Network Map	3.67
10	16	Anonymous FTP Login	3.64
11	19	Intrusion Detection	3.60
12	10	MARC Reactor Logs #1	3.50
13	21	MARC Reactor Logs #2	3.44
14	2	Warning Banners Implementation and Check	3.43
15	3	MVP Calls in Sick	3.00
16	15	Pros and cons of IM Service	2.82
17	4	Password Policy	2.43
18	11	Board of Directors - Presentation on BYOD	2.38
19	8	Whaling Response and Training	2.33
20	25	Asset List and Tech Replacement Plan	2.14
21	26	Risk Management	2.00
22	14	Call Log #1	1.89
23	13	Change Log #1	1.82
24	27	Change Log #2	1.67
25	28	Call Log #2	1.67
26	1	Data Class & Labeling	1.63
27	12	User verification over phone	1.50
28	18	FISMA Compliance	1.50
Legend		Strictly Policy	1
		More Policy	2
		Neither	3
		More Technical	4
		Strictly Technical	5

Table 8: Inject Technical vs. Policy

LY NŜŭN2ăLJŜŏŭΣ Y I·ţλyƎ ŭKŜ ădzNØŜè ø2NŭK LJ2λyŭă λY ŭKŜ Ŏ2YLJŜŭλŭλ2Y YλƎKŭ KI·ØŜ LJN2ŘdzŎŜŘ I· KλƎKŜN NŜăLJ2yãŜ NI·ŭŜΦ I2øŜØŜNΣ ŭKŜ ŜŭKλŎă 2Ŧ I·øI·NŘλyƎ LJ2λyŭă Ŧ2N Ŏ2YLJŧŜŭλ2Y 2Ŧ ŭKŜ ădzNØŜè Ŧ2N ŭKŜ ŭKŜăλă λă 2Ŧ Ŏ2yŎŜNyΣ øKλŎK λă øKè ŭKŜ NŜăŜI·NŎKŜN ŘŜŎλŘŜŘ ŭ2 KI·yŘ λŭ 2dzŭ I·ă I· y2yπăŎ2NŜŘ λy?ŜŎŭΦ ² KŜYŭKŜ λy?ŜŎŭ øI·ă NŜŎŜλØŜŘ ōè ă2YŜ 2Ŧ ŭKŜ ŭŜI·YăΣ ŭKŜè Řλă NŜƎI·NŘŜŘ λŭΦ hyŜ ŭŜI·Y ŎNdzYLJŧŜŘ λŭ dzLJ I·yŘ ŭKNŜø λŭ 2YŭKŜ Ŧŧ22NΦ ¢KŜ ăYI·ŧŧŜN ădzNØŜè I·ŘYλyλăŭŜNŜŘ I·ŭ LŘI·K2 {ŭI·ŭŜ ¦yλØŜNăλŭè KI·Ř млƒ̂ NŜŭdzNYNI·ŭŜ ōŜŎI·dzăŜ LJ2λyŭă øŜNŜ I·øI·NŘŜŘ Ŧ2N Ŏ2YLJŧŜŭλ2yΦ !LJLJI·NŜyŭŧèΣ I· Ǝ22Ř øI·è ŭ2 Y2ŭλØI·ŭŜ ŭKŜ ăŭdzŘŜyŭă ŭ2 ŭI·ţŜ LJI·Nŭŭ λY I· ădzNØŜè λă ŭ2 I·øI·NŘ LJ2λyŭă λY ŭKŜ Ŏ2YLJŜŭλŭλ2yΦ

Interview

¢2 I·ŎKλŜØŜ ŭKŜ Ǝ2I·f 2Ŧ λyŭŜNØλŜøλyƎ ă2YŜ2yŜ ŦN2Y b//5/Σ 5øI·èyŜ ² λŧŧλI·YăΣ !ăă2ŎλI·ŭŜ 5λNŜŎŭ2N 2Ŧ ¢ŜŎKy2ŧ2ƎèΣ wŜăŜI·NŎK ɔ /èōŜN /2YLJŜŭλŭλ2yã I·ŭ ŭKŜ /ŜyŭŜN Ŧ2N LYŦNI·ăŭNdzŎŭdzNŜ !ăădzNI·yŎŜ I·yŘ {ŜŎdzNλŭè ó/L!{ŭ I·yŘ 5λNŜŎŭ2N 2Ŧ ŭKŜ bI·ŭλ2yI·f /2ŧŧŜƎλI·ŭŜ /èōŜN 5ŜŦŜyãŜ /2YLJŜŭλŭλ2yΣ øI·ă Ŏ2yŭI·ŎŭŜŘΦ a NΦ ² λŧŧλI·Yă I·ŎŎŜLJŭŜŘ ŭKŜ λyØλŭI·ŭλ2YŦ2N ŭKŜ λyŭŜNØλŜøΦ ¢KŜ ŭλYŜ øI·ă ăŜŭ dzLJ I·yŘ ŭKŜ λyŭŜNØλŜø øI·ă KŜŧŘ 2ØŜN ŭKŜ LJK2yŜ óăŜŜ ŭNI·yãŎNλLJŭ λY !LJLJŜyŘλÈ !Φŭ

a NΦ ² λŧŧλI·Yă 2dzŭŧλyŜŘ ă2YŜ ŭKλyƎă ŭKI·ŭ b//5/ ŧ22ţă Ŧ2N øKŜY øNλŭλyƎ I·YλŷŜŎŭΦ CλNăŭΣ ŭKŜ ŭŜI·Y ŧ22ţă Ŧ2N ă2YŜŭKλyƎ ōI·ăŜŘ 2Y I· NŜI·ŧăŭλŎ L¢ ŭI·ăţΦ ¢Kλă KŜŧLJă ŭKŜ ăŭdzŘŜyŭă fŜI·NY2N NŜŦNŜăK I· ăţλŧŧ ŭKI·ŭ ŎI·YōŜ dzăŜŘ λY I· ŦdzŭdzNŜ ŎI·NŜŜNΦ LŦ ŭKŜ λy?ŜŎŭ λă ōI·ăŜŘ 2Y I· NŜI·ŧ ŭI·ăţΣ ŭKŜ ăŭdzŘŜyŭă ŎI·YI·ŧă2 ŧ22ţ dzLJ K2ø ŭ2 I·ŎŎ2YLJŧăK ŭKŜ ŭI·ăţ 2yŧλyŜ λŦ ŭKŜ ăŭŜLJă yŜŎŜăăI·Nè ŭ2 Ŏ2YLJŧŜŭŜ ŭKŜ λy?ŜŎŭ I·NŜ dzyŦI·YλŧλI·NΦ

9ŘdzŎI·ŭλ2yI·f øI·ŧdzŜ I·ŧă2 LJŧI·ěă I· ōλƎ LJI·Nŭŭ λYŭKŜ ŎNŜI·ŭλ2Y2Ŧ I·YλŷŜŎŭΦ hyŜ 2Ŧ ŭKŜ Ǝ2I·ŧă 2Ŧ ŭKŜ //5/ ŜØŜyŭă λă ŭ2 KŜŧLJ ŭKŜ ăŭdzŘŜyŭă ŧŜI·NYăţλŧŧă dzăŜŦdzŧ λY ŭKŜλN Ŧdzŭdz NŜ ŎI·NŜŜN

I·yŘ űƨ ŘŜϒƨyãűℕI·űŜ űKI·ű ʮyƨøfŜŘƎŜΦ LŦ I·y˙λy?ŜŎű Řƨŝă yƨű űŜI·ŎKΣ λű ŘƨŜă yƨű KŜfLJ ϒŜŜű űKλă ƎƨI·fΦ

bŜÈű űKλyƎ űKŜ ŎℕŜI·űλƨy˙űŜI·ϒ˙ I·ăʮă λă λŦ űKŜ ăűdzŘŜyűă ŎI·y˙ℕŜI·ăƨyI·ōfè Ŏƨϒ˙LJfŜűŜ űKŜ λy?ŜŎű λy˙űKŜ űλϒŜ I·ffƨűűŜŘΦ {ƨϒŜ űI·ăʮă űKI·ű I·y˙L¢ LJℕƨŦŜăăλƨyI·f øλff dzyŘŜℕűI·ʮŜ ŎI·yƴyƨű ōŜ I·ŎŎƨϒ˙LJfλăKŜŘ λy˙űKŜ мс Kƨdzℕă ƨŦ űKŜ Ŏƨϒ˙LJŜűλűλƨyΦ ! yƨűKŜℕ IjdzŜăűλƨy˙λă λŦ űKŜ űI·ăʮ øλff űI·ʮŜ űƨƨ ϒ˙dzŎK ŜIjdzλLJϒŜyű ƨℕ űƨƨ fƨyƎ űƨ Ŏƨy˙FλƎdzℕŜΦ ¢Kλă yŜŜŘă űƨ ōŜ Ŏƨy˙ăλŘŜℕŜŘ øKλfŜ LJfI·yƴyλyƎ űKŜ λy?ŜŎűăΦ

¢KŜ ℕŜădzfűă ƨŦ űKŜ λy?ŜŎű ϒ˙dzăű I·făƨ ōŜ I·ōfŜ űƨ ōŜ ŜØI·fdzI·űŜŘ I·yŘ ăŎƨℕŜŘΦ LŦ λű ŎI·yƴyƨű ōŜ ϒŜI·ădzℕŜŘΣ űKŜ ƨdzŘƎŜă øλff yƨű ōŜ I·ōfŜ űƨ ƎλØŜ I· ăŎƨℕŜΣ ϒ˙I·ʮλyƎ űKŜ λy?ŜŎű dzăŜfŜăă űƨ űKŜ Ŏƨϒ˙LJŜűλűλƨyΦ {ŎƨℕλyƎ λă I·y˙λϒ˙LJƨℕűI·yű LJI·ℕűƨŦ űKŜ Ŏƨϒ˙LJŜűλűλƨyΦ ! y˙ dzyãŎƨℕI·ōfŜ λy?ŜŎű λă I·y˙dzyƴdzăI·ōfŜ λy?ŜŎűΦ

² λff űKŜ λy?ŜŎű ōŜ ŎKI·ffŜyƎλyƎ Ŝyƨdz∃KK ¢KŜ λy?ŜŎű ăKƨdzfŘ ōŜ ŘλŦŦλŎdzfűΣ ōdzű LJƨăăλōfŜ λy˙űKŜ űλϒŜ ŦℕI·ϒŜΦ α ! ff ƨŦ űKŜϒ˙ KI·ØŜ I· ăƨfdzűλƨyΦ {ƨϒŜ KI·ØŜ ℕŜI·ffè ƨōØλƨdză ăƨfdzűλƨyã űKI·ű λŦ ăűdzŘŜyűă űƨƨʮ I· fλűűfŜ ōλű ƨŦ űλϒŜ űKŜè øƨdzfŘ ŦλyŘ λűε ó ² λffλI·ϒ˙ăΣ нлмпúΦ hűKŜℕ λy?ŜŎűă ϒ˙λƎKű ℕŜIjdzλℕŜ űKŜ űŜI·ϒ˙ă űƨ ōŜ ŎℕŜI·űλØŜ I·yŘ ŘŜØŜfƨLJ űKŜ ăƨfdzűλƨy˙I·ă I· űŜI·ϒ˙Φ

¢KŜ űƨƨfă űƨ Ŏƨϒ˙LJfŜűŜ űKŜ λy?ŜŎű ϒ˙dzăű ōŜ I·ØI·λfI·ōfŜΣ ŜλűKŜℕ ƨy˙űKŜ ŜyØλℕƨyϒ˙Ŝyű ƨℕ Řƨøyfƨ I·ŘI·ōfŜ Ŧℕƨϒ˙ űKŜ λyűŜℕyŜűΦ /ŜℕűI·λy˙λy?ŜŎűă ℕŜIjdzλℕŜ ăLJŜŎλŦλŎ űƨƨfăΣ ŦƨℕŜÈI·ϒ˙LJfŜΣ Řƨλy∃ I· ŦƨℕŜyãλŎ I·yI·fèăλă ƨy˙I· ŦfI·ăK ŘℕλØŜΦ ² λff űKŜ ăűdzŘŜyűă KI·ØŜ I·ŎŎŜăă űƨ 9y˙/I·ăŜ ƨℕ h{CƨℕŜyãλŎăK ¢Kλă űI·ăʮ øƨdzfŘ ōŜ λϒ˙LJƨăăλōfŜ Ŧƨℕ ăűdzŘŜyűă űƨ Ŏƨϒ˙LJfŜűŜ øλűKƨdzű űKŜ I·LJLJℕƨLJℕλI·űŜ űƨƨfăΦ

² λffλI·ϒ˙ă ŜÈLJfI·λyŜŘ űKI·ű űKŜ fI·ăű űKλyƎ Ŧƨℕ ŘŜăλƎyŜℕă űƨ űKλyʮ I·ōƨdzű λă øλff űKŜ λy?ŜŎű ŦλŦ dzyŘŜℕ űKŜ ōdzăλyŜăă ăŎŜyI·ℕλƨΦ 5λŦŦŜℕŜyű λyŘdzăűℕλŜă KI·ØŜ ŘλŦŦŜℕŜyű ℕŜƎdzfI·űλƨyãΦ

Ly?ŜŎűă ŘŜl·fλyƎ ǿλűK ⅠⅠt ! ! ǿ2dztŘ y2ű ōŜ l·LJLJŃ2LJŃλl·űŜ λŦ űKŜ ōdzăλyŜăă ăŎŜyl·ŃΛ2 ǿl·ă l· ōl·y˥φ

{2Y˙Ŝ λy?ŜŎűă l·ŃŜ ƎŜyŜŃΛŎ l·yŘ Ŏl·y˙ōŜ Y˙2ŘλŦλŜŘ ű2 ŦΛű λy˙l·fY˙2ăű l·yè ŜyØλŃ2yY˙ŜyűΣ ōdzű λű λă

λY˙LJ2ŃűI·yű ű2 λyŎfdzŘŜ ă2Y˙Ŝ űKl·ű l·ŃŜ ăLJŜŎλŦλŎ ű2 è2dzŃ ōdzăλyŜăăφ

C2Ń űKŜ Y˙2ăű LJl·ŃűΣ űKŜ ŃŜăŜl·ŃŎKŜŃ ǿl·ă y2ű ădzŃLJŃλăŜŘ ǿλűK a ŃΦ ² λffλl·Y˙ăΩ

ŃŜăLJ2yãŜăφ a ŃΦ ² λffλl·Y˙ă ŘλŘ Řλ˙ăŎdzăă űKl·ű Ŏ2yãλŘŜŃl·űλ2yã ăK2dztŘ ōŜ Y˙l·ŘŜ l·ă ű2 űKŜ

l·Y˙2dzyű 2Ŧ űλY˙Ŝ ŃŜljdzλŃŜŘ ű2 l·ŎŎ2Y˙LJfλăK űKŜ űl·ă˥Σ űKŜ ŃŜljdzλŃŜY˙Ŝyű űKl·ű űKŜ λy?ŜŎű ōŜ l·ōfŜ

ű2 ōŜ Y˙Ŝl·ădzŃŜŘ 2Ń ăŎ2ŃŜŘΣ l·yŘ űKŜ ű22fă ű2 l·ŎŎ2Y˙LJfλăK űKŜ űl·ă˥ Y˙dzăű ōŜ l·ØI·λfl·ōfŜ l·yŘ Ŧλű

ǿλűK űKŜ ōdzăλyŜăă ăŎŜyl·ŃΛ2φ ¢KŜ ŃŜăŜl·ŃŎKŜŃ Kl·Ř Ŏ2yãλŘŜŃŜŘ űKŜ ăl·Y˙Ŝ λŘŜl·ă ǿKλfŜ

ŎŃŜl·űλyƎ űKŜ λy?ŜŎűă Ŧ2Ń tw//5/Σ ōdzű 2ØŜŃf22˥ŜŘ űKλă ǿKŜy˙Ŝăűl·ōfλăKλyƎ ŜÈLJŜŎűŜŘ ŎŃλűŜŃλl·

Ŧ2Ń űKλă ŃŜăŜl·ŃŎKφ

Analysis of NCCDC Injects

¢KŜ ŃŜăŜl·ŃŎKŜŃ ǿl·ă l·fă2 l·ōfŜ ű2 Ǝl·λy˙l·ŎŎŜăă l·yŘ LJŜŃY˙λăăλ2y˙ű2 l·yl·fèÎŜ űKŜ нлмл

l·yŘ нлмм b//5/ λy?ŜŎűăφ ¢ǿ2 ŦλfŜă ǿŜŃŜ ŃŜŎŜλØŜŘ űKl·ű Ŏ2yűl·λyŜŘ űKŜ ǿ2ŃŘ ŦλfŜă 2Ŧ űKŜ

λy?ŜŎűăφ Ly?ŜŎűă ŦŃ2Y˙ ō2űK èŜl·Ńă ǿŜŃŜ ŜØl·fdzl·űŜŘ ōè űKŜ ŃŜăŜl·ŃŎKŜŃ l·yŘ Ŏfl·ăăλŦλŜŘ l·ă

LJ2fλŎèΣ űŜŎKyλŎl·fΣ 2Ń ō2űKφ a ŃΦ ² λffλl·Y˙ă Y˙Ŝyűλ2yŜŘ űKl·ű ă2Y˙Ŝ λy?ŜŎűă ǿŜŃŜ ŃŜdzăŜŘ ŦŃ2Y˙

èŜl·Ń ű2 èŜl·Ń ōŜŎl·dzăŜ űKŜ Ŏ2yŎŜLJűă ǿŜŃŜ λY˙LJ2ŃűI·yű Ŧ2Ń Ŏ2Y˙LJŜűλű2Ńă ű2 fŜl·ŃY˙ó ² λffλl·Y˙ăΣ

нлмпúΣ ă2 űKŜ ŃŜăŜl·ŃŎKŜŃ Ŏ2Y˙LJl·ŃŜŘ űKŜ űǿ2 èŜl·Ńă ű2 ăŜŜ űKŜ l·Y˙2dzyű 2Ŧ ŃŜdzăŜ 2Ŧ λy?ŜŎűăφ

! yl·fèăλă Ŧ2dzyŘ űKl·ű λY˙нлмлΣ 2dzű 2Ŧ űKŜ он λy?ŜŎűă dzăŜŘΣ c€ǿ ǿŜŃŜ űŜŎKyλŎl·f

λy?ŜŎűăΣ м€ǿ ǿŜŃŜ LJ2fλŎè ŃŜfl·űŜŘΣ l·yŘ м¢ǿ ǿŜŃŜ ō2űK űŜŎKyλŎl·f l·yŘ LJ2fλŎè ōl·ăŜŘφ Ly˙нлммΣ

2dzű 2Ŧ űKŜ от λy?ŜŎűă dzăŜŘΣ c¥ǿ ǿŜŃŜ űŜŎKyλŎl·f λy?ŜŎűăΣ м€ǿ ǿŜŃŜ LJ2fλŎè ŃŜfl·űŜŘΣ l·yŘ м€ǿ

ǿŜŃŜ ō2űK űŜŎKyλŎl·f l·yŘ LJ2fλŎè ōl·ăŜŘφ ¢KŜ LJŃŜŘ2Y˙λyl·yŎŜ 2Ŧ űŜŎKyλŎl·f λy?ŜŎűă 2ØŜŃ LJ2fλŎè

λy?ŜŎűă ădzNJLJNJλăŜŘ űKŜ NJŜăŜI·NJŎKŜNJΣ ăλyŎŜ űKŜ NJŜăŜI·NJŎKŜNJ I·λYˆŜŘ ŦƧNJ I· YˆƧ NJŜ ŜØŜyˆŘλăűNJλōdzűλƧyˆ

ƧŦ LJƧfλŎè I·yŘ űŜŎKyλŎI·f λy?ŜŎűă λyˆűKŜ ŎƧYˆLJŜűλűλƧyˆKŜ NJI·yΦ

Lyˆ Ŏ2YˆLJI·NJλyƎ űKŜ ű ø2 èŜI·NJăΣ I·yΛ·fèăλă ăK2øŜŘ űKI·ű пφ ƧŦ űKŜ λy?ŜŎűă ŦNJ2Yˆ нлмм

øŜNJŜ ØŜNJè Ŏf2ăŜ Ŏ2LJλŜă ƧŦ űKŜ LJNJŜØλ2dză èŜI·NJΦ {2YˆŜ ƧŦ űKŜ λy?ŜŎűă øŜNJŜ ø2NJŘ ŦƧNJ ø2NJŘ

ŜÈŎŜLJű ŦƧNJ űKŜ yΛ·YˆŜ ƧŦ űKŜ Ŏ2YˆLJI·yè λyˆűKŜ ăŎŜyΛ·NJλƧΦ ¢KŜ NJŜăŜI·NJŎKŜNJ ŘλŘ y2ű ŜÈLJŜŎű űKλă

ű2 ŦλyŘ űKλă NJŜădzfű ŜλűKŜNJΦ ¢KŜ LJKλf2ăƧLJKè I·ű űKŜ Ŏ2YˆLJŜűλűλƧyã űKŜ NJŜăŜI·NJŎKŜNJ KI·Ř ōŜŜyˆ

λyØƧfØŜŘ λyˆø I·ă űKŜ ŘŜăλƎyˆűŜI·Yˆ ûNJλŜŘ y2ű ű2 NJdzyˆűKŜ ăI·YˆŜ λy?ŜŎű λyˆŎƧyãŜŎdzűλØŜ èŜI·NJă

ōŜŎI·dzăŜ űKŜ ăűdzŘŜyˆűă I·NJŜ I·ff2øŜŘ ű2 LJI·NJűλŎλLJI·űŜ ŦƧNJ Yˆdzfűλ LJfŜ èŜI·NJăΦ LŦ λy?ŜŎűă I·NJŜ űKŜ

ăI·YˆŜΣ űKŜ ØŜűŜNJI·yã ƧŦ űKŜ Ŏ2YˆLJŜűλűλƧyˆŎ2dzfŘ KI·ØŜ I·yˆI·ŘØI·yűI·ƎŜ ƧØŜNJ űKŜ NJ22ţλŜăΦ

¦ yŦƧNJűdzyΛ·ûŜfèΣ űKŜ NJŜăŜI·NJŎKŜNJ Ƨyfè KI·Ř I·ŎŎŜăă ű2 ű ø2 èŜI·NJă ƧŦ λy?ŜŎűăΦ ! yˆλyűŜNJŜăűλyƎ

I·yΛ·fèăλă ø2dzfŘ ōŜ ű2 Ŏ2YˆLJI·NJŜ űKŜ ySÈű ŦŜø èŜI·NJă ű2 ăŜŜ λŦ űKŜ ûNJŜyŘ Ŏ2yűλydzŜăΦ CdzNJűKŜNJ

NJŜăŜI·NJŎK Ŏ2dzfŘ ōŜ Ř2yŜ ű2 ăŜŜ λŦ ûŜI·Yˆă øK2 KI·Ř Ŏ2YˆLJfŜûŜŘ űKŜ λy?ŜŎű ûKŜ èŜI·NJ ōŜŦƧNJŜ

ŘλŘ ăλƎyλŦλŎI·yűfè ōŜûûŜNJ ƧyˆűKŜ NJŜLJŜI·ûŜŘ λy?ŜŎű ûKI·yˆűKŜ ûŜI·Yˆă øK2 KI·Ř yŜØŜNJ Ř2yŜ ûKŜ

