

Briefing

Bachelor of Computing in

Information Security

2024/25

Joint-Academic-Committee (InfoSec)

BCOMP Information Security

- Introduced in 2015. Enhanced and replaced *Specialisation in Information Security*.
 - Started with 11 students from AY14/15.
- Some cohorts:
 - AY14/15: 11,
 - AY15/16: 16,
 - ...
 - AY20/21: 67,
 - AY21/22: 40,
 - AY22/23: 43
 - AY23/24: 61

InfoSec

- Why InfoSec (Information Security) aka CyberSecurity?
 - ***“Defence Against the Dark Arts”***
 - Necessity (<https://securitybrief.asia/story/singapore-faces-high-ot-cyberattack-frequency-report-warns>)
 - *“73.3% of respondents in Singapore reported experiencing at least one cyberattack in the past year”*
 - Opportunities (<https://www.weforum.org/agenda/2024/04/cybersecurity