λy?ŜŎű ōŜŦƧNJŜΦ

¢2 ØI·fλŘI·ûŜ I·yˆŜŦŦŜŎûλØŜ λy?ŜŎűΣ ûKŜ NJŜăŜI·NJŎKŜNJ ŘŜŎλŘŜŘ ű2 f22ţ I·ű ûKŜ b / / 5 /

λy?ŜŎűă I·ă ŜÈI·YˆLJfŜă ƧŦ K2ø λy?ŜŎűă ăK2dzfŘ ōŜ YˆI·ŘŜΦ ¢ø2 λy?ŜŎűă KI·ØŜ ōŜŜyˆăŜfŜŎűŜŘ ûKI·ű

ûKŜ NJŜăŜI·NJŎKŜNJ ûK2dzƎKű øŜNJŜ Ǝ22Ř ŜÈI·YˆLJfŜăΦ ¢KŜ Ƨ2ff2øλyƎ λy?ŜŎű λă ŦNJ2Yˆ ûKŜ нлмл

b / / 5 /Φ ¢KŜ ăŎŜyΛ·NJλ2 øI·ă I·yˆ2yfλyŜ ăLJ2NJűλyƎ Ǝ22Řă ăű2NJŜΦ ¢KŜ NJŜăŜI·NJŎKŜNJ fλţŜŘ ûKλă λy?ŜŎű

ōŜŎI·dzăŜ λű YˆλÈŜŘ ō2ûK LJƧfλŎè I·yŘ ûŜŎKyλŎI·f ōè KI·ØλyƎ ûKŜ ûŜI·Yˆ ŜÈI·YˆλyŜ ûKŜ Ŏ2ŘŜ ƧŦ ûKŜ

LJNJƧƎNJI·YΣ I· ØŜNJè ûŜŎKyλŎI·f ûI·ăţΣ I·yŘ ŜØI·fdzI·ûλyƎ ûKŜ NJλăţă ûKI·ű λű LJƧăŜŘΣ I· LJƧfλŎè ûI·ăţΦ ¢Kλă

LJNJƧŎŜăă Ŏ2dzfŘ ōŜ ûλŜŘ ōI·Ŏţ ű2 ăŜØŜNJI·f ăûI·yŘI·NJŘăΣ ûKŜ wλăţ a I·yΛ·ƎŜYˆŜyű CNJI·YˆŜø2NJţ ŦƧNJ

ŜÈI·YˆLJfŜΦ ¢KŜ λy?ŜŎű ø2dzfŘ I·fă2 ōŜ ŎKI·ffŜyƎλyƎ ű2 Ŏ2YˆLJfŜûŜΣ ōdzű y2ű λYˆLJƧăăλōfŜΦ ¢KŜ

I·dzűK2NJ I·fă2 λyŎfdzŘŜŘ ă2YŜ ØŜōăλűŜă Ŧ2NJ űKŜ ăűdzŘŜyűă ű2 fŜI·NJy I·ō2dzű űKŜ ű I·ă] I·ű KI·yŘΦ

¢KŜ ăűdzŘŜyűă ØŜNJŜ NJŜIjdzλNJŜŘ ű2 ŎNJŜI·űŜ I· NJŜLJ2NJűΣ ă2YŜűKλy∃ űKI·ű λă I· ØŜNJè Ŏ2YY2y ű I·ă] λy

űKŜ NJŜI·f Ø2NJfŘΦ ² NJλűλy∃ I· NJŜLJ2NJű I·fă2 KŜfLJă ăűdzŘŜyűă ăűNJŜűŎK ōŜè2yŘ űŜŎKyλŎI·f ă]λffă ű2

ŘŜØŜf2LJ Ŏ2YYdzyλŎI·űλ2y ă]λffăΦ

Jock Xpress

From: Philip Carson

To: IT Staff

Subject: Assessment of Web Application for Purchase

We are considering purchasing an off-the-shelf web application to manage customers and bill payments, however we are concerned about security risks and how deploying this web application might affect our PCI compliance efforts.

We have a demonstration copy of the application installed on a virtual machine. Download the VM from your team page under injects (it's called Win2003.zip) and use VMWare Player to run it (software is available in the software repository). You can access the application you need to examine at http://localhost/RiskEUtilitySetup/ within the virtual machine. You can log in with the username "jim_dean" and the password "sausage". The code for the application is available at C:\Inetpub\wwwroot\RiskEUtilitySetup\ for you to examine.

Please make an evaluation of potential security problems in the application and write up a report outlining any issues and the associated business risk. I believe the sites www.owasp.org and www.webappsec.org provide some guidance in this area.

What I want to see is a report with an executive summary and then a listing of any vulnerabilities or weaknesses identified sorted by the associated business risk ordered from high to low. Please include a list of tools that were used as well as information on how you found each vulnerability. This isn't required at this time, but if possible please provide some suggestions about how you recommend remediating any identified issues. I would also like to know the name of the analyst(s) who worked on the report in case we need to discuss any of the observations in depth.

I need your assessment completed and report turned into me at 6:00 PM today.

Thanks,

Philip

Figure 2: 2010 NCCDC Inject

¢KŜ ăŜŎ2yŘ λy?ŜŎŭ λă ŦN2Y ŭKŜ нлмм b / / 5 / φ ¢KŜ ăŎŜyl·NJλ2 ŦŜl·ŭdzNŜŘ l· ōNJλŎ]ă l·yŘ Y2NJŭl·NJ LJKl·NJYl·Ŏè ǿλŭK l·y2yŭλyŜ LJNJŜăŜyŎŜφ ¢KŜ λy?ŜŎŭ Ŏl·ŭŭă Ŧ2NJ ŭKŜ ăŭdzŘŜyŭă ŭ2 l·yl·ŭèÎŜ ŭKŜ yŜŭǿ2NJ] l·yŘ NJŜŘŜăλ∃yYλŭ λyY l· Y2NJŜ ăŜŎdzNJŜ Ŧl·ăKλ2yφ ¢Kλă λy?ŜŎŭ λă Y2NJŜ ŭŜŎKyλŎl·f λY yl·ŭdzNJŜ l·yŘ l·ŭă2 λyŎŭdzŘŜă l· NJŜLJ2NJŭ ŭKl·ŭ ǿλŭf ōŜ ăŎ2NJŜŘ 2yYLJNJ2ŦŜăăλ2yl·ŭăY l·ă ǿŜŭf l·ă ŭKŜ ŭŜŎKyλŎl·f l·ăLJŜŎŭăφ !yYλyŭŜNJŜăŭλy∃ l·ăLJŜŎŭ 2Ŧ ŭKλă λy?ŜŎŭ λă ŭKl·ŭ λŭ NJŜljdzλNJŜă ŭKŜ ŭŜl·Yă ŭ2 ŭKλy] l·ō2dzŭ ōdzŘ∃ŜŭΣ l·yYl·ăLJŜŎŭ ŭKl·ŭ Ř2Ŝăyŭŭ ŜyŭŜNJ λyŭ2 Ŏ2YLJŜŭλŭλ2yã 2ŦŭŜyΣ èŜŭ λă l· Ŏ2yãŭl·yŭ λăădzŜ λyYŭKŜ L¢ λyŘdzăŭNJèφ

Inject #: 22

From: Philip Carson

To: IT Staffa

Subject: Network Redesign

IT Staff,

I've heard some comments from a few of you about how messed up our network is. So tell me how you'd fix it. Perform a complete secure network design for me as if you were going to redo the KwikePills network from the ground up. Tell me how you'd design the network, what technologies/software/hardware you would use, how you would support our core services and remote users, how you'd handle things like authentication and file access, etc. Prepare a proposal for me and have it ready for me at 5 PM today. Be sure to include an overall budget (dollars and hours) and a timeline for implementation.

Thanks,

Philip

Figure 3: 2011 NCCDC Inject

Chapter IV: Conclusions

¢KŜ ŃŜăŜł·ŃŎKŜŃ Ŏ2yŎfdzŘŜŘ ŭKł·ŭ ŭKŜ ŎŃλŭŜŃλł· λyŭλł·ftè ŎK2ăŜy˜ŭ2 ŜØł·fdzł·ŭŜ ł·y˜λy?ŜŎŭ ø ł·ă Ø ł·fλŘΦ ł 2øŜØŜŃΣ ŭKŃ2dzƎK ŭKŜ Ŏ2dzŃăŜ 2Ŧ ŭKŜ ŃŜăŜł·ŃŎKΣ ł·ŘŘλŭλ2ył·f λŭŜY˜ă øŜŃŜ λyŭŃ2ŘdzŎŜŘ ŭKł·ŭ ăK2dzfŘ ōŜ λyŎfdzŘŜŘ λy˜ŭKŜ ŎŃλŭŜŃλł· Ŧ2Ń ł·y˜ŜŦŦŜŎŭλØŜ λy?ŜŎŭΦ

Guidelines for Injects

¢KŜ ŃŜăŜł·ŃŎKŜŃ ŦŜŜfă ŭKŜ Ŧ2ff2øλyƎ ƎdzλŘŜfλyŜă ł·ŃŜ ŜăăŜyŭλł·f ŭ2 Y˜ł·ʼŜ ł·y˜ŜŦŦŜŎŭλØŜ λy?ŜŎŭΦ LŘŜł·ă Ŧ2Ń ŭKŜăŜ ƎdzλŘŜfλyŜă Ŏ2Y˜Ŝ ŦŃ2Y˜ ŭKŜ ŃŜăŜł·ŃŎKŜŃΣ ŭKŜ λyŭŜŃØλŜø øλŭK 5øł·èyŜ ² λffλł·Y˜ăΣ ł·yŘ ł·y˜ł·ŃŭλŎfŜ Ŝyŭλŭf ŜŘ ćLyŎŃŜł·ăλyƎ ł λŭă ł·yŘ wŜŘdzŎλyƎ aλăăŜă λy˜/waк[h{ {ŎŜył·ŃλăY DdzλŘŜfλyŜă Ŧ2Ń {λY˜dzfł·ŭ2Ń {ŎŜył·ŃλăΣ 5ŜØŜf2LJY˜Ŝyŭ¢

- ał·ʼŜ λy?ŜŎŭă ŃŜł·f /ŃŜł·ŭŜ λy?ŜŎŭă ŭKł·ŭ ł·ŃŜ ŃŜł·f ø2ŃfŘ ŭł·ăʼăΦ DλØŜ Ŏ2Y˜LJŜŭλŭ2Ńă ł·ŎKł·yŎŜ ŭ2 ł·Ŏŭ ł·ă ø2dzfŘ ōŜ ŃŜłjdzλŃŜŘ 2y˜ŭKŜ ?2ō ótŃλyŎŜΣ hăŜŃΣ {ł·fł·ăΣ ɜ ² 22ŘŃdzŦŦúΦ
- łł·ØŜ ł· Yλ È 2Ŧ ăλY˜LJfŜ ł·yŘ Ŏ2Y˜LJfŜ È LJŃ2ōfŜY˜ă Ŧ2Ń Ŏ2Y˜LJŜŭλŭ2Ńă ŭ2 ă2fØŜ ótŃλyŎŜΣ hăŜŃΣ {ł·fł·ăΣ ɜ ² 22ŘŃdzŦŦúΦ .Ŝ ădzŃŜ ŭ2 ŎKł·ffŜyƎŜ ŭKŜ Ŏ2Y˜LJŜŭλŭ2Ńă øKλfŜ ăŭλff Ył·ʼλyƎ ŭKŜ ŭł·ăʼă LJ2ăăλōfŜΦ
- !ff2ø Ŧ2Ń Ŝy2dzƎK ŭλY˜Ŝ ŭ2 Ŏ2Y˜LJfŜŭŜ ŭKŜ λy?ŜŎŭΦ 5dzŜ ŭ2 ŭKŜ ył·ŭdzŃŜ 2Ŧ ŭKŜ Ŏ2Y˜LJŜŭλŭ2yΣ ŭł·ăʼă ł·ŃŜ Ŏ2yŘŜyăŜŘ ŭ2 ł·ff2ø ŭλY˜Ŝ Ŧ2Ń ăŭdzŘŜyŭ ł·ŎŎ2Y˜LJfλăKY˜Ŝyŭ¢
- YŜŜLJ ŭKŜ ăŎŜył·ŃλΣ λy˜Yλ yŘ øKŜy˜ŎŃŜł·ŭλyƎ ł·y˜λy?ŜŎŭΦ ał·ʼŜ ădzŃŜ ŭKŜ λy?ŜŎŭ Ŧλŭă λyŭ2 ŭKŜ ăŎŜył·ŃλΣ ŎŃŜł·ŭŜŘΦ ¢Kλă Ył·ʼŜă ŭKŜ ăŎŜył·ŃλΣ Y˜2ŃŜ ŃŜł·fΦ
- tŃ2ØλŘŜ ŭKŜ Ŏ2Y˜LJŜŭλŭ2Ńă øλŭK fŜł·ŃyλyƎ 2LJLJ2ŃŭdzyλŭλŜăΦ łŜfLJ LJŃŜLJł·ŃŜ ŭKŜY˜ Ŧ2Ń ŭKŜλŃ Ŧdzŭ˜dzŃŜ Ŏł·ŃŜŜŃă ó ² λffλł·Y˜ăΣ нлмпúΦ

- bŜØŜ₦ 2ØŜ₦f22ʼ] ŭKŜ ăY·l·ff ŘŜŭl·λfăΦ {Y·l·ff ŘŜŭl·λfă Y·l·ʼ]Ŝ ŭKŜ λy?ŜŎŭ Y·2₦Ŝ ₦Ŝl·fλăŭλŎ ŭ2 Ŏ2Y·LJŜŭλŭ2₦ă ótN₦λyŎŜΣ hăŜ₦Σ {l·fl·ăΣ ϑ ² 22Ř₦dz₮₮ŭΦ
- LŘŜyŭλ₮è l·yŘ ʼ]ŜŜLJ λy·Yλ yŘ ŭKŜ ₦Ŝă2dz₦ŎŜă l·Ø l·λfl·ōfŜ λy·ŭKŜ ŜyØλ₦2yYŜyŭ l·ă λy?ŜŎŭă l·₦Ŝ Ŏ₦Ŝl·ŭŜŘ ótN₦λyŎŜΣ hăŜ₦Σ {l·fl·ăΣ ϑ ² 22Ř₦dz₮₮ŭΦ 5Ŝăλ∃y·λy?ŜŎŭă ōl·ăŜŘ 2y·ŭKŜ ŜIjdzλLJYŜyŭ l·Ø l·λfl·ōfŜ ŭ2 Ŏ2Y·LJŜŭλŭ2₦ă ŘdzN₦λy∃ ŭKŜ Ŏ2Y·LJŜŭλŭλ2y·ó ² λffλl·YăΣ нлмпŭΦ
- 5Ŝăλ∃y·λy?ŜŎŭă ŭ2 ōŜ Ŝl·ăλfè YŜl·ădz₦ŜŘ l·yŘ ăŎ2₦ŜŘ ó ² λffλl·YăΣ нлмпŭΦ

  aŜl·ădz₦ŜYŜyŭă Ŏl·y·λyŎfdzŘŜ ØλŜØλy∃ l· ăŜŭŭλy∃ 2₦ ØŜōLJl·∃ŜΣ Ŏ2yŘdzŎŭλy∃ l· ₦2dzŭλyŜ 2₦ ăŜ₦λŜă 2₮ ăŭŜLJă ŭ2 Ŏ2Y·LJfŜŭŜ l· ŭl·ăʼ]Σ ∃₦l·Řλy∃ l· ₦ŜLJ2₦ŭΣ ?dzŘ∃λy∃ l· LJ₦ŜăŜyŭl·ŭλ2yΣ ŜŭŎΦ

5λăŭ₦l·Ŏŭλ2yã l·yŘ Ŏ2Y·YdzyλŎl·ŭλ2yã ŭKl·ŭ l·₦Ŝ λ₦₦ŜfŜØl·yŭ ŘdzN₦λy∃ l·y·λy?ŜŎŭ Ŏl·y·l·ŘŘ l· ăŜyãŜ 2₮ ₦Ŝl·fλăY· ŭ2 ŭKŜ ŜÈLJŜ₦λŜyŎŜ ótN₦λyŎŜΣ hăŜ₦Σ {l·fl·ăΣ ϑ ² 22Ř₦dz₮₮ŭΦ Lŭ λă LJ2ăăλōfŜ ŭ2 l·ŘŘ l·y·ŜYŜ₦∃ŜyŎè ăλŭdzl·ŭλ2y·λy·ŭKŜ YλŘŘfŜ 2₮ Ŏ2Y·LJfŜŭλ2y·2₮ l·y·λy?ŜŎŭΦ ¢KŜ 2₦l·y∃Ŝ ŭŜl·Y LJ₦2ØλŘŜă ă2Y·Ŝ 2₮ ŭKλă λyŭŜ₦₦dzLJŭλ2y·λy· / / 5 / Ŏ2Y·LJŜŭλŭλ2yã óăŜŜ ŭl·ōfŜ мŭΦ

a l·LJLJλy∃ l·y·λy?ŜŎŭ ŭ2 l· ăŭl·yŘl·₦ŘΣ ădzŎK l·ă LyŭŜ₦yl·ŭλ2yl·f h₦∃l·yλÎl·ŭλ2y·₮2₦ {ŭl·yŘl·₦ŘλÎl·ŭλ2y·óL{hŭ нтллл ăŜ₦λŜăΣ tl·èY·Ŝyŭ / l·₦Ř LyŘdzăŭ₦è ót / LŭΣ / 2yŭ₦2f hō?ŜŎŭλØŜă ₮2₦ Ly₮2₦Y·l·ŭλ2y·l·yŘ wŜfl·ŭŜŘ ¢ŜŎKy2f2∃è ó / h . L¢ŭΣ CL{ a !Σ wλăʼ] a l·yl·∃ŜY·Ŝyŭ C₦l·Y·ŜØ2₦ʼ] ów a CŭΣ Ly₮2₦Y·l·ŭλ2y·¢ŜŎKy2f2∃è Ly₮₦l·ăŭ₦dzŎŭdz₦Ŝ [λō₦l·₦è ŏL¢L[ŭΣ KŜfLJă ŭ2 Ø l·fλŘl·ŭŜ ŭKŜ λy?ŜŎŭ l·ă l· ₦Ŝl·f L¢ ŭl·ăʼ]Φ {ŭl·yŘl·₦Řă Ŏl·y·l·fă2 ōŜ dzăŜŘ l·ă l· ăŭl·₦ŭλy∃ LJ2λyŭ ₮2₦ Ŏ₦Ŝl·ŭλy∃ λy?ŜŎŭăΦ l 2ØŜØŜ₦Σ ØKλfŜ ăŭl·yŘl·₦Řă l·₦Ŝ Ŏ₦Ŝl·ŭŜŘ ₮₦2Y· ŭKŜ Ŏ2ffŜŎŭλØŜ ŜÈLJŜ₦λŜyŎŜă 2₮ L¢ ŜÈLJŜ₦ŭăΣ ăŭl·yŘl·₦Řă l·fă2 fl·∃ ōŜKλyŘ ŭKŜ yŜØŜăŭ L¢ LJ₦Jl·ŎŭλŎŜăΦ ¢Kdzăλy?ŜŎŭă Ŏl·y·ōŜ Ŏ₦Ŝl·ŭŜŘ ₮₦2Y· ăŭl·yŘl·₦ŘăΣ ōdzŭ λŭ ăK2dzfŘ y2ŭ ōŜ l· ₦ŜIjdzλ₦ŜYŜyŭΦ

9ŦŦƧNJűă l·NJŜ ŏdzNJNJŜyűfè dzyŘŜNJø l·è űƧ Y l·LJ ŏèōŜNJăŜŏdzNJλűè ŏƧYLJŜűλűλƧyã űƧ L¢ øƧNJ]ŦƧNJŏŜ]yƧøfŜŘƎŜ ă]λffă l·yŘ l·ōλfλűλŜă óY{ ! ăúφ ¢KŜ bl·űλƧyl·f LyăűλűdzűŜ ƧŦ {űl·yŘl·NJŘă l·yŘ ¢ŜŏKyƧfƧƎè óbL{¢ú Kl·ă]λŏ]ŜŘ ƧŦŦ űKŜ bl·űλƧyl·f Lyλűλl·űλØŜ ŦƧNJ /èōŜNJăŜŏdzNJλűè 9Řdzŏl·űλƧy óbL/9úφ ¦yŘŜNJ űKλă λyλűλl·űλØŜΣ bL{¢ Kl·ă LJl·NJűyŜNJŜŘ øλűK űKŜ 5ŜLJl·NJűYŜyű ƧŦ l ƧYŜfl·yŘ {ŜŏdzNJλűè ó5 l {ú /èōŜNJăŜŏdzNJλűè 9Řdzŏl·űλƧy ɜ ! ø l·NJŜyŜăă ó/9ɜ ! ú .NJl·yŏK űƧ ŏNJŜl·űŜ űKŜ /èōŜNJ /ƧYLJŜűλűλƧyã tNJƧ?ŜŏŰ ó/ / tú ó/èōŜNJ /ƧYLJŜűλűλƧy tNJƧ?ŜŏŰ ó/ / tú bl·űλƧyl·f Lyλűλl·űλØŜ ŦƧNJ /èōŜNJăŜŏdzNJλűè / l·NJŜŜNJă l·yŘ {űdzŘλŜă óbL/ /{úΣ нлмпúφ ¢KŜ / / t LJNJƧ?ŜŏŰ øλff l·făƧ KŜfLJ λy?ŜŏŰ ŏNJŜl·űƧNJă űƧ λŘŜyűλŦè űl·ă]ă ŦƧNJ L¢ ?Ƨōă űKl·ű ŏl·y ōŜ dzăŜŘ l·ă λy?ŜŏŰăφ

Further Research

² KλfŜ űKŜ l·ăLJŜŏŰă ƧŦ øKl·ű Y l·]Ŝă l·y ŜŦŦŜŏŰλØŜ λy?ŜŏŰ øŜNJŜ ŘλăŏdzăăŜŘΣ űKŜ YŜűKƧŘă ƧŦ KƧø űƧ ăŏƧNJŜ λy?ŜŏŰă øŜNJŜ yƧűφ ² KŜNJŜ λy?ŜŏŰă Kl·ØŜ űŜŏKyλŏl·f l·ăLJŜŏŰă l·ă øŜff l·ă NJŜLJƧNJűă l·yŘ LJNJŜăŜyűl·űλƧyãΣ l· ƎdzλŘŜ øλűK ŜÈl·YLJfŜă ƧŦ űKŜ ŘλŦŦŜNJŜyű YŜűKƧŘă ƧŦ KƧø űƧ ƎNJl·ŘŜ λy?ŜŏŰă øƧdzfŘ ōŜ KŜfLJŦdzf űƧ űKŜ / / 5 / ŏƧYYdzyλűèφ wŜƎλƧyl·f ŜØŜyűă l·NJŜ KƧăűŜŘ ōè ØƧfdzyűŜŜNJăΣ øKƧ Y l·è ƧNJ Y l·è yƧű ōŜ ŜŘdzŏl·űƧNJă l·yŘ Kl·ØŜ ŜÈLJŜNJλŜyŏŜ l·yŘ λyăűNJdzŏűλƧy ƧyƧ ŜØl·fdzl·ûλyƎ l·yŘ ûŜăûλyƎ λy l·y ŜŘdzŏl·ûλƧyl·f ăŜûûλyƎφ

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Proceedings of the 9th Colloquium for Information Systems Security Education

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/Kl·YLJλƶyăKλLJ /dzLJΦ *Proceedings of the 15th Colloquium for Information Systems Security Education* óLJLJΦ уτπфнúΦ Cl·λ₦ōƶ₦yΣ hKλƶY /L{{9Φ

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² λffλl·YăΣ 5Φ óнлмпΣ !LJ₦λf тúΦ ² Kl·ű Yl·ţŜă l·yŜŦŦŜŎűλØŜ LyƶŜŎűΦ ówΦ .ŜŎţăűŜl·ŘΣ LyűŜ₦ØλŜØŜ₦ú

² 22ŘØl·ℕŘΣ .ΦΣ ℊ ¸2dzyƎΣ ¢Φ óнллтúΦ wŜŘŜăλƎyλyƎ l·yŘ Ly₮2ℕY l·ûλ2y {èăúŜY {ŜŎdzℕλûè

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Appendix A: Interview with Dwayne Williams

Interview with Dwayne Williams, Associate Director Technology Research and Cyber Competitions

Monday, April 7 at 9:00 a.m. MST

Interview was conducted by Ryan Beckstead

Ryan: I 2ø f2y∃ KI·ØŜ è2dz ōŜŜy˜λyØ2fØŜŘ øλűK / / 5 / I·yŘ ŏI·y˜è2dz ŘŜăŎNJλōŜ è2dzNJ NJ2fŜK

Dwayne: ² Ŝ ăűI·NJűŜŘ / / 5 / λy˜нллрΦ LŦ è2dz f22ʼ I·ű űKŜ Kλăű2NJè 2Ŧ λűΣ è2dzΩff y2űŜ űKI·ű ōI·Ŏʼ λy˜нллпΣ űKŜNJŜ øI·ă I·y˜b{C ăLJ2yã2NJŜŘ Y˜ŜŜűλy∃ øKŜNJŜ űKŜè ŏI·Y˜Ŝ ű2∃ŜűKŜNJ I·yŘ ăI·λŘ áKŜè øŜ ăK2dzfŘ NJŜI·ffè Ř2 ă2Y˜Ŝ ă2NJű 2Ŧ Ly˜Ŧ2NJY˜I·űλ2y˜ {ŜŎdzNJλűè /2Y˜LJŜűλűλ2yε I·yŘ ă2Y˜Ŝ 2Ŧ űKŜ Ŧ2fʼă űKI·ű øŜNJŜ ōŜKλyŘ λű øŜNJŜ ă2Y˜Ŝ 2Ŧ űKŜ LJŜ2LJfŜ øK2 ø2NJʼŜŘ Ŧ2NJ űKŜ / 5 · LJNJ2∃NJI·Y˜ I·ű űKŜ I·ŏI·ŘŜY˜èΦ ¢KŜλNJ Ŧ2Ŏdză øI·ă y2ű ű2 ŜÈLJI·yŘ űKŜ / 5 · ű2 λyŎfdzŘŜ ŎλØλfλI·y˜λyãűλűdzűλ2yãΦ ¢KŜλNJ ∃2I·f øI·ă ű2 ŎNJŜI·űŜ ă2Y˜ŜűKλy∃ ŘλŦŦŜNJŜyű űKI·ű ø2dzfŘ ōŜ I·ØI·λfI·ōfŜ Ŧ2NJ ŎλØλfλI·y˜λyãűλűdzűλ2yãΦ !ű űKI·ű LJI·NJűλŎdzfI·NJ Ŏ2yŦŜNJŜyŎŜΣ Y˜è ō2ăă øI·ă űKŜNJŜ π 5NJΦ DNJŜ∃2NJè ² KλűŜΦ I Ŝ fλăűŜyŜŘ ű2 I·ff 2Ŧ űKŜ ŘλăŎdzăăλ2yã I·yŘ λű øI·ă KŜI·Řλy∃ Ř2øy˜űKŜ űNJI·Řλűλ2yI·f I·ŏI·ŘŜY˜λŎ LJI·űK 2Ŧ áfŜűΩă Ŧ2NJY˜ ă2Y˜Ŝ Ŏ2Y˜Y˜λűűŜŜă ű2 f22ʼ I·ű űKŜ λăădzŜέΦ I Ŝ ăI·λŘΣ áLΩØŜ ∃2ű I·y˜λŘŜI·Σ L űKλyʼ øŜ KI·ØŜ ă2Y˜Ŝ Ŧ2fʼă øK2 Ŏ2dzfŘ LJdzű ă2Y˜ŜűKλy∃ ű2∃ŜűKŜNJΦέ I Ŝ LJdzffŜŘ ă2Y˜Ŝ 2űKŜNJ λyűŜNJŜăűŜŘ tK5Ωă ŦNJ2Y˜ I·NJ2dzyŘ űKŜ I·NJŜI· λy˜¢ŜÈI·ăΣ ŘλŦŦŜNJŜyű ăŎK22făΦ I Ŝ I·ăʼŜŘ űKŜY˜ űKI·ű λŦ øŜ LJdzű ű2∃ŜűKŜNJ I·y˜ŜØŜyűΣ ø2dzfŘ è2dz I·ú ōŜ øλffλy∃ ű2 KŜfLJ 2dzű I·yŘ

ōú ø2dztŘ è2dz ōŜ øλftλy∃ ű2 ăŜyŘ I· űŜI·Y˙φ ¢KŜ ŦλNăű ŦλØŜ ăŎK22fă ∃2ű ű2∃ŜűKŜNJ

λy˙нллр ă2 Y˙èăŜfŦΣ I· ∃Ŝyűt̂SY˙I·y˙yI·Y˙ŜŘ YŜØλy˙ ! NJŎKŜNJΣ I·yŘ ă2Y˙Ŝ 2űKŜNJ

Ŧ2f˙ă I·ű űKŜ /L! { øKŜNJŜ øŜ ø2NJ˙ ōdzλfű űKŜ / / 5 / ăèăűŜY˙ Ŧ2NJ űKI·ű ŦλNăű

NJŜ∃λ2yI·f ŜØŜyűφ ² Ŝ KŜfŘ λű KŜNJŜ λy˙{I·y˙ ! yű2yλ2 λy˙нллрφ

! ű űKI·ű ŜØŜyű øŜ KI·Ř I· Ŏ2dzLJfŜ 2Ŧ Ŧ2f˙ă Ŏ2Y˙Ŝ λy˙fλ˙Ŝ 9NJλŎ {LJI·y∃fŜNJ

I·yŘ /I·ăŜè hΩ.NJλŜy˙űKI·ű KI·Ř λyűŜNJŜăű λy˙űKŜ Ŏ2Y˙LJŜűλűλ2y˙λűăŜfŦφ ¢KŜè

ŜÈLJNJŜăăŜŘ I·y˙λyűŜNJŜăű I·yŘ ăI·λŘ KŜè λŦ űKŜ Y˙2ŘŜf ø2NJ˙ă ø2dztŘ è2dz ōŜ

λyűŜNJŜăűŜŘ λy˙dză NJdzyÿλy∃ űKλă ŜØŜyű ă2Y˙ŜøKŜNJŜ ŜfăŜ I·yŘ øŜ ăI·λŘ ădzNJŜΣ

I·ōă2fdzűŜfèφ ² Ŝ NJI·y˙űKI·ű ŦλNăű ŜØŜyű I·yŘ űKŜ Y˙2ŘŜf ø2NJ˙ŜŘ NJŜI·ffè øŜff π

I·Ŏűdz I·ffè ōŜűűŜNJ űKI·y˙L űK2dz∃Kű λű ø2dztŘφ ! ff űKŜ ōI·ăλŎ ōdzλftŘλy∃ ōf2Ŏ˙ă űKI·ű

ŜÈλăűŜŘ λy˙нллрΣ ŜÈλăű y2øΣ ű2ŘI·èφ hØŜNJ űKŜ fI·ăű yλyŜ èŜI·NJă øŜΩØŜ ōŜŜy˙

űøŜI·˙λy∃ I·yŘ I·Řdzăűλy∃ űKŜ Y˙2ŘŜf I·ă øŜ ∃2 I·f2y∃Σ ōdzű űKŜ Ŏ2NJŜ

ŦNJI·Y˙Ŝø2NJ˙ KI·ă I·føI·èă ōŜŜy˙űKŜ ăI·Y˙Ŝ ŦNJ2Y˙ űKŜ ∃Ŝű ∃2Σ űKI·ű űKλă ø2dztŘ ōŜ

I· ŘŜŦŜyăλØŜ Ŏ2Y˙LJŜűλűλ2yΣ űKŜ ăűdzŘŜyűă ø2dztŘ fŜI·NJy˙ű2 ăŜŎdzNJŜ I·yŘ ŘŜŦŜyŘ

I· ∃NJ2dzLJ 2Ŧ ăèăűŜY˙ă űKI·ű űKŜè øŜNJŜ LJNJ2ØλŘŜŘΣ űKI·ű űKŜ ŜØŜyű ø2dztŘ ōŜ

ōdzăλyŜăă 2NJλŜyűŜŘ λy˙űKI·ű è2dz ø2dztŘ ōŜ I·ăăλ∃yŜŘ ű2 NJdzy˙I·yŘ Y˙I·yI·∃Ŝ I·yŘ

Y˙I·λyűI·λy˙I· ăY˙I·ff ōdzăλyŜăă ōè ˙ŜŜLJλy∃ dzLJ ŎNJλűλŎI·f ăŜNJØλŎŜăΣ NJŜăLJ2yŘλy∃ ű2

Ŏdzăű2Y˙ŜNJă I·yŘ ă2 2y˙ ¢KI·ű ōdzăλyŜăă Ŧ2Ŏdză I·yŘ ŘŜŦŜyăλØŜ Ŧ2Ŏdză øŜNJŜ űKŜNJŜ

ŦNJ2Y˙ űKŜ ∃Ŝű ∃2φ ¢KŜ I·Y˙2dzyű 2Ŧ Ŧ2Ŏdză 2y˙λy?ŜŎűă ØŜNJădză ˙ŜŜLJλy∃ LJ2λyűă dzLJ

ØŜNJădză I· fλØŜ NJŜŘ űŜI·Y˙ űI·˙λy∃ LJ2λyűă I·øI·è ŦNJ2Y˙ è2dzΣ KI·Øλy∃ I·y˙I·dzű2Y˙I·űŜŘ

ăŎ2NJλy∃ Ŝy∃λyŜΣ I·yŘ ă2 2y˙π I·ff 2Ŧ űK2ăŜ Ŏ2Y˙LJ2yŜyűă ŜÈλăűŜŘφ 9ØŜNJèűKλy∃

KI·ă Ǝ2ŭŭŜy˜λy₮λyλŭŜfè ōŜŭŭŜ№Σ ōdzŭ ŭKŜ ōI·ăλŎ ōdzλfŘλyƎ ōf2Ŏ⌊ă ₮№2Y˜ ŭKŜ нллр ŜØŜyŭ I·№Ŝ I·ff ăŭλff ŭKŜ№Ŝ ŭ2ŘI·èΦ

¢KŜ yŜÈŭ èŜI·№Σ ØŜ KI·Ř ₮2dz№ №ŜƎλ2yI·f ŜØŜyŭă I·№2dzyŘ ŭKŜ Ŏ2dzyŭ№è I·yŘ ØŜ KI·Ř 2dz№ ₮λ№ăŭ yI·ŭλ2yI·f ŎKI·Y˜LJλ2yãKλLJ I·yŘ λŭ KI·ă ⌊λyŘ 2₮ Ǝ№2øy˜₮№2Y˜ ŭKŜ№ŜΦ ¢Kλă ăŜI·ă2y˜ØŜ KI·Ř 2ØŜ№ мул Ŏ2ftŜƎŜă I·yŘ dzyλØŜ№ăλŭλŜă ŭKI·ŭ LJfI·èŜŘΦ ² Ŝ Ř2 ăKI·№Ŝ λy₮2№Y˜I·ŭλ2y˜ōI·Ŏ⌊ I·yŘ ₮2№ŭK ōŜŭØŜŜy˜№ŜƎλ2yI·fă λy˜ŭŜ№Y˜ă 2₮ λy?ŜŎŭă ŭKI·ŭ ØŜ№Ŝ dzăŜŘ λy˜LJ№ŜØλ2dză èŜI·№ă I·ŭ ŭKŜ yI·ŭλ2yI·făΣ ØŜ ŜăăŜyŭλI·ffè LJdzăK ŭK2ăŜ Ř2øy˜ŭ2 ŭKŜ №ŜƎλ2yI·fă I·yŘ fŜŭ LJŜ2LJfŜ ⌊λyŘ 2₮ LJλŎ⌊ I·yŘ ŎK22ăŜ ØKλŎK λy?ŜŎŭă ŭKŜè øI·yŭ ŭ2 №ŜπdzăŜ 2№ λ₮ ŭKŜè øI·yŭ ŭ2 ø№λŭŜ ŭKŜλ№ 2øy˜ 2№λƎλyI·f λy?ŜŎŭăΦ ² Ŝ I·№Ŝ I·ŭ ŭKŜ LJ2λyŭ y2ø øKŜ№Ŝ I· f2ŭ 2₮ №ŜƎλ2yI·fă I·№Ŝ Ŏ№ŜI·ŭλyƎ ŭKŜλ№ 2øy˜λy?ŜŎŭ ăŜŭă I·yŘ øŜ I·№Ŝ ăKI·№λyƎ ōŜŭØŜŜy˜№ŜƎλ2yã I·ă øŜ ŎI·yΦ

aè №2fŜ y2øΣ LΩY˜ ŭKŜ Řλ№ŜŎŭ2№ 2₮ ŭKŜ yI·ŭλ2yI·f LJ№2Ǝ№I·Y˜ăΦ I Ŝ№Ŝ I·ŭ ¦¢{ !Σ øŜ ŜăăŜyŭλI·ffè ăλŭ I·ŭ ŭKŜ ŭ2LJ 2₮ ŭKŜ KŜI·LJ λ₮ è2dz øλff I·yŘ øŜ ø2№⌊ øλŭK 2dz№ №ŜƎλ2yI·f LJI·№ŭyŜ№ăΦ ¢KŜ t I·Ŏλ₮λŎ wλY˜ wŜƎλ2yI·f λă №dzy˜ōè I· Ǝ№2dzLJ 2₮ LJŜ2LJfŜ ø2№⌊λyƎ ŭ2ƎŜŭKŜ№Φ hōØλ2dzăfè λ₮ è2dzØŜ ōŜŜy˜λyØ2fØŜŘΣ è2dz ⌊y2ø ŭKI·ŭ Ǝ№2dzLJΦ ² Ŝ KI·ØŜ ŭŜy˜№ŜƎλ2yI·f ŜØŜyŭă I·№2dzyŘ ŭKŜ Ŏ2dzyŭ№èΦ ¢KŜè I·№Ŝ ăŜYλ I·dzŭ2y2Y˜2dză λy˜ŭKI·ŭ ŭKŜè ŘŜØŜf2LJ ŭKŜλ№ 2øy˜Ŏ2YLJŜŭλŭλ2y˜ăèăŭŜY˜ λy˜ ŭŜ№Y˜ă 2₮ ŭKŜ λy?ŜŎŭă ŭKŜè dzăŜΣ ŭKŜ ăŎŜyI·№λ2Σ ŭKŜ I·Ŏŭdz I·f 2LJŜ№I·ŭλyƎ ăèăŭŜY˜ă I·yŘ ŭKŜ ăŜ№ØλŎŜă ŭKI·ŭ I·№Ŝ ōŜλyƎ ăŎ2№ŜŘΣ ōdzŭ ŜØŜ№èō2Řè LJfI·èă ōè ŭKŜ ăI·YŜ №dzfŜ ō22⌊Φ ² Ŝ KI·ØŜ I· №dzfŜă Ŏ2YYλŭŭŜŜ ŭKI·ŭ ƎŜŭă ŭ2ƎŜŭKŜ№ øλŭK I· №ŜLJ№ŜăŜyŭI·ŭλØŜ ₮№2Y˜ ŜI·ŎK №ŜƎλ2y˜ŭKI·ŭ ăŜŭă ŭKŜY˜ 2dzŭΦ aè ?2ō λă ŭ2 YI·⌊Ŝ

ãdzNJŜ ŭKI·ŭ ŭKŜ y1·ŭλ2y1·f LJNJ2ƎNJI·Y ãŭI·èã 2y˜ŭNJI·Ŏ] I·yŘ L I·fã2 2NJƎI·yλÎŜ I·yŘ ŜÈŜŎdzŭŜ ŭKŜ y1·ŭλ2y1·f ŎKI·YLJλ2yãKλLJ ŜØŜyŭΦ a è ŭŜI·Y ŭI·]Ŝã ŎI·NJŜ 2Ŧ ŭKŜ LJNJ2ƎNJI·Y I·ŭ fI·NJƎŜΣ ōdzŭ øŜ ãLJŜŎλŦλŎI·ffè LJdzŭ ŭ2ƎŜŭKŜNJ I·yŘ NJdzy˜I·yŘ ŜÈŜŎdzŭŜ ŭKŜ y1·ŭλ2y1·f ŎKI·YLJλ2yãKλLJ ŜØŜyŭ ŜØŜNJè ! LJNJλfΦ

Ryan: ² KI·ŭ λã è2dzNJ ŜŘdzŎI·ŭλ2y1·f ōI·Ŏ]ƎNJ2dzyŘK ² KI·ŭ ŘλŘ è2dz ƎŜŭ è2dzNJ dzyŘŜNJƎNJI·Ř λyΣ Ř2 è2dz KI·ØŜ I· a I·ãŭŜNJã 2NJ 52Ŏŭ2NJI·ŭŜK

Dwayne: L Ř2yŭ KI·ØŜ I· a I·ãŭŜNJã 2NJ 52Ŏŭ2NJI·ŭŜ èŜŭΦ a è dzyŘŜNJƎNJI·ŘdzI·ŭŜ øI·ã λy˜ /2YLJdzŭŜNJ {ŎλŜyŎŜ 2dzŭ 2Ŧ . I·èf2NJ ¦ yλØŜNJãλŭèΦ L øŜyŭ ŦNJ2Y˜ ŭKŜNJŜ ŭ2 ŭKŜ ¦Φ{Φ ! λNJ Ŧ2NJŎŜ I·yŘ L ŘλŘ ŘŜŦŜyãλØŜ Ŏ2dzyŭŜNJY˜ŜI·ãdzNJŜãΦ {2 L ŘλŘ NJŜI·f ŭλY˜Ŝ I·ŭŭI·Ŏ] I·yI·fèãλã I·yŘ ŘŜŦŜyãŜ 2y˜Ŏ2Y˜LJdzŭŜNJ ãèãŭŜY˜ã I·yŘ yŜŭø2NJ]ã ãèãŭŜY˜ã Ŧ2NJ ŭKŜ ! λNJ Ŧ2NJŎŜ Ŧ2NJ I· øKλfŜΦ ! ŦŭŜNJ fŜI·ØλyƎ ŭKŜ ! λNJ Ŧ2NJŎŜΣ L øŜyŭ λyŭ2 Ŏ2Y˜Y˜ŜNJŎλI·f ãŜŎdzNJλŭè Ŏ2yãdzfŭλyƎ Ŧ2NJ I· ydzY˜ōŜNJ 2Ŧ èŜI·NJãΦ L ƨ2λyŜŘ ŭKŜ ŎŜyŭŜNJ KŜNJŜ I·ō2dzŭ ŭŜy˜èŜI·NJã I·Ǝ2Φ hyŜ 2Ŧ ŭKŜ Ŏ22f ŭKλyƎã I·ō2dzŭ ŭKŜ ŎŜyŭŜNJ KŜNJŜ λã λŭ λã ØŜNJè KŜI·ØλfŭŜ ãŭI·ŦŦŜŘ ōè LJŜ2LJfŜ øK2 KI·ØŜ 2LJŜNJI·ŭλ2y1·f ōI·Ŏ]ƎNJ2dzyŘãΣ øKλŎK λã NJŜI·ffè KI·yŘè øKŜy˜è2dz I·NJŜ Ř2λyƎ ã2Y˜ŜŭKλyƎ fλ]Ŝ / / 5 / Φ ! ff ŭKŜ Ŧ2f]ã ø2NJ]λyƎ KŜNJŜ KI·ØŜ Ř2yŜ Ŏ2Y˜Y˜ŜNJŎλI·f Ŏ2yãdzfŭλyƎ I·yŘ ŭKŜèΩØŜ Ř2yŜ LJŜyŭŜãŭãΣ ŭKŜèΩØŜ NJdzy˜2LJŜNJI·ŭλ2y˜ŎŜyŭŜNJãΣ I·yŘ ŭKŜèΩØŜ NJdzy˜λyŎλŘŜyŭ NJŜãLJ2yãŜ ŭŜI·Y˜ãΦ ² Ŝ KI·ØŜ I· fI·NJƎŜ yŜŭø2NJ] 2Ŧ I·ŘØλã2NJã ŭKI·ŭ øŜ ōNJλyƎ λy˜I·ŭ ŘλŦŦŜNJŜyŭ ŭλY˜Ŝã ŘdzNJλyƎ ŭKŜ èŜI·NJ ŭ2 ƎŜŭ ŭKŜλNJ I·ŘØλŎŜΦ ² KI·ŭΩã dzLJ I·yŘ Ŏ2Y˜λyƎ λy˜ŭKŜ λyŘdzãŭNJèK ² KI·ŭ Ř2 è2dz ãŜŜ I·ã ŭKŜ yŜÈŭ ōλƎ Ŧ2ŎI·f LJ2λyŭK ² KI·ŭΩã ŭKŜ yŜÈŭ ōλƎ LJdzãKK ² KI·ŭ I·NJŜ ŭKŜ LJNJ2ōfŜY˜ã ŭKI·ŭ è2dz ãŜŜ 2ØŜNJ I·yŘ 2ØŜNJ I·ƎI·λy˜ I·ã è2dz Ǝ2 ŦNJ2Y˜ ãY˜I·ff ōdzãλyŜãã ŭ2 ãY˜I·ff ōdzãλyŜããK ² KI·ŭ I·NJŜ ŭK2ãŜ λããdzŜã

ŭKI·ŭ è2dz ăŜŜK a 2ăŭ 2Ŧ ŭKŜ ŘI·ŭI· I·yŘ λyŭŜf I·yŘ ŭKŜ Ŧ2Ŏdză ŭKI·ŭ øŜ LJdzăK Ř2øy˘ŭ2 / / 5 / λă ōI·ăŜŘ 2y˘øKI·ŭ øŜΩØŜ ăŜŜy˘λy˘ŭKŜ ŃŜI·f ø2ŃfŘΣ 2Ń øKI·ŭ ă2YŜ 2Ŧ 2dzŃ I·ŘØλă2Ńă I·ŃŜ ōŃλyƎλyƎ ŭ2 dză I·ă ćKŜèΣ è2dzΩff yŜØŜŃ ōŜfλŜØŜ øKI·ŭ L ăI·ø I·ŭ ŭKλă ăYI·ff ōdzăλyŜăăε λŘŜI·ăΦ I ŜŃŜ øI·ă ŭKŜ LJŃ2ōfŜY˘ ŭKI·ŭ ŭKŜè ŜyŎ2dzyŭŜŃŜŘ I·ŭ ŭKI·ŭ ăYI·ff ōdzăλyŜăăΦ I ŜŃŜΩă I· ŭI·ăţ ŭKI·ŭ øŜ KI·Ř ŭ2 KŜfLJ ŭKŜY˘ Ŏ2Y˘LJfŜŭŜΦ

Ryan: {2 λă ŭKI·ŭ øKI·ŭ è2dz ŘŃI·ø ŦŃ2Y˘ Ŧ2Ń ŎŃŜI·ŭλyƎ è2dzŃ λy?ŜŎŭăK Lă ŭKI·ŭ ŭKŜ Y˘I·ŭŜŃλI·f è2dz ŘŃI·ø ŦŃ2Y˘ λă è2dzŃ 2øy˘ŜÈLJŜŃλŜyŎŜăK

Dwayne: ¢KI·ŭΩă I· LJ2Ńŭλ2y˘2Ŧ λŭΣ èŜI·KΦ L ø2dzfŘ ăI·è λy˘f22ţλyƎ I·ŭ øKŜŃŜ øŜ ƎŜŭ ŭKŜ ă2dzŃŎŜă ŦŃ2Y˘ λy?ŜŎŭăΣ Y˘2ăŭ ŜØŜŃè λy?ŜŎŭ øŜ KI·ØŜ Ř2yŜ I·ŭ ŭKŜ yI·ŭλ2yI·f fŜØŜf λă ōI·ăŜŘ 2y˘I· ŃŜI·f ŭI·ăţΦ {2Y˘ŜŭKλyƎ ŭKI·ŭ LΩØŜ KI·Ř ŭ2 Ř2Σ 2yŜ 2Ŧ Y˘è Ŏ2ffŜI·ƎdzŜă KI·ă KI·Ř ŭ2 Ř2Σ 2Ń ă2Y˘ŜŭKλyƎ 2yŜ 2Ŧ 2dzŃ I·ŘØλă2Ńă KI·ă KI·Ř ŭ2 Ř2 2Ń KI·ă ăŜŜy˘Ř2yŜ I·ŭ I· ăYI·ff ōdzăλyŜăă ă2YŜøKŜŃŜΦ ¢KŜ ŭI·ăţă ŭKI·ŭ øŜ λăădzŜΣ 2ŦŭŜyŭλY˘Ŝă è2dz KI·ØŜ ŭ2 ŭøŜI·ţ ŭKŜY˘ I· fλŭŭfŜ ōλŭ ŭ2 Ŧλŭλyŭ2 ŭKŜ ŜyØλŃ2yY˘Ŝyŭ ōdzŭ ŭKŜè I·ŃŜ ŃŜI·f ø2ŃfŘΦ LŦ è2dz I·ŃŜ I·y˘L¢ LJŃ2ŦŜăăλ2yI·fΣ è2dz Y˘I·è ōŜ I·ăţŜŘ ŭ2 øŃλŭŜ ŭKI·ŭ LJ2fλŎè 2y˘Y˘2ōλfŜ ŘŜØλŎŜă øλŭKλy˘è2dzŃ 2ŃƎ I·yλÎ I·ŭλ2yΣ è2dz Y˘I·è ōŜ I·ăţŜŘ ŭ2 ŃŜØλŜø ŜÈλăŭλyƎ LJ2fλŎλŜăΣ è2dz Y˘I·è ōŜ I·ăţŜŘ ŭ2 KŜfLJ ăŜŭ dzLJ I· yŜø ±t b ŭKI·ŭΩă Ǝ2ŭ ŭ2 ōŜ Ř2yŜ λy˘ŭKŜ yŜÈŭ Ŏ2dzLJfŜ 2Ŧ K2dzŃă ōŜŎI·dzăŜ è2dz KI·ØŜ I· yŜø LJŃ2?ŜŎŭ Ŏ2Yλy Ǝ 2yfλyŜΦ ¸2dz Y˘I·è ōŜ I·ăţŜŘ ŭ2 LJŃ2ØλŘŜ I·y˘I·yI·fèăλă 2Ŧ ŭKŜ Ńλăţă 2Ŧ ōŃλyƎλyƎ ŭKλă LJŃ2?ŜŎŭ 2y˘λy˘ŭKλă ŎdzŃŃŜyŭ Ŏ2yŦλƎdzŃI·ŭλ2y˘øKŜy˘è2dz KI·ØŜyΩŭ Ř2yŜ ŭKλă ăŭŜLJ 2Ń ŭKŜăŜ ăŭŜLJăΦ ¢KŜăŜ I·ŃŜ I·ff I·ōă2fdzŭŜfè ŭI·ăţă ŭKI·ŭ L KI·ØŜ ăŜŜy˘Ř2yŜ 2Ń I·ŭ fŜI·ăŭ I· LJŜŃY˘dzŭI·ŭλ2y˘2Ŧ λŭ Ř2yŜ λy˘ŭKŜ ŃŜI·f ø2ŃfŘΦ ² Ŝ

øλff 2Ŧűŝy˘ŏKl·y∃ŝ űKŝ űl·ă] ăfλ∃Kűfè ű2 Y˘l·]ŝ ădzŃŝ λűΩă y˘2ű Ńŝl·ffè 2ōØλ2dză

øKŝŃŝ λű ŏl·Y˘ŝ ŦŃ2Y˘Σ øŝ yŝØŝŃ dzăŝ Ńŝl·f ŏ2Y˘LJl·yè yl·Y˘ŝă 2Ń l·yèűKλy∃ fλ]ŝ

űKl·ű! ōă2fdzűŝfèΣ űKl·ű λă ă2Y˘ŝűKλy∃ űKl·ű L űKλy˘] Y˘l·]ŝă l· ∃22Ř λy?ŝŏű λă

ă2Y˘ŝűKλy∃ űKl·ű λă l· Ńŝl·fλăűλŏ űl·ă] π 2yŝ űKl·ű è2dz ŏ2dzfŘ fŝ∃λűλY˘l·űŝfè ōŝ

l·ă]ŝŘ ű2 Ř2 yŝÈű èŝl·Ń λy˘è2dzŃ ŏl·Ńŝŝ Ń λŦ è2dz ∃Ńl·Řdzl·űŝ 2Ń l· Ŧŝø èŝl·Ńă Ř2øy˘

űKŝ Ń2l·Ř λy˘è2dzŃ λyŦ2ŃY˘l·űλ2y˘ăŝŏdzŃλűè ŏl·Ńŝŝ Ńφ

Ryan: ² Kl·ű ŝfăŝ Ř2 è2dz űKλy˘] Y˘l·]ŝă l· ∃22Ř λy?ŝŏűK ² Kl·ű l·Ńŝ è2dzŃ ∃dzλŘŝfλyŝă Ŧ2Ń Y˘l·]λy∃ l· ∃22Ř λy?ŝŏűK

Dwayne: ¢Kŝ ŦλŃăű űKλy∃ øŝ f22] l·ű λă ŏl·y˘øŝ ŦλyŘ ă2Y˘ŝűKλy∃ űKl·ű λă ōl·ăŝŘ 2y˘l· Ńŝl·f ű]·ă]φ LŦ λű λă ă2Y˘ŝűKλy∃ űKl·ű ŝÈλăűă λy˘űKŝ Ńŝl·f ø2ŃfŘΣ l·yŘ è2dz Y˘λ∃Kű fŝ∃λűλY˘l·űŝfè ōŝ l·ă]ŝŘ ű2 Ř2 λű űKŝŃŝ l·Ńŝ l· Ŧŝø ŘŝŦλyλűŝ ōŝyŝŦλűă ű2 űKl·ű φ hyŝ λă űKl·ű è2dz l·Ńŝ Ńŝλy˘Ŧ2Ńŏλy∃ 2Ń űŝl·ŏKλy∃ l· yŝø ă]λff űKl·ű ŏl·y˘ōŝ dzăŝŦdzf fl·űŝŃ 2y˘Ř2øy˘űKŝ LJλLJŝ Ŧ2Ń ă2Y˘ŝō2Řè λy˘űKŝλŃ ŏl·Ńŝŝ Ńφ ¢Kŝ 2űKŝŃ űKλy∃ űKl·ûΩă yλŏŝ l·ō2dzű Ř2λy∃ Ńŝl·fλăűλŏ űl·ă]ă λă è2dz l·Ńŝ Y˘2Ńŝ fλ]ŝfè ű2 ŦλyŘ Kŝf˙LJ 2yfλyŝ l·ō2dzű λűφ ¸2dz ŏl·y˘Kλű D222∃fŝ l·yŘ ăl·è ćKŝèΣ øKl·ű l·Ńŝ ă2Y˘ŝ ăl·Y˘LJfŝ LJ2fλŏλŝă űKl·ű ŝÈλăűΣ øKl·ű l·Ńŝ űKŝ l·Ŏűdzl·f ăűŝLJă L ø2dzfŘ yŝŝŘ ű2 ∃2 űKŃ2dz∃K ű2 ăŝű dzLJ űKλă ±tb øλűK űKλă ŝÈűŝŃyl·f ŏfλŝyűΣ øKl·ű l·Ńŝ űKŝ Ńλă]ă l·ăă2ŏλl·ûŝŘ øλűK űKλă LJl·ŃλŏdzfŃ ă2Ŧűøl·Ńŝ LJl·ŏ]l·∃ŝΣ 2Ń K2ø Ř2 L Ř2 l·y˘l·ăăŝăăY˘ŝyű l·yŘ øKl·ű l·Ńŝ űKŝ ű2LJ ûŝy˘Ńλă]ă ŦŃ2Y˘ h ² !{tέφ !ff 2Ŧ űK2ăŝ ûKλy∃ă ∃2 λyű2 λű øKŝy˘øŝ f22] l·ű λűφ Lă λű Ńŝl·f ø2ŃfŘK Lă λű ŏl·ăŝŘ 2y˘l· Ńŝl·f ûl·ă]K Lă λű ă2Y˘ŝűKλy∃ űKl·ű ûKŝ ăûdzŘŝyűă λŦ ûKŝè Ř2yΩû]y˘2ø l·yèûKλy∃ l·ō2dzű λű ø2dzfŘ

ŭKŜè ŦλyŘ dzăŜŦdzf LJ2λyŭă 2Ŧ ōI·Ŏ]ƎŃ2dzyŘ λyŦ2ŃYˇI·ŭλ2yˇŭ2 KŜfLJ ŭKŜYˇ Ŏ2YˇLJfŜŭŜ ŭKI·ŭ ŭI·ă]K

¢KŜ 2ŭKŜŃ LJI·ŃŭŭI·ō2dzŭ λŭ λă Ř2Ŝă λŭ KI·ØŜ I·yè ŜŘdzŎI·ŭλ2yI·f ØI·fdzŜΦ Lă λŭ Ǝ2λyƎ ŭ2 ŭŜI·ŎK ŭKŜYˇ I· yŜø ă]λffK 52Ŝă λŭ ŜÈLJ2ăŜ ŭKŜYˇ ŭ2 ă2YˇŜŭKλyƎ ŭKŜè ø2dzfŘ yŜŜŘ ŭ2]y2ø λyˇŭKŜλŃ LJŜŃăLJŜŎŭλØŜ ŎI·ŃŜŜŃK 52Ŝă λŭ ŃŜλyŦ2ŃŎŜ ă2YˇŜŭKλyƎ ŭKŜè KI·ØŜ I·fŃŜI·Řè fŜI·ŃyŜŘ 2Ń ŭ2dzŎKŜŘ 2Ń LJfI·èŜŘ øλŭK λyˇŭKŜλŃ I·ŎI·ŘŜYˇλŎ ŎI·ŃŜŜŃK {2 ŭKŜŃŜ yŜŜŘă ŭ2 ōŜ ă2YˇŜ ŜŘdzŎI·ŭλ2yI·f ØI·fdzŜΦ ! f2ŭ 2Ŧ ŭKI·ŭ KI·ă ŭ2 ōŜ ŦλfŭŜŃŜŘ ŭKŃ2dzƎK ŭKŜ Ŏ2yŎŜLJŭ 2Ŧ ŎI·yˇè2dz ?dzăŭ dzăŜ ŭKI·ŭ λyˇŭKŜ Ŏ2YˇLJ2ăλŭλ2yˇLJŜŃλ2ŘK ¢KŜŃŜ I·ŃŜ 2ōØλ2dzăfè ă2YˇŜ λy?ŜŎŭă ŭKI·ŭ è2dz I·ŃŜ ?dzăŭ yŜØŜŃ Ǝ2λyƎ ŭ2 ōŜ I·ōfŜ ŭ2 Ř2Φ 9λŭKŜŃ ŭKŜè ŭI·]Ŝ ŭ22 f2yƎΣ ŭKŜŃŜΩă ŭ22 YˇdzŎK ŜIjdzλLJYˇŜyŭ λyØ2fØŜŘΣ 2Ń ŭKŜŃŜΩă y2 øI·è è2dz ŎI·yˇŎ2YˇLJŃŜăă λŭ λyŭ2 ŭKŜ ŭλYˇŜ ŦŃI·YˇŜΦ

¸2dz KI·ØŜ ŭ2 f22] I·ŭ ă2YˇŜŭKλyƎ I·yŘ ăI·è λă ŭKλă I· ŭI·ă] L ŎI·yˇ ŃŜI·ă2yI·ōfè ŜÈLJŜŎŭ ŭKŜ ŭŜI·Yˇ ŭ2 Ř2K ¸2dz KI·ØŜ ŭ2 ōŜ I·ōfŜ ŭ2 fλYˇλŭ ŭKŜ ŭλYˇŜ λyˇøKλŎK ŭKŜŃŜ λă Ŏ2YˇLJfŜŭλ2yˇ2Ŧ ŭKŜ ŭI·ă]Φ Lă λŭ ă2YˇŜŭKλyƎ ŭKI·ŭ ŎI·yˇōŜ Ř2yŜ λyˇŭKŜ мсЬ K2dzŃă ŭKI·ŭ øŜ I·ŃŜ Ǝ2λyƎ ŭ2 ōŜ Ńdzyˇyˇλy Ǝ ŭKλă Ŏ2YˇLJŜŭλŭλ2yˇK Lă λŭ ă2YˇŜŭKλyƎ L ŎI·yˇƎŜŭ Ř2yŜ λyˇŭø2 2Ń Ŧ2dzŃ 2Ń ŜλƎKŭ K2dzŃăK ¢KŜŃŜ KI·ă Ǝ2ŭ ŭ2 ōŜ I· ŭλYˇŜŦŃI·YˇŜ I·yŘ I· ŃŜI·ă2yI·ōfŜ ŜÈLJŜŎŭI·ŭλ2yˇŦ2Ń ădzŎŎŜăă ă2 ŭKI·ŭ ŭKŜ ăŭdzŘŜyŭă øλff ōŜ I·ōfŜ ŭ2 ƎŜŭ ŭKŃ2dzƎK λŭΦ

¸2dz KI·ØŜ ŭ2 ōŜ I·ōfŜ ŭ2 Ŝăŭ I·ōfλăK ăŎ2ŃλyƎ ŎŃλŭŜŃλI· I·yŘ LJ2λyŭ ØI·fdzŜă Ŧ2Ń ŭKI·ŭ λy?ŜŎŭΦ ² KI·ŭ Ř2Ŝă ădzŎŎŜăăŦdzf Ŏ2YˇLJfŜŭλ2yˇ2Ŧ ŭKI·ŭ λy?ŜŎŭ f22] fλ]ŜK Lă λŭ I· ŃŜLJ2ŃŭΣ λă λŭ I· ŭI·ă]K Lă λŭ ă2YˇŜŭKλyƎ L ŎI·yˇŎKŜŎ] øλŭK I· ōŃ2øăŜŃK ² KI·ŭ

I·NJŜ ŭKŜ ăŎ2NJλy∃ ŎNJλŭŜNJλI· ŭKI·ŭ L f22ʼ] I·ŭK ² KI·ŭ ø2dzfŘ L ŜÈLJŜŎŭ ŭ2 ăŜŜ λy˜I·
LJŜNJŦŜŎŭ NJŜăLJ2yãŜ ŭ2 ŭKI·ŭ λy?ŜŎŭK ! y˜λy?ŜŎŭ Y˜I·è ōŜ ∃NJŜI·ŭΣ ōdzŭ λŦ L ŎI·yŭ
Ŧλ∃dzNJŜ 2dzŭ K2ø ŭ2 ∃NJI·ŘŜ λŭ I·yŘ ăŎ2NJŜ λŭΣ ŭKŜy˜λŭ λă 2Ŧ y2 dzăŜ ŭ2 è2dz ŦNJ2Y˜ I·
Ŏ2Y˜LJŜŭλŭλ2y˜LJŜNJăLJŜŎŭλØŜφ

! y2ŭKŜNJ ŭKλy∃ øŜ f22ʼ] I·ŭΣ λă λŭ ∃2λy∃ ŭ2 ōŜ ŎKI·ffŜy∃λy∃ ŭ2 ŭKŜ
ăŭdzŘŜyŭăΣ ōdzŭ ăŭλff LJ2ăăλōfŜ Ŧ2NJ ŭKŜY˜ ŭ2 I·ŎKλŜØŜ λŭφ {2Y˜Ŝ 2Ŧ ŭKŜ λy?ŜŎŭă øŜ
KI·ØŜ Ř2yŜ I·NJŜ ØŜNJè ŘλŦŦλŎdzfŭΣ ŎŜNJŭI·λyfè λy˜ŭKŜ ŭλY˜Ŝ ŦNJI·Y˜Ŝ ŭKI·ŭ øŜ KI·ØŜ I·yŘ
∃λØŜy˜I·ff 2Ŧ ŭKŜ 2ŭKŜNJ ŭKλy∃ă ăŭdzŘŜyŭă I·NJŜ ŜÈLJŜŎŭŜŘ ŭ2 Ř2φ LŦ è2dz ŭ22ʼ] ŜI·ŎK
2Ŧ ŭKŜY˜ λyŘλØλŘdzI·ffèΣ I·ff 2Ŧ ŭKŜY˜ KI·ØŜ I· ă2fdzŭλ2yφ {2Y˜Ŝ KI·ØŜ NJŜI·ffè
2ōØλ2dză ă2fdzŭλ2yã ŭKI·ŭ λŦ ăŭdzŘŜyŭă ŭ22ʼ] I· fλŭŭfŜ ōλŭ 2Ŧ ŭλY˜Ŝ ŭKŜè ø2dzfŘ ŦλyŘ
λŭφ Ly˜ă2Y˜Ŝ ŎI·ăŜă ŭK2ăŜ ŎKI·ffŜy∃Ŝă I·NJŜ I· fλŭŭfŜ ōλŭ KI·NJŘŜNJ I·yŘ è2dz Y˜I·è KI·ØŜ
ŭ2 Ŏ2Y˜Ŝ dzLJ øλŭK ă2Y˜ŜŭKλy∃ Ŏ2Y˜LJfŜŭŜfè ōNJI·yŘ yŜøφ 9ØŜNJè λy?ŜŎŭ ăK2dzfŘ ōŜ
LJ2ăăλōfŜ ŭ2 I·ŎKλŜØŜΣ ŎŜNJŭI·λyfè 2y˜λŭă 2øyφ ¸2dz ŎI·y˜KI·ØŜ I· NJŜI·ffè KI·NJŘ ŭλY˜Ŝ
Ř2λy∃ λŭ λy˜ŭKŜ ŭλY˜Ŝ ŦNJI·Y˜Ŝ øŜ KI·ØŜ ∃λØŜy˜ŭKŜY˜Σ ōdzŭ ŭKI·ŭ λă I· LJI·NJŭ 2Ŧ λŭ I·ŭ
bI·ŭλ2y1·făφ . ŜŎI·dzăŜ ŭKŜ NJŜ∃λ2y1·fă I·NJŜ ∃Ŝŭŭλy∃ ă2 Y˜dzŎK ōŜŭŭŜNJΣ øŜØŜ KI·Ř ŭ2
I·Y˜LJ dzLJ ō2ŭK ŭKŜ ŭI·ăʼ] ă I·yŘ ŭKŜ ø2NJʼ]f2I·Ř ŭKI·ŭ ŭKŜ ăŭdzŘŜyŭă I·NJŜ ŜÈLJŜŎŭŜŘ
ŭ2 Ř2 I·ŭ bI·ŭλ2y1·fă ōŜŎI·dzăŜ ŜØŜNJè2yŜ λă ∃Ŝŭŭλy∃ ōŜŭŭŜNJ I·ŭ ŭKλăφ ¢KŜ ŭŜI·Y˜ă
ŭKI·ŭ I·NJŜ Ŏ2Y˜λy∃ ŭKNJ2dz∃K y2øΣ è2dz Ŏ2dzfŘ ŭI·ʼ]Ŝ I·fY˜2ăŭ I·yè 2Ŧ ŭKŜ NJŜ∃λ2y1·f
øλyyŜNJă I·yŘ LJdzŭ ŭKŜY˜ dzLJ I·∃I·λyãŭ ŭKŜ y1·ŭλ2y1·f ŎKI·Y˜LJλ2yã ŦNJ2Y˜ ŭKŜ лрклс
ŜNJI·φ 9ØŜNJèŭKλy∃Σ λyŎfdzŘλy∃ ŭKŜ Ŏ2Y˜LJŜŭλŭλ2y˜λŭăŜfŦ λă ∃Ŝŭŭλy∃ ōŜŭŭŜNJφ

¢KŜ 2ŭKŜNJ ŭKλy∃ ŭ2 f22ʼ] I·ŭ λă ŭKŜ ŭ22fă I·yŘ ŜIjdzλLJY˜Ŝyŭ I·ØI·λfI·ōfŜ ŭ2
Ř2 ŭKI·ŭ λy?ŜŎŭ ō2ŭK λy˜ŭKŜ I·ØI·λfI·ōfŜ λyŦNJI·ăŭNJdzŎŭdzNJŜφ Lă λŭ ă2Y˜ŜŭKλy∃ ŭKŜè

ø2dztŘ ōŜ I·ōtŜ ű2 LJdztt Ř2øY 2yťłyŜ 2NJ I·NJŜ űKŜ ű22tă I·yŘ ŜIjdzłLJYŜyű I·ťNŜI·Řè űKŜNJŜ łYűKŜ ŜyØłNJ2yYŜyű I·yŘ I·ØI·łťI·ōtŜ Ť2NJ űKŜ ăűdzŘŜyűă ű2 ōŜ I·ōtŜ ű2 Ŏ2YLJťŜűŜ űKI·ű ły?ŜŎűφ

¢KŜ tI·ăű űKłyƎΣ L KI·ØŜ ű2 NJ2tt ōI·Ŏ] ű2 űKŜ ŜŘdzŎI·űł2yI·t ØI·tdzŜφ {2 I·ŤűŜNJ LØØŜ ŤłťűŜ NJŜŘ łű űKNJ2dzƎK I·tt űKłăΣ Ř2Ŝă łű ăűłtt KI·ØŜ ă2YŜ ŜŘdzŎI·űł2yI·t ØI·tdzŜ ű2 łű I·yŘ łă łű ø2NJűK Ř2łyƎ łYűKŜ Ŏ2YLJŜűłűł2yφ ¢KŜ yI·űł2yI·tă øłtt KI·ØŜ I·yèøKŜNJŜ ŤNJ2Y нр ű2 пл ły?ŜŎűă ŘŜLJŜyŘłyƎ 2yűKŜ èŜI·NJ I·yŘ űKŜ űI·ă]ă I·yŘ űKŜ űèLJŜă 2Ť ły?ŜŎűă øŜ dzăŜφ ² Ŝ YłƎKű Ǝ2 űKNJ2dzƎK мллπмрл Ŏ2yŎŜLJűă I·yŘ łŘŜI·ă Ť2NJ űKŜ ły?ŜŎűă I·yŘ űKNJ2ø ă2YŜ 2Ť űKŜY 2dzű 2NJ LJdzű űKŜY 2ŤŤ Ť2NJ Ťdzűdz NJŜ èŜI·Nă ōŜŎI·dzăŜ øŜ Ř2yQű KI·ØŜ űKŜ NJłƎKű ŜIjdzłLJYŜyű 2NJ øŜ Ř2yQű KI·ØŜ űKŜ NJłƎKű ōdzăłyŜăă ăŎŜyI·NJł2φ

¢KŜ tI·ăű űKłyƎ øŜ ű NJè ű2 Ř2 ű NJè ű2 øNJI·LJ dzLJ øłűK łă Ř2Ŝă űKłă ły?ŜŎű NJŜI·ťťè Ťłű űKŜ ōdzăłyŜăă ăŎŜyI·NJł2K C2NJ ŜÈI·YLJťŜΣ 2yŜ èŜI·NJ øŜ ŘłŘ I·yY 2yťłyŜ LJKI·NJYI·Ŏè ŎI·ťťŜŘ ćYøł]ŜLJłťťăε I·yŘ łű KI·Ř I· LJKèăłŎI·t ōNJłŎ]ă I·yŘ Y2NJűI·NJ LJNJŜăŜyŎŜΣ ōdzű łű KI·Ř I·Y 2yťłyŜ ăű2NJŜ I·ă øŜťťφ ² Ŝ I·NJŜ I·ōtŜ ű2 ōdzłťŘ łYűKłyƎă ťł]Ŝ I Lt ! ! Ŏ2yŎŜNJyã I·yŘ t22]łyƎ I·ű I·ăăŜăăYŜyűă 2Ť øKŜűKŜNJ 2NJ y2ű űKŜ Ŏ2YLJI·yè øI·ă ăI·ŤŜƎdzI·NJŘłyƎ űKŜ łyŤ2NJYI·űł2yφ LŤ űKŜNJŜ øI·ă I· ōNJŜŜŎK øK2 Ř2 űKŜè yŜŜŘ ű2 y2űłŤè I·yŘ øKŜyφ {2 è2dz ø2dztŘyQű yŜŎŜăăI·NJłťè Ř2 {I·NJōI·yŜăπ hÈťŜè łYűKŜ YłŘŘťŜ 2Ť I·Y 2yťłyŜ LJKI·NJYI·Ŏè ăŎŜyI·NJł2Σ ōdzű øŜ ű NJè ű2 LJłŎ] I·yŘ ŎK22ăŜ łŘŜI·ă űKI·ű Ťłűφ ¢KŜ ły?ŜŎűŜI·ťťè yŜŜŘă ű2 Ťłű łyű2 űKŜ ōdzăłyŜăă ăŎŜyI·NJł2 I·yŘ YI·]Ŝ ăŜyãŜ Ť2NJ űKŜ ōdzăłyŜăă è2dz KI·ØŜ ƎłØŜYűKŜ ăűdzŘŜyűă Ť2NJ űKI·ű LJI·NJűłŎdztI·NJ èŜI·NJφ

Ryan: 52 è2dz ŎNJŜI·űŜ I· LJ22f 2Ŧ λy?ŜŎűă I·yŘ űKŜy˘űKŜ ăŎŜy1·NJλ2K

Dwayne: b2Σ λűΩă űKŜ 2űKŜNJ ø I·è I·NJ2dzyŘΦ ² Ŝ dzădzI·ffè Ŏ2Y˘Ŝ dzLJ øλűK űKŜ ăŎŜy1·NJλ2 ŦλNJăűΦ ¢KŜ ăŎŜy1·NJλ2ă øŜ dzăŜ I·ű y1·űλ2y1·făΣ ∃ŜyŜNJI·ffè øŜ űKλy˘ 2Ŧ űKŜ ōNJ2I·Ř Ŏ2yŎŜLJűă űKŜ øŜŜ˘ I·ŦűŜNJ fI·ăű èŜI·NJΩă Ŏ2Y˘LJŜűλűλ2y˘2NJ λy˘űKŜ Y˘2yűK 2NJ ű ø2 Ŧ2ff2øλy∃Φ hyŎŜ øŜ KI·ØŜ I·y˘λŘŜI·Σ øŜ ăűI·NJű NJ2dz∃Kfè ŦNJI·Y˘λy∃ 2dzű űKŜ yŜűø2NJ˘ űKI·űΩă ∃2λy∃ ű2 ōŜ λyØ2fØŜŘ I·yŘ űèLJŜă 2Ŧ ăèăűŜY˘ă űKI·ű øŜ ø I·yű űKŜ ăűdzŘŜyűă ű2 ∃Ŝű I· ŎKI·yŎŜ ű2 LJfI·è øλűK I·yŘ øŜ ăűI·NJű ōdzλfŘλy∃ űKŜ λy?ŜŎűă I·NJ2dzyŘ λűΦ b2ø ă2Y˘Ŝ 2Ŧ űKŜ λy?ŜŎűă K2yŜăűfèΣ L ø2dzfŘyΩű ŎI·ff űKŜY˘ ∃ŜyŜNJλŎΣ ōdzű űKŜλNJ NJŜdzăI·ōfŜ y2 Y˘I·űűŜNJ øKI·ű űKŜ ăŎŜy1·NJλ2 λăΦ ² NJλűŜ Y˘Ŝ I· LJ2fλŎè ăűI·űŜY˘Ŝyű űKI·ű KI·ă ű2 ŘŜI·f øλűK Y˘2ōλfŜ ŘŜØλŎŜăΦ ¢KI·ű Ŏ2dzfŘ ōŜ dzăŜŘ λy˘ I·fY˘2ăű I·yè ōdzăλyŜăă ăŎŜy1·NJλ2Φ hy˘űKŜ 2űKŜNJ KI·yŘΣ I L t ! ! λy?ŜŎűăΣ øŜff è2dz ˘λyŘ 2Ŧ yŜŜŘ ă2Y˘ŜűKλy∃ űKI·ű λă ŜλűKŜNJ Y˘ŜŘλŎI·f NJŜfI·űŜŘ 2NJ KI·ă ű2 Ř2 øλűK Y˘ŜŘλŎI·f NJŜŎ2NJŘă 2NJ LJŜNJă2y1·f NJŜŎ2NJŘăΣ űKŜNJŜΩă ∃2ű ű2 ōŜ ă2Y˘ŜűKλy∃ űKI·ű űλŜă λű λy˘ű2 űKŜ ăŎŜy1·NJλ2 ű2 Y˘I·˘ŜŜ λű I·y˘ŜŦŦŜŎűλØŜ λy?ŜŎűΦ

Ryan: I I·ØŜ è2dz KI·Ř λăădzŜă øλűK NJŜ∃λ2y1·f Ŏ2Y˘LJŜűλűλ2yă ŎNJŜI·űλy∃ űKŜλNJ 2øy˘ λy?ŜŎűăK I I·ØŜ è2dz ăŜŜy˘LJNJ2ōfŜY˘ăΣ øKŜNJŜ űKŜè KI·ØŜyΩű ōŜŜy˘IjdzλűŜ dzLJ ű2 LJI·NJK

Dwayne: b2ű NJŜI·ffèΦ b2űKλy∃ űKI·ű ø2dzfŘ ōŜ I· ŎNJλűλŎI·f Y˘I·ăă λăădzŜ 2Ŧ ąhK a è D2ăK űKλă ?dzăű λăyΩű ø2NJ˘λy∃ 2dzűεΦ ¢KŜNJŜ I·NJŜ ă2Y˘Ŝ NJŜ∃λ2yă űKI·ű Ř2 I· ōŜűűŜNJ ?2ō øλűK űKŜλNJ λy?ŜŎűă űKI·y˘2űKŜNJăΣ űKŜèΩff LJdzű Y˘2NJŜ űK2dz∃Kű λyű2 λű π ŎŜNJűI·λyfè λy˘űŜNJY˘ă 2Ŧ űKŜ ∃NJI·ŘλY∃ ŎNJλűŜNJλI· I·yŘ űKŜ ăŎŜy1·NJλ2 űKI·ű ∃2Ŝă I·NJ2dzyŘ λűΦ hØŜNJI·ffΣ øŜ KI·ØŜ LJNJ2ØλŘŜŘ Ŝy2dz∃K ŜÈI·Y˘LJfŜă űKI·ű LJŜ2LJfŜ KI·ØŜ I· ∃22Ř

ōI·ăλă űƨ ŎKƨƨăŜ ₮₦ƨY I·yŘ űKŜèΩtf ăLJ₦λy˥tŜ ăƨYŜ ƨ₮ űKŜλ₦ ƨøy˙λy˙űKŜ₦Ŝ I·yŘ λűűdz₦yã ƨdzű ₮I·λ₦tè øŜftΦ L Řƨy₫ű űKλy˥ øŜ KI·ØŜ I·yè ₦ŜƎλƨyã űKI·ű I·₦Ŝ Řƨλy∃ LJƨƨ₦tèΣ űKŜ₦Ŝ I·₦Ŝ ŎŜ₦űI·λytè ăƨYŜ űKI·ű I·₦Ŝ ōŜűűŜ₦ űKI·y˙ƨűKŜ₦ă ōŜŎI·dzăŜ űKŜè KI·ØŜ Yƨ₦Ŝ ŜÈLJŜ₦λŜyŎŜ űKI·y˙ƨűKŜ₦ăΣ ōdzű L Řƨy₫ű űKλy˥ øŜ KI·ØŜ I·yèƨyŜ øKƨ λă ƨdzăűŘƨλy∃ I· Kƨ₦₦λōtŜ ƨƨō ƨ₮ λűΦ L űKλy˥ ŜØŜ₦èƨyŜ KI·ă I· ∃ƨƨŘ ăŜűƨ₮ λyƨŜŎűă I·yŘ űKŜè ₦ŜdzăŜ ŎŜ₦űI·λy˙ƨyŜă ŜØŜ₦è èŜI·₦ ōŜŎI·dzăŜ űKŜ₦Ŝ I·₦Ŝ ŎŜ₦űI·λy˙űKλy∃ă I·ă ₮I·₦ I·ă ŜŘdzŎI·ûλƨyI·t øI·tdzŜ ûKI·ű èƨdz øI·yűûƨăűŜăă I·∃I·λy˙I·yŘ I·∃I·λyΦ ¸ƨdz øI·yűûƨ Y˙I·˥Ŝ ădz₦Ŝ ûKI·ű yŜø ûŜI·Yă ûKI·ű Ŏ2YŜ ûK₦ƨdz∃K ∃Ŝűûk ŜăŜ LJƨλyűă ƨdzűƨ₮ ûKŜ Ŏ2YLJŜûλûλƨyT ûKŜ₦Ŝ λă ăƨYŜ ŜŘdzŎI·ûλƨy˙ûKI·ű ∃ƨŜă I·tƨy∃ øλûK ûKŜ Ŏ2YLJŜûλûλƨy˙I·ăLJŜŎûΦ

Ryan: 5ƨ èƨdz ăŜŜ I· yŜŜŘ ₮ƨ₦ Ŏ₦ŜI·ûλy∃ Ŏ₦λûŜ₦λI· ₮ƨ₦ Y˙I·˥λy∃ λyƨŜŎûăK

Dwayne: ! ōăƨtdzûŜtèΣ L øƨdztŘ ŎŜ₦ûI·λytè ăI·è I· Ŏ₦λûŜ₦λI· ăŜûΦ tŜ₦KI·LJă yƨûI· ăûI·ûλŎ èƨdz Ydzăû ₮ƨttƨø ·Σ ¸Σ ½Σ ōdzû ŎŜ₦ûI·λytè I· ∃dzλŘI·yŎŜ ƨy˙Kƨø ûƨ Ŏ₦ŜI·ûŜ ŘŜŎŜyû λyƨŜŎûăΦ LŦ èƨdz I·₦Ŝ tƨƨ˥λy∃ ûƨ Ŏ₦ŜI·ûŜ yŜø λyƨŜŎûăΣ Ŏƨyãλ₦Ŝ₦ ûKλăΣ KŜ₦Ŝ₫ă I· ∃ƨƨŘ LJKλtƨăƨLJKèΣ KŜ₦Ŝ₫ă I·y˙I·LJLJ₦ƨI·ŎK ûKI·ű øƨ₦˥ăΣ KŜ₦Ŝ₫ă ûKŜ I·LJLJ₦ƨI·ŎK ûKI·ûΩă ōŜλy∃ dzăŜŘ ădzŎŎŜăăŦdztftè λy˙Ydztûλ˥tŜ LJtI·ŎŜă LJI·₦ûλŎdztI·₦tè λy˙ûKŜ ₦ŜƎλƨyã ûKI·ű Yƨ₫ŜŜ ς ûKI·ű ûèLJŜ ƨ₮ ∃dzλŘI·yŎŜΦ ¢KŜ₦Ŝ I·₦Ŝ ăƨYŜ ₦ŜƎλƨyã ûKI·ű Yλ∃₦I·ûŜ ûƨ yŜø ăλûŜăΣ yƨû ŜØŜ₦è èŜI·₦ ōdzû YI·èōŜ ŜØŜ₦è ƨûKŜ₦ èŜI·₦ ûƨ yŜø ăŎKƨƨtăΣ yŜø λyăûλûdzûλƨyã I·yŘ ûKŜèΩtf ō₦λy∃ λy˙yŜø Ø2tdzyûŜŜ₦ă ûKI·ű Ŏ₦ŜI·ûŜ λyƨŜŎûăΦ LûΩă I·tøI·èă ∃ƨƨŘ ûƨ ₦ŜYλyŘ LJŜƨLJtŜ ûKI·ű KI·ØŜ ōŜŜy˙Řƨλy∃ λû I· øKλtŜ ƨ₮ Kƨø λû ăKƨdztŘ ōŜ Řƨy₫ŜŜ ăƨ ûKI·ű øŜ Řƨy₫ű ∃Ŝû tI·Îè Φ LûΩă I·tăƨ I· ∃ƨƨŘ ₦Ŝăƨdz₦ŎŜ ûƨ KI·ØŜ ₮ƨ₦ LJŜƨLJtŜ øKƨ I·₦Ŝ Ŏƨ₫λy∃ λyûƨ ûKŜ LJ₦ƨ∃₦I·Y ₮₦ƨY ûKŜ αLΩØŜ ōŜŜy˙I·

Ŏƨⅰ·ŎKΣ LΩØŜ ōŜŜƴⅰ· Ŏƨ⅄LJŜűλűƨ₦Σ ōdzű ƴƨø LΩ⅄ KŜfLJλƴƎ űƨ ₦dzƴⅰ· Ŏƨ⅄LJŜűλűƨƴƐ

LJŜ₦ăLJŜŎűλØŜΦ ¢Kⅰ·ű LJŜ₦ăƨƴ⅄ⅰ·è Kⅰ·ØŜ ăŜŜƴűKŜ λƴ?ŜŎűăΣ ōdzű Kⅰ·ă ƴŜØŜ₦ ōŜŜƴ

ƨƴűKŜ Ŏ₦Ŝⅰ·űλƨƴăλŘŜΦ LűΩă ⅰ· øKƨfŜ ŘλŦŦŜ₦ŜƴŜƴűŜ øƨ₦fŘ øKŜƴ⅄è⅄dz ⅰ·₦Ŝ Ŏ₦Ŝⅰ·űλƴƎΦ

¸ƨdz Kⅰ·ØŜ űƨ ƎƨKŰ₦ƨdzƎK ⅰ· fƨűƨŦ ŰKλƴƎă ⅰ·ƴŘ ŰKλƴ⅂ ⅰ·ōƨdzűƨ KƨØ è⅄dz LJfdzƎ λűƨ λƴ

ⅰ·ƴŘ KƨØ è⅄dz ƎλØŜ ŜØŜ₦èōƨŘè ⅰ· Ŧⅰ·λ₦ ăKƨűƨ ⅰ·ű Ŏƨ⅄LJfŜűλƨƴΦ {ƨΣ èŜⅰ·K L ØƨdzfŘ

ăⅰ·è ⅰ·ōăƨfdzűŜfè ⅰ· Ŏ₦λűŜ₦λⅰ· ăŜűƨØƨdzfŘ ōŜ ⅰ· ƎƨƨŘ ŰKλƴƎΦ

Ryan: ¢KŜ ØŜōăλűŜ ăⅰ·èă è⅄dz ⅰ·₦Ŝ ⅰ·făƨ ŰKŜ Řλ₦ŜŎűƨ₦ ƨŦ tⅰ·ƴƨLJfèK

Dwayne: ¸Ŝⅰ·KΣ tⅰ·ƴƨLJfèΦ LűΩă ⅰ· Ŏƨ⅄LJfŜűŜfè ŘλŦŦŜ₦ŜƴŜƴűŜ ⅰ·ƴλƴⅰ·fΦ LűΩă ƴƨ₦ŜŜ ƨŦ ⅰ· ƴλƴƎ ƨŦ

ŰKŜ ⅰλff ŜØŜƴűΦ ¢KŜ₦ŜŜ ⅰ·₦Ŝ ƴƨ λƴ?ŜŎűă λƴ⅂λűŰ ⅰ·ű ⅰ·ffΦ . ⅰ·ăλŎⅰ·ffèΣ øŜ ŰK₦ƨØ ⅰ· Ǝ₦ƨdzLJ

ƨŦ ØλŜ₦Űdzⅰ·f ƴⅰ·ŎKλƴŜă λƴ⅂ŰKŜ ƴλŘŘfŜΣ ⅰ·ƴèØKŜ₦ŜŜ Ŧ₦ƨƴ рлπсл Űⅰ·₦ƎŜŰă ⅰ·ƴŘ ŰKŜ

Ŏƨ⅄LJŜűλűƨ₦ăŰKⅰ·ű ⅰ·₦Ŝ LJfⅰ·èλƴƎ ⅰ·ű ŰKŜ ŰλƴŜ øλff Ǝƨ ⅰ·ŦŰŜ₦ŰKŜƴΦ ¢KŜ ŎKⅰ·ffŜƴƎŜ

λă űƨ ō₦Ŝⅰ·⅂ λƴűƨ øKⅰ·ŰŜØŜ₦ ₦Ŝăƨdz₦ŎŜ èƨdz øⅰ·ƴűΣ LJfⅰ·ƴŰ èƨdz₦ Ŧfⅰ·ƎΣ ⅂ŜŜLJ ŰKŜ

ăŜ₦ØλŎŜă ₦dzƴƴλƴƎ ŰKⅰ·ű ⅰ·₦Ŝ ƨƴŰKŜ₦Ŝ ⅰ·ƴŘ ŰKŜƴŘŜŦŜƴŘ λŰ Ŧ₦ƨƴ ŜØŜ₦èōƨŘè

ŜfăŜ Ű₦èλƴƎ űƨ ō₦Ŝⅰ·⅂ λƴΦ ² Kⅰ·ű èƨdz dzădzⅰ·ffè ăŜŜ λă ƨdzŰ ƨŦ ŰKŜ рл ƨ₦ ăƨ űⅰ·₦ƎŜŰă

ƴⅰ·èōŜ нƨ⅂ŰKⅰ·ű ⅰ·₦Ŝ ăƨŦŰ ⅰ·ƴŘ LJ₦ŜŰűè Ŝⅰ·ăè űƨ ƎŜŰ λƴűƨΦ ¸ƨdz ăŜŜ ⅰ· fƨűƨŦ

LJŜƨLJfŜ LJdzăKλƴƎ Ŝⅰ·ŎK ƨŰKŜ₦ ƨŦŦ ƨŦ ŰKƨăŜ ăèăŰŜƴă λƴ⅂ŰKŜ Ŧλ₦ăŰ Kƨdz₦ űƨ űøƨ

Kƨdz₦ă dzƴŰλf ăƨƴŜƨƴŜ Ŏⅰ·ƴ⅂ƎŜŰ λƴ⅂ljdzλŎ⅂ Ŝƴƨdz⅂K űƨ fƨŎ⅂ λŰ Řƨøƴ⅂ⅰ·ƴŘ ⅂ŜŜLJ

ŜØŜ₦èōƨŘè ŜfăŜ ƨdzŰΦ LűΩă ⅰ· LJŜ₦ƴdzŰⅰ·ŰλƨƴƨŦ èƨdz₦ Ű₦ⅰ·ŘλŰλƨƴ⅂ⅰ·f Ŏⅰ·LJŰdz₦Ŝ ŰKŜ

Ŧfⅰ·ƎΦ ¢KŜ ƨƴŜ ōλƎ ŘλŦŦŜ₦ŜƴŎŜ ŰKŜ₦Ŝ λăΣ èƨdz Řƨƴ₦Ű ƎŜŰ LJƨλƴŰă Ŧƨ₦ Ŏⅰ·LJŰdz₦λƴƎ

ŰKŜ ăèăŰŜƴΣ èƨdz ƎŜŰ LJƨλƴŰă Ŧƨ₦ ƴⅰ·λƴŰⅰ·λƴλƴƎ ŰKŜ ăèăŰŜƴ⅄ ⅰ·ƴŘ ⅂ŜŜLJλƴƎ

ŜØŜ₦èōƨŘè ŜfăŜ ƨdzŰ ƨŦ λŰ ⅰ·ŦŰŜ₦ èƨdzΩØŜ Ŏⅰ·LJŰdz₦ŜŘ λŰΦ

Ryan: ² Kⅰ·ű ŘλŘ ŰKŜ ŎŜƴŰŜ₦ ŘŜŎλŘŜ èƨdz ƴŜŜŘŜŘ űƨ ăŰⅰ·₦Ű ⅰ·ƴƨŰKŜ₦ Ŏƨ⅄LJŜűλűƨƴK

Dwayne: hNJλƎλyl·ffèΣ ōŜŎl·dzăŜ λŭ ø l·ă ăƧYŜŭKλyƎ ŭKl·ŭ ø l·ă ƨdzăŭ ƬƧNJ ƬdzyΦ //5/ λă YdzŎK YƧNJŜ ƧƬ l· LJNJƧƬŜăăλƧyl·ffè ƧNJλŜyŭŜŘ ŎƧYLJŜŭλŭλƧyΣ yƧŭ ŭKl·ŭ /¢CΩă l·NJŜ yƧŭ LJNJƧƬŜăăλƧyl·fΣ ōdzŭ //5/ ŭNJl·ŘλŭλƧyl·ffè øλff LJNJƧŘdzŎŜ ăƧYŜƧyŜ l·yŘ l·ŭŭNJl·Ŏŭ ăƧYŜƧyŜ λyŭŜNJŜăŭŜŘ λyl·yLbCh{9/ Ŏl·NJŜŜNJΦ ¢KŜè ŎƧdzfŘ ƎƧ ƧyŭƧ ōŜ l· LJŜyŭŜăŭŜNJΣ ƧNJ ƎƧ ƧyŭƧ l· ƎƧØŜNJyYŜyŭ ƨƧōΣ ƧNJ λyŘdzăŭNJè ƨƧō ƧNJ øKŜNJŜØŜNJΦ ! fƧŭ ƧƬ ŭKŜY l·NJŜ LJƧŭŜyŭλl·f /L{hΩă ƧNJ /LhΩă ƧNJ ŜØŜy /9hΩăΦ ! ff ƧƬ dzăλyŭKŜ LbCh{9/ ŎƧYYdzyλŭè fλ]Ŝ ŭƧ ŘƧ ƧŭKŜNJ ƬdzyăŭdzƬƬΦ Lŭ ø l·ă]λyŘ ƧƬ l· NJŜŎNJŜl·ŭλƧyl·f ŎƧyŭŜăŭ l·yŘ øŜ ŭKƧdzƎKŭ Ƨ]l·èΣ ŜØŜNJèōƧŘèΣ ƧNJ l·ŭ fŜl·ăŭ ŭKŜ LJŜƧLJfŜ øŜ øƧNJ] øλŭKΣ λƬ èƧdzΩØŜ ŘƧyŜ LJŜyŭŜăŭă l·yŘ èƧdzΩØŜ ŘƧyŜ l·ăăŜăăYŜyŭă l·yŘ èƧdzΩØŜ YλÈŜŘ λyŭKŜ ŘŜƬŜyăλØŜ ăλŘŜ ƧƬ λŭΣ ŭKŜNJŜ ăKƧdzfŘ ōŜ ăƧYŜ]λyŘ ƧƬ l· ŎNJŜl·ŭλØŜ ƨdzŭfŜŭ ŭƧ ƨdzăŭ ƎƧ LJfl·èΦ ¢Kl·ŭΩă NJŜl·ffè øKè øŜ ŘŜØŜf2LJŜŘ t l·yƧLJfèΦ LŭΩă NJŜl·ffè ōŜŜy l· fƧŭ YƧNJŜ LJƧLJdzfl·NJ ŭKl·yL ŭKƧdzƎKŭ λŭ øƧdzfŘ ōŜΦ ² Ŝ NJl·yλŭ l·ŭ .fl·Ŏ] l l·ŭ ŭKŜ fl·ăŭ ŭøƧ èŜl·NJăΣ l·yŘ øŜΩNJŜ ƎƧλyƎ ŭƧ NJdzyλŭ l·Ǝlλyŭ .fl·Ŏ] l l·ŭ l·Ǝl·λyŭKλă èŜl·NJΦ ² Ŝ ŭƧƧ] λŭ ŭƧ !dzăŭNJl·fλl·Σ øŜ Yl·è ŭl·]Ŝ λŭ ŭƧ bŜø ¸ƧNJ]Σ l·yŘ ŭKŜyøŜ NJdzyλŭ ŜØŜNJè hŎŭƧōŜNJ KŜNJŜ ƬƧNJ ŭKŜ fƧŎl·f ŎƧffŜƎŜă l·yŘ dzyλØŜNJăλŭλŜăΦ ¢KŜ fƧyƎπŭŜNJY ƎƧl·f λă ŭƧ]λŎ] ŭKl·ŭ Ƨdzŭ l·ă l·y ƧyfλyŜ ŎƧYLJŜŭλŭλƧyΣ KƧLJŜƬdzffè fl·ŭŜNJ ŭKλă ădzYYŜNJ λyŭƧ Ƭl·ff ăŜl·ăƧy l·yŘ]λyŘ ƧƬ ŘƧ λŭ ƧLJLJƧăλŭŜ ƧƬ ŭKŜ //5/ ăŜl·ăƧyΦ LŭΩă l· ăYl·ffŜNJ ŜØŜyŭ ς ŭŜl·Yă Ƨyfè Kl·ØŜ π YŜYōŜNJăΦ ¸ƧdzŎl·ydzăŜ l·yè LJdzōfλŎl·ffè l·Øl·λfl·ōfŜ ŭƧƧfΦ ¢KŜNJŜ l·NJŜ ŎKl·ffŜyƎŜă λyλŭΣ ōdzŭ ŭKŜè l·NJŜ yƧŭ λyƨŜŎŭăΦ Lŭ øƧdzfŘ ōŜ ăƧYŜŭKλyƎ fλ]ŜΣ λy ŭKλă ŜyØλNJƧyYŜyŭ ăƧYŜøKŜNJŜ λă {l·ffè WŜy]λyã ŎNJŜŘλŭ Ŏl·NJŘ yƨzYōŜNJΦ LƬ èƧdz ƬλyŘ λŭ l·yŘ ōNJλyƎ λŭ ŭƧ YŜΣ èƧdz ƎŜŭ pл LJƧλyŭăΦ Lŭ ø l·ă YŜl·yŭ ŭƧ ōŜ l· fλƎKŭ

ØŜλƎKűΣ fŜăă ăűNdzŎűdzNŜŘΣ ŜI·ăè Ŏ2ΥLJŜűλűλ2γ∓2NJ dză ű2 Ndzγ I·yŘ ∓2NJ dză ű2 ű I·ʅŜ ă2ΥŜØKŜNJŜ I·yŘ ƨdzăű LJN2ØλŘŜ ă2ΥŜ ŎKI·ftŜyƎŜă I·yŘ ŜyűŜNJűI·λyΥŜyű ØI·fdzŜΦ ¢KŜNJŜ λă ăűλff ă2ΥŜ ŜŘdzŎI·űλ2γØI·fdzŜ ű2 λűΣ ōdzű λű λă ΥŜI·yű ű2 ōŜ ŜI·ăλŜNJ ű2 Ndzγ I·yŘ Υ2NJŜ LJ2NJűI·ōfŜ űKI·γ / / 5 /

Ryan: L NJŜI·Ř űKŜ I·NJűλŎfŜ űKI·ű è2dz I·yŘ 5NJΦ ² KλűŜ ØNJ2űŜ I·ō2dzű ŎNJŜI·űλyƎ I· Ŏèō ŜNJ ăŜŎdzNJλűè ŎKI·ΥLJλ2yãKλLJ ŎdzLJΦ I2Ø λă űKI·ű Ǝ2λyƎK ! NJŜ è2dz ∓λyŘλyƎ LJŜ2LJfŜ ădzLJLJ2NJűλØŜ 2∓ λűΣ 2NJ K2Ø ∓I·NJ λă λűK L ʅy2Ø λű ăI·λŘ űKI·ű K2LJŜ∓dzffèΣ űKŜ ŎdzLJ Ø2dzfŘ KI·ØŜ ōŜŜγŜăűI·ōfλăKŜŘ ŜλűKŜNJ űKλă èŜI·NJ 2NJ fI·ăű èŜI·NJΦ

Dwayne: LűΩă Ǝ2λyƎ ØŜffΦ LűΩă LJN2ōI·ōfè ăf2ØŜŘ Ř2Øγ I· ōλű ōŜŎI·dzăŜ ØŜ KI·ØŜ ōŜŜγ KŜI·Øλfè λyØ2fØŜŘ λγ / èōŜNJt I·űNJλ2ű űKλă èŜI·NJΦ ¢KŜ / L ! { LJN2ØλŘŜŘ I·ff űKŜ űŜŎKy2f2Ǝè ∓2NJ / èōŜNJt I·űNJλ2űΦ ² Ŝ NJI·γ I·ff 2∓ űKŜλNJ 2yfλyŜ N2dzyŘă I·yŘ ØŜ ƨdzăű NJI·γűKŜλNJ ∓λyI·făΦ ¢KI·ű KI·ă ăf2ØŜŘ űKŜ ŎdzLJ ŘŜØŜf2LJΥŜyű Ř2Øγ I· fλűűfŜ ōλűΣ ōdzű λű λă ăűλff űKŜNJŜΦ ¢KŜ λyλűλI·f I·fƎ2NJλűKΥ λă űKŜNJŜΣ λűΩă ōŜŜγ2dzű ∓2NJ I· fλűűfŜ ØKλfŜ I·yŘ ØŜΩØŜ I·ăʅŜŘ LJŜ2LJfŜ ű2 Ŏ2ΥΥŜyű 2γλű I·yŘ ădzƎƎŜăű ŎKI·yƎŜă ű2 λűΦ ² ŜΩNJŜ λγűKŜ LJN2ŎŜăă y2Ø 2∓ f22ʅyƎ űKN2dzƎK űKŜ ăLJŜŎűNJdzΥ 2∓ ØKI·ű Ŏ2ΥLJŜűλűλ2yã I·NJŜ 2dzű űKŜNJŜ I·yŘ λyØλűλyƎ űKŜΥ ű2 ăŜyŘ űKŜλNJ NJŜădzfűă ű2 dzăΦ ¢KŜ dzfűλΥI·űŜ Ǝ2I·f λă ű2 y2ű ŎNJŜI·űŜ I·γb / ! ! ăűNJdzŎűdzNJŜ I·fűK2dzƎK I·ű ă2ΥŜ LJ2λyű ØŜ ΥI·è Ŏ2yãλŘŜNJ Ř2λyƎ űKI·ű LűΩă NJŜI·ffè ű2 LJN2ØλŘŜ I· NJŜŎ2Ǝyλűλ2γ ΥŜŎKI·yλăΥΣ ă2ΥŜűKλyƎ ű2 ŜyŎ2dzNJI·ƎŜ ăŎK22fă ű2 LJI·NJűλŎλLJI·űŜ λγI· f2ű 2∓ Ŏ2ΥLJŜűλűλ2yã I·yŘ ű2 Ř2 ØŜff λγűK2ăŜ Ŏ2ΥLJŜűλűλ2yãΦ hyŜ 2∓ űKŜ űKλyƎă ØŜ ljdzλŎʅfè ∓2dzyŘ I·ă ØŜ űI·fʅŜŘ ű2 ăűdzŘŜyűăΣ ćλ∓ è2dz Ř2 I· / / 5 / Ř2 è2dz Ř2 I·γèűKλyƎ ŜfăŜKć ! fΥ2ăű dzyλØŜNJăI·ffèΣ ăűdzŘŜyűă ăI·λŘΣ ćhK èŜI·KΣ L Ř2 űKλăΣ L Ř2

ŭKl·ŭ Ŏ2Y˜LJŜŭλŭλ2y£ L Ř2 ŭKλă 2yŜ 2ØŜ№ KŜ№Ŝ¢ {2£ øŜ ŭl·f˥ŜŘ ŭ2 5 l { l·ō2dzŭ λŭ

l·yŘ ŭKŜè ăl·λŘ èŜl·K ŭKl·ŭ ø2dzfŘ ōŜ l· ∃22Ř ŭKλy∃ ŭ2 ōdzλfŘ l·yŘ Ŝy˜Ŏ2dz№l·∃Ŝ

LJl·№ŭλŎλLJl·ŭλ2y£ y2ŭ ƨdzăŭ λy˜ / / 5 / ōdzŭ λy˜2ŭKŜ№ Ŏ2Y˜LJŜŭλŭλ2yã l·ă øŜffΦ b2ŭ ƨdzăŭ

λy˜2yŜă ŭKl·ŭ øŜ №dzy£ ōdzŭ ŭKŜ№Ŝ l·№Ŝ l· f2ŭ 2Ŧ ∃№Ŝl·ŭ Ŏ2Y˜LJŜŭλŭλ2yã 2dzŭ ŭKŜ№Ŝ

ō2ŭK l·ŭ f2Ŏl·f fŜØŜf l·yŘ l· №Ŝ∃λ2yl·f fŜØŜfΦ a l·èōŜ ŭKŜè l·№Ŝ y2ŭ ljdzλŭŜ yl·ŭλ2yl·f

èŜŭ£ ōdzŭ λŦ øŜ Ŏl·y˜KŜfLJ ŭKŜY˜ ∃Ŝŭ ă2Y˜Ŝ ŜÈLJ2ădz№Ŝ l·yŘ λyŭŜ№Ŝăŭ l·yŘ LJdzŭ l·

LJ№λÎŜ 2dzŭ ŭKŜ№Ŝ ŭKl·ŭ LJŜ2LJfŜ Ŏl·y˜∃l·λy˜ōè LJl·№ŭλŎλLJl·ŭλy∃ λy˜l· f2ŭ 2Ŧ ŭKŜăŜ

Ŏ2Y˜LJŜŭλŭλ2yã l·yŘ Ř2λy∃ øŜff Y˜l·èōŜ øŜ Ŏ2dzfŘ KŜfLJ ŭKŜY˜ ∃№2øΦ ² Ŝ Ŏ2dzfŘ

№ŜŎ2∃yλÎŜ 2yŜ LJl·№ŭλŎdzfl·№ ăŎK22f Ŧ2№ Kl·Øλy∃ l· ∃№Ŝl·ŭ LJŜ№Ŧ2№Y˜l·yŎŜ èŜl·№ l·yŘ

K2LJŜŦdzffè l·ŭŭ№l·Ŏŭ Y˜2№Ŝ Ŏ2Y˜LJŜŭλŭ2№ă ŭ2 l·ff ŭK2ăŜ Ŏ2Y˜LJŜŭλŭλ2yã ŭKl·ŭ l·№Ŝ

l·№2dzyŘ ŭKŜ Ŏ2dzyŭ№èΦ

Appendix B: PRCCDC Saturday Survey

PRCCDC Inject Survey (Saturday)

Informed Consent

This survey is to gain information about how you perceived the injects. This information from this survey will be used to support a thesis regarding what makes an effective inject. No identifying information will be collected for the survey. Participation is voluntary and will not affect your score in the competition. We appreciate your time in filling out this survey. It will take approximately 10 minutes to complete the survey. If you have any questions, please contact Ryan Beckstead at beckryan@niatec.isu.edu.

***Do you agree to take the survey?**

- ◯ Yes, I agree to take the survey
- ◯ No, I do not agree to take the survey

PRCCDC Inject Survey (Saturday)

PRCCDC Inject Survey

Please tell us how you feel about each inject by selecting a response for each question. Please check N/A if you did not work on this inject or do not remember it.

Inject #1 Data Class & Labeling

◯ N/A

How difficult was this inject?

Very Easy	Easy	Neither	Difficult	Very Difficult
◯	◯	◯	◯	◯

Do you think this inject simulated a real world work task for an IT professional?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Did this inject help you to learn about this type of task required while on the job?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Do you feel this inject was more technical or more policy?

Strictly Technical	More Technical	Neither	More Policy	Strictly Policy
◯	◯	◯	◯	◯

PRCCDC Inject Survey (Saturday)

PRCCDC Inject Survey

Please tell us how you feel about each inject by selecting a response for each question. Please check N/A if you did not work on this inject or do not remember it.

Inject #2 Warning Banners Implementation and Check

◯ N/A

How difficult was this inject?

Very Easy	Easy	Neither	Difficult	Very Difficult
◯	◯	◯	◯	◯

Do you think this inject simulated a real world work task for an IT professional?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Did this inject help you to learn about this type of task required while on the job?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Do you feel this inject was more technical or more policy?

Strictly Technical	More Technical	Neither	More Policy	Strictly Policy
◯	◯	◯	◯	◯

PRCCDC Inject Survey (Saturday)

PRCCDC Inject Survey

Please tell us how you feel about each inject by selecting a response for each question. Please check N/A if you did not work on this inject or do not remember it.

Inject #3 MVP Calls in Sick

◯ N/A

How difficult was this inject?

Very Easy	Easy	Neither	Difficult	Very Difficult
◯	◯	◯	◯	◯

Do you think this inject simulated a real world work task for an IT professional?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Did this inject help you to learn about this type of task required while on the job?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Do you feel this inject was more technical or more policy?

Strictly Technical	More Technical	Neither	More Policy	Strictly Policy
◯	◯	◯	◯	◯

PRCCDC Inject Survey (Saturday)

PRCCDC Inject Survey

Please tell us how you feel about each inject by selecting a response for each question. Please check N/A if you did not work on this inject or do not remember it.

Inject #4 Password Policy

◯ N/A

How difficult was this inject?

Very Easy	Easy	Neither	Difficult	Very Difficult
◯	◯	◯	◯	◯

Do you think this inject simulated a real world work task for an IT professional?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Did this inject help you to learn about this type of task required while on the job?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Do you feel this inject was more technical or more policy?

Strictly Technical	More Technical	Neither	More Policy	Strictly Policy
◯	◯	◯	◯	◯

PRCCDC Inject Survey (Saturday)

PRCCDC Inject Survey

Please tell us how you feel about each inject by selecting a response for each question. Please check N/A if you did not work on this inject or do not remember it.

Inject #5 MARC Reactor Update

◯ N/A

How difficult was this inject?

Very Easy	Easy	Neither	Difficult	Very Difficult
◯	◯	◯	◯	◯

Do you think this inject simulated a real world work task for an IT professional?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Did this inject help you to learn about this type of task required while on the job?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Do you feel this inject was more technical or more policy?

Strictly Technical	More Technical	Neither	More Policy	Strictly Policy
◯	◯	◯	◯	◯

PRCCDC Inject Survey (Saturday)

PRCCDC Inject Survey

Please tell us how you feel about each inject by selecting a response for each question. Please check N/A if you did not work on this inject or do not remember it.

Inject #6 Complete Network Map

◯ N/A

How difficult was this inject?

Very Easy	Easy	Neither	Difficult	Very Difficult
◯	◯	◯	◯	◯

Do you think this inject simulated a real world work task for an IT professional?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Did this inject help you to learn about this type of task required while on the job?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Do you feel this inject was more technical or more policy?

Strictly Technical	More Technical	Neither	More Policy	Strictly Policy
◯	◯	◯	◯	◯

PRCCDC Inject Survey (Saturday)

PRCCDC Inject Survey

Please tell us how you feel about each inject by selecting a response for each question. Please check N/A if you did not work on this inject or do not remember it.

Inject #7 Encrypted Blueprints

◯ N/A

How difficult was this inject?

Very Easy	Easy	Neither	Difficult	Very Difficult
◯	◯	◯	◯	◯

Do you think this inject simulated a real world work task for an IT professional?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Did this inject help you to learn about this type of task required while on the job?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Do you feel this inject was more technical or more policy?

Strictly Technical	More Technical	Neither	More Policy	Strictly Policy
◯	◯	◯	◯	◯

PRCCDC Inject Survey (Saturday)

PRCCDC Inject Survey

Please tell us how you feel about each inject by selecting a response for each question. Please check N/A if you did not work on this inject or do not remember it.

Inject #8 Whaling Response and Training

◯ N/A

How difficult was this inject?

Very Easy	Easy	Neither	Difficult	Very Difficult
◯	◯	◯	◯	◯

Do you think this inject simulated a real world work task for an IT professional?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Did this inject help you to learn about this type of task required while on the job?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Do you feel this inject was more technical or more policy?

Strictly Technical	More Technical	Neither	More Policy	Strictly Policy
◯	◯	◯	◯	◯

PRCCDC Inject Survey (Saturday)

PRCCDC Inject Survey

Please tell us how you feel about each inject by selecting a response for each question. Please check N/A if you did not work on this inject or do not remember it.

Inject #9 Disable USB on Computers

◯ N/A

How difficult was this inject?

Very Easy	Easy	Neither	Difficult	Very Difficult
◯	◯	◯	◯	◯

Do you think this inject simulated a real world work task for an IT professional?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Did this inject help you to learn about this type of task required while on the job?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Do you feel this inject was more technical or more policy?

Strictly Technical	More Technical	Neither	More Policy	Strictly Policy
◯	◯	◯	◯	◯

PRCCDC Inject Survey (Saturday)

PRCCDC Inject Survey

Please tell us how you feel about each inject by selecting a response for each question. Please check N/A if you did not work on this inject or do not remember it.

Inject #10 MARC Reactor Logs #1

◯ N/A

How difficult was this inject?

Very Easy	Easy	Neither	Difficult	Very Difficult
◯	◯	◯	◯	◯

Do you think this inject simulated a real world work task for an IT professional?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Did this inject help you to learn about this type of task required while on the job?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Do you feel this inject was more technical or more policy?

Strictly Technical	More Technical	Neither	More Policy	Strictly Policy
◯	◯	◯	◯	◯

PRCCDC Inject Survey (Saturday)

PRCCDC Inject Survey

Please tell us how you feel about each inject by selecting a response for each question. Please check N/A if you did not work on this inject or do not remember it.

Inject #11 Board of Directors - Presentation on BYOD

◯ N/A

How difficult was this inject?

Very Easy	Easy	Neither	Difficult	Very Difficult
◯	◯	◯	◯	◯

Do you think this inject simulated a real world work task for an IT professional?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Did this inject help you to learn about this type of task required while on the job?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Do you feel this inject was more technical or more policy?

Strictly Technical	More Technical	Neither	More Policy	Strictly Policy
◯	◯	◯	◯	◯

PRCCDC Inject Survey (Saturday)

PRCCDC Inject Survey

Please tell us how you feel about each inject by selecting a response for each question. Please check N/A if you did not work on this inject or do not remember it.

Inject #12 User verification over phone

◯ N/A

How difficult was this inject?

Very Easy	Easy	Neither	Difficult	Very Difficult
◯	◯	◯	◯	◯

Do you think this inject simulated a real world work task for an IT professional?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Did this inject help you to learn about this type of task required while on the job?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Do you feel this inject was more technical or more policy?

Strictly Technical	More Technical	Neither	More Policy	Strictly Policy
◯	◯	◯	◯	◯

PRCCDC Inject Survey (Saturday)

PRCCDC Inject Survey

Please tell us how you feel about each inject by selecting a response for each question. Please check N/A if you did not work on this inject or do not remember it.

Inject #13 Change Log #1

◯ N/A

How difficult was this inject?

Very Easy	Easy	Neither	Difficult	Very Difficult
◯	◯	◯	◯	◯

Do you think this inject simulated a real world work task for an IT professional?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Did this inject help you to learn about this type of task required while on the job?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Do you feel this inject was more technical or more policy?

Strictly Technical	More Technical	Neither	More Policy	Strictly Policy
◯	◯	◯	◯	◯

PRCCDC Inject Survey (Saturday)

PRCCDC Inject Survey

Please tell us how you feel about each inject by selecting a response for each question. Please check N/A if you did not work on this inject or do not remember it.

Inject #14 Call Log #1

◯ N/A

How difficult was this inject?

Very Easy	Easy	Neither	Difficult	Very Difficult
◯	◯	◯	◯	◯

Do you think this inject simulated a real world work task for an IT professional?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Did this inject help you to learn about this type of task required while on the job?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Do you feel this inject was more technical or more policy?

Strictly Technical	More Technical	Neither	More Policy	Strictly Policy
◯	◯	◯	◯	◯

PRCCDC Inject Survey (Saturday)

Demographics

What is your gender?

- ◯ Female
- ◯ Male

Which race/ethnicity best describes you? (Please choose only one.)

- ◯ American Indian or Alaskan Native
- ◯ Asian / Pacific Islander
- ◯ Black or African American
- ◯ Hispanic American
- ◯ White / Caucasian

What school are you attending?

What is your year in college?

- ◯ Freshman
- ◯ Sophomore
- ◯ Junior
- ◯ Senior
- ◯ Graduate
- ◯ Other

What is your GPA?

- ◯ 4.1 or above
- ◯ 3.6 - 4.0
- ◯ 3.1 - 3.5
- ◯ 2.6 - 3.0
- ◯ 2.1 - 2.5
- ◯ 2.0 or below

What is your major?

Appendix C: PRCCDC Sunday Survey

PRCCDC Inject Survey (Sunday)

Informed Consent

This survey is to gain information about how you perceived the injects. This information from this survey will be used to support a thesis regarding what makes an effective inject. No identifying information will be collected for the survey. Participation is voluntary and will not affect your score in the competition. We appreciate your time in filling out this survey. It will take approximately 10 minutes to complete the survey. If you have any questions, please contact Ryan Beckstead at beckryan@niatec.isu.edu.

***Do you agree to take the survey?**

- ◯ Yes, I agree to take the survey
- ◯ No, I do not agree to take the survey

PRCCDC Inject Survey (Sunday)

PRCCDC Inject Survey

Please tell us how you feel about each inject by selecting a response for each question. Please check N/A if you did not work on this inject or do not remember it.

Inject #15 Pros and cons of IM Service

◯ N/A

How difficult was this inject?

Very Easy	Easy	Neither	Difficult	Very Difficult
◯	◯	◯	◯	◯

Do you think this inject simulated a real world work task for an IT professional?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Did this inject help you to learn about this type of task required while on the job?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Do you feel this inject was more technical or more policy?

Strictly Technical	More Technical	Neither	More Policy	Strictly Policy
◯	◯	◯	◯	◯

PRCCDC Inject Survey (Sunday)

PRCCDC Inject Survey

Please tell us how you feel about each inject by selecting a response for each question. Please check N/A if you did not work on this inject or do not remember it.

Inject #16 Anonymous FTP Login

◯ N/A

How difficult was this inject?

Very Easy	Easy	Neither	Difficult	Very Difficult
◯	◯	◯	◯	◯

Do you think this inject simulated a real world work task for an IT professional?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Did this inject help you to learn about this type of task required while on the job?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Do you feel this inject was more technical or more policy?

Strictly Technical	More Technical	Neither	More Policy	Strictly Policy
◯	◯	◯	◯	◯

PRCCDC Inject Survey (Sunday)

PRCCDC Inject Survey

Please tell us how you feel about each inject by selecting a response for each question. Please check N/A if you did not work on this inject or do not remember it.

Inject #17 Set up instant messaging service

◯ N/A

How difficult was this inject?

Very Easy	Easy	Neither	Difficult	Very Difficult
◯	◯	◯	◯	◯

Do you think this inject simulated a real world work task for an IT professional?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Did this inject help you to learn about this type of task required while on the job?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Do you feel this inject was more technical or more policy?

Strictly Technical	More Technical	Neither	More Policy	Strictly Policy
◯	◯	◯	◯	◯

PRCCDC Inject Survey (Sunday)

PRCCDC Inject Survey

Please tell us how you feel about each inject by selecting a response for each question. Please check N/A if you did not work on this inject or do not remember it.

Inject #18 FISMA Compliance

◯ N/A

How difficult was this inject?

Very Easy	Easy	Neither	Difficult	Very Difficult
◯	◯	◯	◯	◯

Do you think this inject simulated a real world work task for an IT professional?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Did this inject help you to learn about this type of task required while on the job?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Do you feel this inject was more technical or more policy?

Strictly Technical	More Technical	Neither	More Policy	Strictly Policy
◯	◯	◯	◯	◯

PRCCDC Inject Survey (Sunday)

PRCCDC Inject Survey

Please tell us how you feel about each inject by selecting a response for each question. Please check N/A if you did not work on this inject or do not remember it.

Inject #19 Intrusion Detection

◯ N/A

How difficult was this inject?

Very Easy	Easy	Neither	Difficult	Very Difficult
◯	◯	◯	◯	◯

Do you think this inject simulated a real world work task for an IT professional?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Did this inject help you to learn about this type of task required while on the job?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Do you feel this inject was more technical or more policy?

Strictly Technical	More Technical	Neither	More Policy	Strictly Policy
◯	◯	◯	◯	◯

PRCCDC Inject Survey (Sunday)

PRCCDC Inject Survey

Please tell us how you feel about each inject by selecting a response for each question. Please check N/A if you did not work on this inject or do not remember it.

Inject #20 Recover Data

◯ N/A

How difficult was this inject?

Very Easy	Easy	Neither	Difficult	Very Difficult
◯	◯	◯	◯	◯

Do you think this inject simulated a real world work task for an IT professional?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Did this inject help you to learn about this type of task required while on the job?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Do you feel this inject was more technical or more policy?

Strictly Technical	More Technical	Neither	More Policy	Strictly Policy
◯	◯	◯	◯	◯

PRCCDC Inject Survey (Sunday)

PRCCDC Inject Survey

Please tell us how you feel about each inject by selecting a response for each question. Please check N/A if you did not work on this inject or do not remember it.

Inject #21 MARC Reactor Logs #2

◯ N/A

How difficult was this inject?

Very Easy	Easy	Neither	Difficult	Very Difficult
◯	◯	◯	◯	◯

Do you think this inject simulated a real world work task for an IT professional?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Did this inject help you to learn about this type of task required while on the job?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Do you feel this inject was more technical or more policy?

Strictly Technical	More Technical	Neither	More Policy	Strictly Policy
◯	◯	◯	◯	◯

PRCCDC Inject Survey (Sunday)

PRCCDC Inject Survey

Please tell us how you feel about each inject by selecting a response for each question. Please check N/A if you did not work on this inject or do not remember it.

Inject #22 Honey Pot

◯ N/A

How difficult was this inject?

Very Easy	Easy	Neither	Difficult	Very Difficult
◯	◯	◯	◯	◯

Do you think this inject simulated a real world work task for an IT professional?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Did this inject help you to learn about this type of task required while on the job?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Do you feel this inject was more technical or more policy?

Strictly Technical	More Technical	Neither	More Policy	Strictly Policy
◯	◯	◯	◯	◯

PRCCDC Inject Survey (Sunday)

PRCCDC Inject Survey

Please tell us how you feel about each inject by selecting a response for each question. Please check N/A if you did not work on this inject or do not remember it.

Inject #23 Configure Host ACL

◯ N/A

How difficult was this inject?

Very Easy	Easy	Neither	Difficult	Very Difficult
◯	◯	◯	◯	◯

Do you think this inject simulated a real world work task for an IT professional?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Did this inject help you to learn about this type of task required while on the job?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Do you feel this inject was more technical or more policy?

Strictly Technical	More Technical	Neither	More Policy	Strictly Policy
◯	◯	◯	◯	◯

PRCCDC Inject Survey (Sunday)

PRCCDC Inject Survey

Please tell us how you feel about each inject by selecting a response for each question. Please check N/A if you did not work on this inject or do not remember it.

Inject #24 Move SCADA server off domain

◯ N/A

How difficult was this inject?

Very Easy	Easy	Neither	Difficult	Very Difficult
◯	◯	◯	◯	◯

Do you think this inject simulated a real world work task for an IT professional?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Did this inject help you to learn about this type of task required while on the job?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Do you feel this inject was more technical or more policy?

Strictly Technical	More Technical	Neither	More Policy	Strictly Policy
◯	◯	◯	◯	◯

PRCCDC Inject Survey (Sunday)

PRCCDC Inject Survey

Please tell us how you feel about each inject by selecting a response for each question. Please check N/A if you did not work on this inject or do not remember it.

Inject #25 Asset List and Tech Replacement Plan

◯ N/A

How difficult was this inject?

Very Easy	Easy	Neither	Difficult	Very Difficult
◯	◯	◯	◯	◯

Do you think this inject simulated a real world work task for an IT professional?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Did this inject help you to learn about this type of task required while on the job?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Do you feel this inject was more technical or more policy?

Strictly Technical	More Technical	Neither	More Policy	Strictly Policy
◯	◯	◯	◯	◯

PRCCDC Inject Survey (Sunday)

PRCCDC Inject Survey

Please tell us how you feel about each inject by selecting a response for each question. Please check N/A if you did not work on this inject or do not remember it.

Inject #26 Risk Management

◯ N/A

How difficult was this inject?

Very Easy	Easy	Neither	Difficult	Very Difficult
◯	◯	◯	◯	◯

Do you think this inject simulated a real world work task for an IT professional?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Did this inject help you to learn about this type of task required while on the job?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Do you feel this inject was more technical or more policy?

Strictly Technical	More Technical	Neither	More Policy	Strictly Policy
◯	◯	◯	◯	◯

PRCCDC Inject Survey (Sunday)

PRCCDC Inject Survey

Please tell us how you feel about each inject by selecting a response for each question. Please check N/A if you did not work on this inject or do not remember it.

Inject #27 Change Log #2

◯ N/A

How difficult was this inject?

Very Easy	Easy	Neither	Difficult	Very Difficult
◯	◯	◯	◯	◯

Do you think this inject simulated a real world work task for an IT professional?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Did this inject help you to learn about this type of task required while on the job?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Do you feel this inject was more technical or more policy?

Strictly Technical	More Technical	Neither	More Policy	Strictly Policy
◯	◯	◯	◯	◯

PRCCDC Inject Survey (Sunday)

PRCCDC Inject Survey

Please tell us how you feel about each inject by selecting a response for each question. Please check N/A if you did not work on this inject or do not remember it.

Inject #28 Call Log #2

◯ N/A

How difficult was this inject?

Very Easy	Easy	Neither	Difficult	Very Difficult
◯	◯	◯	◯	◯

Do you think this inject simulated a real world work task for an IT professional?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Did this inject help you to learn about this type of task required while on the job?

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
◯	◯	◯	◯	◯

Do you feel this inject was more technical or more policy?

Strictly Technical	More Technical	Neither	More Policy	Strictly Policy
◯	◯	◯	◯	◯

PRCCDC Inject Survey (Sunday)

Inject Opinions

Did you feel like you had enough time to complete the injects in the time allotted?

Way too much time	Too much time	Just right	Too little time	Way too little time
○	○	○	○	○

How did you feel about the overall difficulty of the injects?

Too difficult	Difficult	Just right	Easy	Too easy
○	○	○	○	○

After this competition, do you feel more prepared to work in the IT field?

More prepared	A little more prepared	No effect
○	○	○

How well did your education prepare you for this competition?

Helped a lot	Helped a little	Didn't help at all
○	○	○

In your opinion, what makes an effective inject?

What was the most interesting inject from this competition?

PRCCDC Inject Survey (Sunday)

Demographics

Please answer the following questions the same as you answered them on Saturday.

What is your gender?

- ◯ Female
- ◯ Male

Which race/ethnicity best describes you? (Please choose only one.)

- ◯ American Indian or Alaskan Native
- ◯ Asian / Pacific Islander
- ◯ Black or African American
- ◯ Hispanic American
- ◯ White / Caucasian

What school are you attending?

What is your year in college?

- ◯ Freshman
- ◯ Sophomore
- ◯ Junior
- ◯ Senior
- ◯ Graduate
- ◯ Other

What is your GPA?

- ◯ 4.1 or above
- ◯ 3.6 - 4.0
- ◯ 3.1 - 3.5
- ◯ 2.6 - 3.0
- ◯ 2.1 - 2.5
- ◯ 2.0 or below

What is your major?

PRCCDC Inject Survey (Sunday)

Thank You

Thank you for your time.

Appendix D: Saturday Survey Data

RespondentID	Do you agree to take the survey?	Inject #1 Data Class & Labeling	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #2 Warning Banners Implementation and Check
	Response	Response					Response
3139948127	Yes, I agree to take the survey		Easy	Agree	Disagree	Strictly Policy	
3139745645	Yes, I agree to take the survey						
3139534736	Yes, I agree to take the survey						
3139190805	Yes, I agree to take the survey		Very Easy	Agree	Strongly Agree	Strictly Policy	N/A
3139189500	Yes, I agree to take the survey	N/A	Easy	Agree	Agree	More Policy	
3139186854	Yes, I agree to take the survey	N/A					N/A
3139186706	Yes, I agree to take the survey	N/A					
3139185397	Yes, I agree to take the survey						
3139184395	Yes, I agree to take the survey	N/A					N/A
3139184280	Yes, I agree to take the survey		Easy	Agree	Agree	Strictly Policy	N/A
3139184235	Yes, I agree to take the survey	N/A					N/A
3139183827	Yes, I agree to take the survey	N/A					N/A
3139183807	Yes, I agree to take the survey	N/A					N/A
3139183033	Yes, I agree to take the survey	N/A					N/A
3139181823	Yes, I agree to take the survey	N/A	Easy	Agree	Neither	More Policy	
3139180329	Yes, I agree to take the survey	N/A					N/A
3139179506	Yes, I agree to take the survey	N/A					N/A
3139177381	Yes, I agree to take the survey		Neither	Agree	Strongly Agree	Neither	
3139177337	Yes, I agree to take the survey	N/A					N/A
3139177052	Yes, I agree to take the survey	N/A					N/A
3139174350	Yes, I agree to take the survey						
3139173740	Yes, I agree to take the survey						
3139172984	Yes, I agree to take the survey		Easy	Agree	Agree	More Policy	
3139171540	Yes, I agree to take the survey		Very Easy	Agree	Agree	Strictly Policy	

RespondentID	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #3 MVP Calls in Sick	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?
					Response			
3139948127	Neither	Agree	Agree	More Technical	N/A			
3139745645								
3139534736								
3139190805						Difficult	Strongly Agree	Agree
3139189500	Easy	Agree	Agree	More Technical	N/A			
3139186854					N/A			
3139186706	Easy	Neither	Agree	More Policy	N/A			
3139185397								
3139184395					N/A			
3139184280						Very Difficult	Agree	Agree
3139184235					N/A			
3139183827						Very Easy	Strongly Disagree	Disagree
3139183807					N/A			
3139183033						Very Easy	Strongly Agree	Strongly Agree
3139181823	Easy	Agree	Agree	More Technical		Neither	Agree	Agree
3139180329						Neither	Agree	Agree
3139179506					N/A			
3139177381	Easy	Agree	Agree	More Technical		Very Easy	Agree	Agree
3139177337						Neither	Neither	Neither
3139177052					N/A			
3139174350								
3139173740								
3139172984	Easy	Agree	Agree	More Policy		Very Easy	Strongly Agree	Agree
3139171540	Easy	Agree	Agree	More Technical		Very Easy	Disagree	Neither

RespondentID	Do you feel this inject was more technical or more policy?	Inject #4 Password Policy	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #5 MARC Reactor Update	How difficult was this inject?
		Response					Response	
3139948127		N/A						Very Easy
3139745645								
3139534736								
3139190805	More Technical	N/A					N/A	
3139189500			Easy	Agree	Neither	More Technical	N/A	
3139186854		N/A					N/A	
3139186706			Easy	Agree	Agree	More Policy		Easy
3139185397								
3139184395		N/A					N/A	
3139184280	More Technical	N/A						Easy
3139184235		N/A					N/A	
3139183827	Neither	N/A					N/A	
3139183807		N/A					N/A	
3139183033	Neither		Very Easy	Strongly Agree	Strongly Agree	Neither	N/A	
3139181823	Neither		Easy	Agree	Agree	More Policy		Neither
3139180329	More Policy	N/A					N/A	
3139179506			Very Easy	Strongly Agree	Strongly Disagree	More Policy	N/A	
3139177381	More Policy		Neither	Agree	Agree	More Policy	N/A	
3139177337	Neither	N/A						Easy
3139177052		N/A					N/A	
3139174350								
3139173740								
3139172984	Neither		Very Easy	Strongly Agree	Agree	More Policy		Difficult
3139171540	Neither	N/A					N/A	

RespondentID	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #6 Complete Network Map	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?
				Response			
3139948127	Disagree	Agree	More Technical		Easy	Strongly Agree	Agree
3139745645							
3139534736							
3139190805				N/A			
3139189500				N/A			
3139186854				N/A			
3139186706	Strongly Agree	Agree	More Technical	N/A			
3139185397							
3139184395				N/A			
3139184280	Agree	Agree	More Technical		Easy	Agree	Agree
3139184235				N/A			
3139183827				N/A			
3139183807				N/A			
3139183033				N/A			
3139181823	Neither	Neither	Neither		Neither	Agree	Agree
3139180329				N/A			
3139179506					Easy	Strongly Agree	Strongly Disagree
3139177381							
3139177337	Agree	Strongly Disagree	Strictly Technical	N/A			
3139177052				N/A			
3139174350							
3139173740							
3139172984	Agree	Disagree	More Technical		Easy	Agree	Agree
3139171540					Neither	Agree	Agree

RespondentID	Do you feel this inject was more technical or more policy?	Inject #7 Encrypted Blueprints Response	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #8 Whaling Response and Training Response	How difficult was this inject?
3139948127	Strictly Technical		Difficult	Agree	Agree	Strictly Technical		Very Easy
3139745645								
3139534736								
3139190805		N/A						Easy
3139189500		N/A					N/A	
3139186854		N/A					N/A	
3139186706		N/A					N/A	
3139185397								
3139184395		N/A					N/A	
3139184280	Neither		Difficult	Agree	Agree	Strictly Technical		Easy
3139184235		N/A					N/A	
3139183827		N/A					N/A	
3139183807			Very Difficult	Agree	Agree	More Technical		Easy
3139183033		N/A					N/A	
3139181823	More Technical		Neither	Neither	Neither	Neither		Easy
3139180329			Difficult	Agree	Agree	More Technical		Difficult
3139179506	More Technical	N/A					N/A	
3139177381								
3139177337			Difficult	Agree	Disagree	Strictly Technical		Easy
3139177052		N/A					N/A	
3139174350								
3139173740								
3139172984	More Technical		Very Difficult	Agree	Agree	Strictly Technical		Easy
3139171540	More Policy	N/A						Easy

RespondentID	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #9 Disable USB on Computers	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?
				Response				
3139948127	Disagree	Agree	More Policy		Difficult	Agree	Agree	More Technical
3139745645								
3139534736								
3139190805	Agree	Agree	More Policy	N/A				
3139189500					Difficult	Neither	Agree	Strictly Technical
3139186854				N/A				
3139186706					Difficult	Agree	Agree	More Technical
3139185397								
3139184395				N/A				
3139184280	Agree	Agree	More Policy	N/A				
3139184235				N/A				
3139183827				N/A				
3139183807	Agree	Agree	More Technical	N/A				
3139183033				N/A				
3139181823	Agree	Agree	More Policy		Easy	Agree	Agree	More Technical
3139180329	Agree	Agree	More Policy		Easy	Agree	Agree	More Technical
3139179506					Very Easy	Strongly Agree	Neither	Strictly Technical
3139177381								
3139177337	Agree	Agree	More Policy		Very Easy	Strongly Agree	Strongly Agree	Strictly Technical
3139177052				N/A				
3139174350								
3139173740								
3139172984	Agree	Agree	Neither		Difficult	Agree	Agree	More Technical
3139171540	Agree	Agree	More Policy		Neither	Agree	Agree	Strictly Technical

RespondentID	Inject #10 MARC Reactor Logs #1	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #11 Board of Directors - Presentation on BYOD	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?
	Response					Response		
3139948127		Easy	Agree	Agree	More Technical	N/A		
3139745645								
3139534736								
3139190805	N/A						Neither	Strongly Agree
3139189500	N/A					N/A		
3139186854	N/A					N/A		
3139186706		Difficult	Agree	Strongly Agree	Strictly Technical	N/A		
3139185397								
3139184395		Easy	Neither	Agree	More Technical	N/A		
3139184280	N/A						Difficult	Agree
3139184235	N/A					N/A		
3139183827	N/A						Easy	Strongly Agree
3139183807	N/A					N/A		
3139183033	N/A					N/A		
3139181823		Easy	Agree	Agree	More Policy		Neither	Agree
3139180329	N/A						Difficult	Neither
3139179506	N/A					N/A	Very Easy	Agree
3139177381								
3139177337	N/A						Neither	Strongly Agree
3139177052	N/A					N/A		
3139174350								
3139173740								
3139172984		Easy	Agree	Agree	More Technical	N/A		
3139171540		Neither	Agree	Agree	More Policy		Difficult	Strongly Agree

RespondentID	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #12 User verification over phone	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #13 Change Log #1
			Response					Response
3139948127				Easy	Disagree	Neither	More Policy	
3139745645								
3139534736								
3139190805	Agree	Neither	N/A					N/A
3139189500			N/A					N/A
3139186854			N/A					
3139186706			N/A					
3139185397								
3139184395			N/A					
3139184280	Agree	Neither		Easy	Agree	Agree	Strictly Policy	
3139184235			N/A					N/A
3139183827	Agree	More Policy	N/A					N/A
3139183807			N/A					
3139183033				Very Easy	Strongly Agree	Strongly Agree	Strictly Policy	
3139181823	Agree	More Policy		Neither	Agree	Agree	More Policy	
3139180329	Agree	More Policy	N/A					N/A
3139179506	Disagree	More Technical	N/A					N/A
3139177381								
3139177337	Agree	Strictly Policy	N/A					N/A
3139177052				Neither	Agree	Agree	More Policy	N/A
3139174350								
3139173740								
3139172984			N/A					
3139171540	Disagree	More Policy		Easy	Strongly Agree	Neither	Strictly Policy	

RespondentID	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #14 Call Log #1 Response	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?
3139948127	Difficult	Strongly Agree	Neither	More Technical		Easy	Disagree	Disagree
3139745645								
3139534736								
3139190805	Easy	Agree	Neither	Strictly Policy		Easy	Disagree	Neither
3139189500					N/A			
3139186854	Easy	Strongly Agree	Agree	More Policy	N/A			
3139186706	Easy	Agree	Agree	More Policy	N/A			
3139185397								
3139184395	Easy	Neither	Neither	More Policy	N/A			
3139184280	Easy	Agree	Agree	More Policy		Easy	Agree	Agree
3139184235					N/A			
3139183827					N/A			
3139183807	Very Easy	Agree	Agree	Strictly Policy		Easy	Agree	Agree
3139183033	Very Easy	Strongly Agree	Strongly Agree	Strictly Policy		Easy	Disagree	Disagree
3139181823	Neither	Agree	Agree	More Policy		Neither	Agree	Agree
3139180329					N/A			
3139179506					N/A			
3139177381								
3139177337					N/A			
3139177052						Neither	Strongly Agree	Strongly Agree
3139174350								
3139173740								
3139172984	Very Easy	Agree	Agree	More Policy		Very Easy	Agree	Agree
3139171540	Easy	Agree	Agree	Strictly Policy		Difficult	Disagree	Disagree

RespondentID	Do you feel this inject was more technical or more policy?	What is your gender?	Which race/ethnicity best describes you? (Please choose only one.)	What school are you attending?	What is your year in college?	What is your GPA?
		Response	Response	Open-Ended Response	Response	Response
3139948127	Strictly Policy	Male	White / Caucasian	The Evergreen State College	Senior	2.6 - 3.0
3139745645						
3139534736						
3139190805	Strictly Policy	Female	White / Caucasian	TESC	Senior	3.6 - 4.0
3139189500		Male	White / Caucasian	Highline Community College	Sophomore	3.6 - 4.0
3139186854		Male	White / Caucasian	ITT Technical Institute	Sophomore	3.6 - 4.0
3139186706		Male	White / Caucasian	ITT Tech	Junior	3.6 - 4.0
3139185397						
3139184395		Male	White / Caucasian	ITT Technical Institute	Senior	3.1 - 3.5
3139184280	More Policy	Male	White / Caucasian	ITT Tech Boise	Senior	3.6 - 4.0
3139184235		Male	White / Caucasian	ITT Tech	Junior	3.6 - 4.0
3139183827		Male	White / Caucasian	ITT Tech Boise, ID	Sophomore	3.6 - 4.0
3139183807	More Policy	Male	White / Caucasian	ITT Tech	Sophomore	3.6 - 4.0
3139183033	Neither	Male	White / Caucasian		Other	3.6 - 4.0
3139181823	More Policy	Male	Black or African American	Whatcom	Freshman	2.6 - 3.0
3139180329		Male	White / Caucasian	Highline Community College	Junior	3.6 - 4.0
3139179506		Male	White / Caucasian	Highline Community college	Sophomore	3.6 - 4.0
3139177381						
3139177337		Male	White / Caucasian	Highline	Sophomore	3.6 - 4.0
3139177052	Neither	Female	Black or African American	Highline Community college	Other	3.6 - 4.0
3139174350						
3139173740						
3139172984	More Policy	Female	White / Caucasian	Highline Community College	Sophomore	3.6 - 4.0
3139171540	Strictly Policy	Male	White / Caucasian	University of Idaho	Other	4.1 or above

RespondentID	What is your major?
	Open-Ended Response
3139948127	Computer Science
3139745645	
3139534736	
3139190805	Computer Science
3139189500	Cybersecurity
3139186854	Network Systems Administration
3139186706	Computer Science with an Emphasis in Programming
3139185397	
3139184395	Information Systems and Cybersecurity
3139184280	Information Systems and Cybersecurity
3139184235	Information Cyber-Security
3139183827	Network Systems Administrator
3139183807	Software applications development
3139183033	
3139181823	computer Systems Information
3139180329	Data Recovery / Forensic Expert
3139179506	Network Security
3139177381	
3139177337	Network Specialist
3139177052	Data Recovery/Computer Forensics
3139174350	
3139173740	
3139172984	Data Recovery / Forensic Expert
3139171540	Computer Science/Engineering

Appendix E: Sunday Survey Data

RespondentID	Do you agree to take the survey?	Inject #15 Pros and cons of IM Service	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #16 Anonymous FTP Login
	Response	Response					Response
3142283595	Yes, I agree to take the survey	N/A					N/A
3142170267	Yes, I agree to take the survey	N/A					N/A
3139956950	Yes, I agree to take the survey						
3139956902	No, I do not agree to take the survey						
3139956801	Yes, I agree to take the survey	N/A					N/A
3139956499	Yes, I agree to take the survey	N/A					N/A
3139956022	Yes, I agree to take the survey						
3139955946	Yes, I agree to take the survey	N/A					N/A
3139952004	Yes, I agree to take the survey		Neither	Strongly Agree	Strongly Agree	More Technical	
3139943593	Yes, I agree to take the survey	N/A					N/A
3139940490	Yes, I agree to take the survey		Neither	Neither	Neither	Neither	N/A
3139930422	Yes, I agree to take the survey	N/A					
3139925528	Yes, I agree to take the survey	N/A					N/A
3139921831	Yes, I agree to take the survey						
3139918082	Yes, I agree to take the survey	N/A					
3139916803	Yes, I agree to take the survey	N/A					
3139914912	Yes, I agree to take the survey		Difficult	Agree	Disagree	Strictly Technical	N/A
3139913490	Yes, I agree to take the survey	N/A					N/A
3139913459	Yes, I agree to take the survey	N/A	Difficult	Disagree	Disagree	More Policy	N/A
3139912806	Yes, I agree to take the survey		Easy	Disagree	Neither	More Policy	

RespondentID	Do you agree to take the survey?	Inject #15 Pros and cons of IM Service	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #16 Anonymous FTP Login
	Response	Response					Response
3139911772	Yes, I agree to take the survey	N/A					N/A
3139911548	Yes, I agree to take the survey	N/A					N/A
3139910862	Yes, I agree to take the survey	N/A					
3139910128	Yes, I agree to take the survey		Easy	Agree	Agree	More Policy	
3139909859	Yes, I agree to take the survey		Easy	Agree	Agree	More Technical	N/A
3139907625	Yes, I agree to take the survey						
3139906358	Yes, I agree to take the survey	N/A	Neither	Neither	Neither	Neither	N/A
3139905924	Yes, I agree to take the survey		Easy	Agree	Agree	More Policy	
3139904658	Yes, I agree to take the survey		Easy	Agree	Agree	Neither	
3139901178	Yes, I agree to take the survey		Easy	Agree	Neither	Strictly Policy	N/A

RespondentID	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #17 Set up instant messaging service	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?
					Response		
3142283595					N/A		
3142170267					N/A		
3139956950							
3139956902							
3139956801					N/A		
3139956499					N/A		
3139956022							
3139955946					N/A		
3139952004	Neither	Strongly Agree	Agree	Strictly Technical		Neither	Strongly Agree
3139943593					N/A		
3139940490						Difficult	Agree
3139930422	Very Easy	Strongly Agree	Strongly Agree	More Technical	N/A		
3139925528					N/A		
3139921831							
3139918082	Difficult	Strongly Agree	Agree	Strictly Technical		Difficult	Neither
3139916803	Easy	Agree	Agree	More Technical	N/A		
3139914912						Difficult	Agree
3139913490					N/A		
3139913459	Easy	Agree	Agree	More Policy	N/A	Difficult	Disagree
3139912806	Easy	Agree	Strongly Agree	Strictly Technical		Difficult	Neither

RespondentID	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #17 Set up instant messaging service	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?
					Response		
3139911772					N/A		
3139911548					N/A		
3139910862	Neither	Disagree	Neither	More Policy		Easy	Agree
3139910128	Neither	Agree	Agree	More Technical		Neither	Agree
3139909859						Easy	Agree
3139907625							
3139906358	Neither	Neither	Neither	Neither			
3139905924	Neither	Agree	Agree	More Technical		Difficult	Agree
3139904658	Easy	Agree	Agree	More Policy		Difficult	Strongly Agree
3139901178						Very Difficult	Agree

RespondentID	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #18 FISMA Compliance Response	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #19 Intrusion Detection Response
3142283595			N/A					N/A
3142170267			N/A					
3139956950								
3139956902								
3139956801			N/A					N/A
3139956499			N/A					N/A
3139956022								
3139955946			N/A					N/A
3139952004	Strongly Agree	Strictly Technical		Difficult	Strongly Agree	Strongly Agree	Strictly Policy	N/A
3139943593			N/A					
3139940490	Agree	More Technical	N/A					N/A
3139930422			N/A					
3139925528			N/A					
3139921831								
3139918082	Neither	More Technical	N/A					N/A
3139916803			N/A					
3139914912	Agree	Strictly Technical	N/A					
3139913490			N/A					N/A
3139913459	Strongly Disagree	Neither	N/A	Difficult	Agree	Agree	More Policy	N/A
3139912806	Agree	Strictly Technical		Easy	Agree	Agree	Strictly Policy	

RespondentID	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #18 FISMA Compliance	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #19 Intrusion Detection
			Response					Response
3139911772			N/A					N/A
3139911548			N/A					
3139910862	Agree	More Technical		Easy	Agree	Agree	Strictly Policy	N/A
3139910128	Agree	Strictly Technical	N/A					N/A
3139909859	Strongly Agree	More Technical	N/A					N/A
3139907625								
3139906358								
3139905924	Agree	More Technical		Easy	Agree	Agree	More Policy	
3139904658	Agree	More Technical		Easy	Agree	Agree	More Policy	
3139901178	Agree	Strictly Technical	N/A					N/A

RespondentID	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #20 Recover Data	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?
					Response			
3142283595					N/A			
3142170267	Easy	Agree	Agree	More Technical	N/A			
3139956950								
3139956902								
3139956801					N/A			
3139956499					N/A			
3139956022								
3139955946					N/A			
3139952004	Difficult	Strongly Agree	Strongly Agree	More Technical	N/A			
3139943593	Difficult	Agree	Agree	More Technical	N/A			
3139940490					N/A			
3139930422	Neither	Neither	Neither	Neither	N/A			
3139925528	Neither	Agree	Agree	Neither	N/A			
3139921831								
3139918082					N/A			
3139916803	Difficult	Strongly Agree	Agree	Strictly Technical	N/A	Very Difficult	Agree	Neither
3139914912	Neither	Strongly Agree	Agree	More Technical		Easy	Agree	Agree
3139913490					N/A			
3139913459					N/A			
3139912806	Difficult	Agree	Neither	Neither		Difficult	Agree	Agree

RespondentID	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #20 Recover Data	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?
					Response			
3139911772					N/A			
3139911548	Easy	Agree	Agree	More Policy	N/A			
3139910862					N/A			
3139910128						Neither	Agree	Agree
3139909859					N/A			
3139907625								
3139906358								
3139905924	Easy	Agree	Agree	More Technical		Difficult	Agree	Agree
3139904658	Difficult	Agree	Agree	More Technical		Difficult	Agree	Strongly Agree
3139901178					N/A			

RespondentID	Do you feel this inject was more technical or more policy?	Inject #21 MARC Reactor Logs #2	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #22 Honey Pot	How difficult was this inject?
		Response					Response	
3142283595			Easy	Agree	Agree	More Technical	N/A	
3142170267		N/A						Easy
3139956950								
3139956902								
3139956801		N/A					N/A	
3139956499		N/A						Neither
3139956022								
3139955946		N/A					N/A	
3139952004		N/A					N/A	
3139943593		N/A						Difficult
3139940490			Very Easy	Agree	Agree	More Technical		Difficult
3139930422			Neither	Neither	Neither	Neither		Neither
3139925528		N/A					N/A	
3139921831								
3139918082			Very Easy	Agree	Neither	More Technical	N/A	
3139916803	Strictly Technical	N/A						Easy
3139914912	More Technical	N/A						Neither
3139913490		N/A					N/A	
3139913459		N/A						Easy
3139912806	More Technical		Difficult	Agree	Agree	Neither		Difficult

RespondentID	Do you feel this inject was more technical or more policy?	Inject #21 MARC Reactor Logs #2	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #22 Honey Pot	How difficult was this inject?
		Response					Response	
3139911772		N/A					N/A	
3139911548		N/A						Neither
3139910862			Easy	Agree	Agree	Strictly Technical	N/A	
3139910128	More Technical	N/A						Difficult
3139909859			Neither	Agree	Strongly Agree	Strictly Technical	N/A	
3139907625		N/A	Very Easy	Agree	Agree	Neither		
3139906358								
3139905924	More Technical		Easy	Agree	Agree	More Policy		Easy
3139904658	Strictly Technical		Easy	Agree	Agree	More Policy		Easy
3139901178		N/A					N/A	

RespondentID	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #23 Configure Host ACL	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?
				Response			
3142283595				N/A			
3142170267	Neither	Agree	Strictly Technical	N/A			
3139956950							
3139956902							
3139956801				N/A			
3139956499	Agree	Agree	Strictly Technical	N/A			
3139956022							
3139955946				N/A			
3139952004				N/A			
3139943593	Agree	Agree	More Technical	N/A			
3139940490	Agree	Agree	More Technical	N/A			
3139930422	Neither	Neither	Neither	N/A			
3139925528				N/A			
3139921831							
3139918082					Difficult	Strongly Agree	Agree
3139916803	Agree	Agree	More Technical	N/A			
3139914912	Agree	Agree	More Technical		Easy	Agree	Disagree
3139913490					Difficult	Agree	Strongly Agree
3139913459	Agree	Agree	More Technical	N/A			
3139912806	Strongly Agree	Strongly Agree	Strictly Technical		Neither	Neither	Agree

RespondentID	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #23 Configure Host ACL	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?
				Response			
3139911772				N/A			
3139911548	Disagree	Disagree	More Technical	N/A			
3139910862					Difficult	Agree	Agree
3139910128	Agree	Agree	Strictly Technical	N/A			
3139909859				N/A			
3139907625							
3139906358							
3139905924	Agree	Agree	More Technical		Easy	Agree	Agree
3139904658	Agree	Agree	Strictly Technical		Easy	Strongly Agree	Agree
3139901178				N/A			

RespondentID	Do you feel this inject was more technical or more policy?	Inject #24 Move SCADA server off domain	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #25 Asset List and Tech Replacement Plan	How difficult was this inject?
		Response					Response	
3142283595		N/A						Easy
3142170267		N/A					N/A	
3139956950								
3139956902								
3139956801		N/A					N/A	
3139956499		N/A					N/A	
3139956022								
3139955946		N/A						Easy
3139952004		N/A					N/A	
3139943593		N/A						Easy
3139940490		N/A					N/A	
3139930422			Neither	Neither	Neither	Neither	N/A	
3139925528		N/A					N/A	
3139921831								
3139918082	Strictly Technical		Very Difficult	Strongly Agree	Agree	More Technical	N/A	
3139916803		N/A						Easy
3139914912	Neither		Easy	Agree	Agree	More Technical	N/A	
3139913490	Strictly Technical		Very Easy	Agree	Agree	Strictly Technical	N/A	
3139913459		N/A					N/A	
3139912806	Neither		Very Easy	Agree	Disagree	Strictly Technical		Easy

RespondentID	Do you feel this inject was more technical or more policy?	Inject #24 Move SCADA server off domain	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #25 Asset List and Tech Replacement Plan	How difficult was this inject?
		Response					Response	
3139911772		N/A						Easy
3139911548		N/A					N/A	
3139910862	Strictly Technical		Very Easy	Agree	Agree	Strictly Technical	N/A	
3139910128		N/A					N/A	
3139909859		N/A					N/A	
3139907625		N/A	Easy	Agree	Agree	More Policy		
3139906358								
3139905924	More Technical		Easy	Agree	Agree	More Technical		Easy
3139904658	More Technical		Neither	Agree	Strongly Agree	More Technical		Easy
3139901178		N/A					N/A	

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RespondentID	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #26 Risk Management Response	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?
3142283595	Agree	Neither	Strictly Policy	N/A				
3142170267					Neither	Agree	Agree	Neither
3139956950								
3139956902								
3139956801				N/A				
3139956499					Difficult	Neither	Neither	Strictly Policy
3139956022								
3139955946	Agree	Agree	More Policy	N/A				
3139952004				N/A				
3139943593	Agree	Agree	More Policy	N/A				
3139940490				N/A				
3139930422				N/A				
3139925528				N/A				
3139921831								
3139918082				N/A				
3139916803	Agree	Agree	More Policy	N/A				
3139914912				N/A				
3139913490				N/A				
3139913459				N/A				
3139912806	Disagree	Neither	More Policy		Easy	Neither	Neither	More Policy

RespondentID	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #26 Risk Managem ent	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?
				Response				
3139911772	Strongly Agree	Agree	Neither	N/A				
3139911548					Neither	Disagree	Agree	More Policy
3139910862				N/A				
3139910128				N/A				
3139909859				N/A				
3139907625								
3139906358								
3139905924	Agree	Agree	More Policy		Easy	Agree	Agree	More Policy
3139904658	Agree	Agree	More Policy	N/A				
3139901178				N/A				

RespondentID	Inject #27 Change Log #2	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #28 Call Log #2	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?
	Response					Response		
3142283595	N/A						Very Easy	Strongly Agree
3142170267	N/A					N/A		
3139956950								
3139956902								
3139956801	N/A					N/A		
3139956499	N/A					N/A		
3139956022								
3139955946		Neither	Disagree	Neither	Strictly Policy		Difficult	Agree
3139952004	N/A					N/A		
3139943593	N/A						Difficult	Agree
3139940490		Difficult	Agree	Agree	More Technical	N/A		
3139930422		Very Easy	Strongly Agree	Disagree	More Policy	N/A		
3139925528	N/A						Very Easy	Agree
3139921831								
3139918082	N/A					N/A		
3139916803		Neither	Agree	Strongly Agree	Strictly Policy		Neither	Strongly Agree
3139914912	N/A					N/A		
3139913490		Very Easy	Strongly Agree	Agree	Strictly Policy	N/A		
3139913459		Easy	Agree	Agree	More Policy		Easy	Agree
3139912806		Very Easy	Agree	Agree	Strictly Policy		Very Easy	Disagree

RespondentID	Inject #27 Change Log #2	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Inject #28 Call Log #2	How difficult was this inject?	Do you think this inject simulated a real world work task for an IT professional?
	Response					Response		
3139911772		Easy	Strongly Agree	Agree	More Policy	N/A		
3139911548		Easy	Agree	Agree	More Policy	N/A		
3139910862		Easy	Agree	Agree	Strictly Policy		Very Easy	Agree
3139910128		Easy	Agree	Agree	More Policy		Easy	Agree
3139909859		Easy	Agree	Agree	Strictly Policy	N/A		
3139907625	N/A	Very Easy		Agree	More Policy			
3139906358								
3139905924		Easy	Agree	Agree	More Policy		Easy	Agree
3139904658		Easy	Agree	Agree	Strictly Policy	N/A		
3139901178	N/A					N/A		

RespondentID	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Did you feel like you had enough time to complete the injects in the time allotted?	How did you feel about the overall difficulty of the injects?	After this competition, do you feel more prepared to work in the IT field?	How well did your education prepare you for this competition?
3142283595	Neither	Strictly Policy	Just right	Just right	A little more prepared	Helped a little
3142170267			Just right	Just right	A little more prepared	Helped a little
3139956950						
3139956902						
3139956801			Just right	Difficult	A little more prepared	Helped a little
3139956499			Just right	Just right	A little more prepared	Helped a little
3139956022						
3139955946	Agree	Strictly Policy	Just right	Just right	A little more prepared	Helped a lot
3139952004			Just right	Just right	More prepared	Helped a lot
3139943593	Agree	More Policy				
3139940490			Just right	Just right	No effect	Didn't help at all
3139930422			Just right	Just right	A little more prepared	Helped a little
3139925528	Neither	Neither	Too little time	Just right	A little more prepared	Helped a lot
3139921831						
3139918082			Too little time	Just right	A little more prepared	Didn't help at all
3139916803	Strongly Agree	Strictly Policy	Just right	Difficult	More prepared	Helped a lot
3139914912			Just right	Easy	More prepared	Helped a lot
3139913490			Just right	Just right	More prepared	Helped a lot
3139913459	Agree	More Policy	Too little time	Difficult	A little more prepared	Helped a little
3139912806	Disagree	Strictly Policy	Just right	Just right	More prepared	Helped a lot

RespondentID	Did this inject help you to learn about this type of task required while on the job?	Do you feel this inject was more technical or more policy?	Did you feel like you had enough time to complete the injects in the time allotted?	How did you feel about the overall difficulty of the injects?	After this competition, do you feel more prepared to work in the IT field?	How well did your education prepare you for this competition?
3139911772			Just right	Difficult	More prepared	Helped a lot
3139911548			Too much time	Just right	A little more prepared	Helped a lot
3139910862	Agree	Strictly Policy	Just right	Just right	More prepared	Helped a lot
3139910128	Agree	More Policy	Just right	Just right	More prepared	Helped a lot
3139909859			Just right	Just right	More prepared	Helped a lot
3139907625			Just right	Just right	A little more prepared	Helped a lot
3139906358						
3139905924	Agree	More Policy	Too little time	Just right	A little more prepared	Helped a lot
3139904658			Just right	Just right	More prepared	Helped a lot
3139901178			Too little time	Just right	More prepared	Helped a lot

RespondentID	In your opinion, what makes an effective inject?	What was the most interesting inject from this competition?	What is your gender?	Which race/ethnicity best describes you? (Please choose only one.)
	Open-Ended Response	Open-Ended Response	Response	Response
3142283595	Something that closely reflects a real world situation, but is still possible for us to accomplish inside of the time restriction.	The reactor update that was actually a virus, and we were supposed to identify it as a virus and refuse to install it.	Female	White / Caucasian
3142170267	How much it makes you learn, while not being overwhelming (mostly just not having multiple big injects right next to each other. This year was really good about inject placement.)	Definitely moving the SCADA server to a different domain. That one, while I didn't take a part in it (I was keeping things up in the background), definitely seemed like a challenge for the three people involved. They definitely learned a lot from that inject.	Male	White / Caucasian
3139956950				
3139956902				
3139956801				
3139956499				
3139956022				
3139955946			Female	White / Caucasian
3139952004			Male	White / Caucasian
3139943593				
3139940490	clear directions	n/a	Male	White / Caucasian
3139930422	realistic	DC policies	Male	Asian / Pacific Islander
3139925528	Clear wording, clear instructions, with an interesting learning experience while also being somewhat challenging. Injects that build on each other in an interesting order were particularly helpful in the experience.	The presentation inject which was to look into policies about Bring Your Own Device to work. Having to look into the different ways that this can be implemented versus how much benefit there actually is was especially interesting.	Male	White / Caucasian
3139921831				
3139918082	An effective detail of what is expected, with pre-conditions and post conditions system,network,etc	Take Scada off the domain, as it was a bit of a trick question	Male	Hispanic American
3139916803			Male	White / Caucasian
3139914912	Balance	installing the Message server and removing the SCADA server from the domain.	Male	White / Caucasian
3139913490	Real life scenarios always make for the best injects.	Inject #23	Male	White / Caucasian
3139913459			Male	White / Caucasian
3139912806	An effective inject is one that requires us to utilize features of the programs and assets we have available to us.	The Honeypot was interesting. As was the IM client. However, with the IM client that should have come earlier so that we could have used the IM client throughout the competition.	Male	White / Caucasian

RespondentID	In your opinion, what makes an effective inject?	What was the most interesting inject from this competition?	What is your gender?	Which race/ethnicity best describes you? (Please choose only one.)
	Open-Ended Response	Open-Ended Response	Response	Response
3139911772	Specific information related to a task that can be completed with the resources alotted.	The honey pot inject was the most interesting to me.	Male	White / Caucasian
3139911548			Male	White / Caucasian
3139910862	Just the right amount of technical and policy.	My favorite was the IM server	Male	White / Caucasian
3139910128	Specificity	Forensics on the recovered USB	Male	White / Caucasian
3139909859		The forensics was very interesting, plus it was very difficult and i with enough time i would have been able to crack the pdf password unfortunately with the time allotted i was unable to break it	Male	White / Caucasian
3139907625	Tests knowledge, rather than google-fu.	Out of the injects that I was involved in, the removal of the SCADA server from the domain was them most interesting. However, the overall experience of frantically reducing the insecurity of the machines was much more interesting.	Male	White / Caucasian
3139906358				
3139905924	one that has you do what would be need in the job	the IM install one	Male	Black or African American
3139904658	The ability for the inject to make you think on your toes as well as make you learn	the constant attacks that required modifications to the security were the most interesting for me.	Male	White / Caucasian
3139901178	Pure time crunch does not an effective inject make. I would like to see more involving injects but with a greater time allotment.	I enjoyed the IM inject, however I felt that it needed significantly more time to be implemented.	Male	White / Caucasian

RespondentID	What school are you attending?	What is your year in college?	What is your GPA?	What is your major?
	Open-Ended Response	Response	Response	Open-Ended Response
3142283595	Western Washington University	Senior	3.1 - 3.5	Computer Science
3142170267	Western Washington University	Sophomore	2.6 - 3.0	Computer Science
3139956950				
3139956902				
3139956801				
3139956499				
3139956022				
3139955946				
3139952004	The Evergreen State College	Senior	3.6 - 4.0	Computer Science
3139943593				
3139940490	HCC	Sophomore	3.6 - 4.0	networking
3139930422	UW BOTHELL	Senior	3.1 - 3.5	CS
3139925528	University of Washington Bothell	Senior	3.1 - 3.5	Community Psychology
3139921831				
3139918082	University of Washington Bothell	Senior	3.1 - 3.5	Computer Science and Systems
3139916803	WCC	Other	3.6 - 4.0	CIS
3139914912	WCC	Senior	3.1 - 3.5	AAS-CIS
3139913490	ITT Tech Boise	Sophomore	3.6 - 4.0	Network Systems Administration
3139913459	UWB	Senior	2.6 - 3.0	CSSE
3139912806	University of Idaho	Other	4.1 or above	Computer Science/Engineering

RespondentID	What school are you attending?	What is your year in college?	What is your GPA?	What is your major?
	Open-Ended Response	Response	Response	Open-Ended Response
3139911772	ITT Technical Insitute	Sophomore	3.6 - 4.0	Network Systems Administration
3139911548	ITT Technical Institute Boise	Senior	3.1 - 3.5	Information Systems and Cybersecurity
3139910862	ITT Tech	Junior	3.6 - 4.0	Computer Science with and Emphasis in Programming
3139910128	ITT Tech - Boise	Senior	3.6 - 4.0	Information Systems and CyberSecurity
3139909859	ITT Tech	Sophomore	3.6 - 4.0	Software Applications Developer
3139907625	WCC	Freshman	3.1 - 3.5	CIS
3139906358				
3139905924	WCC	Sophomore	2.6 - 3.0	Computer Systems Information
3139904658	Whatcom Community College	Other	3.1 - 3.5	Computer Information Security, Cyber Security
3139901178	Whatcom Community College	Freshman	3.1 - 3.5	CIS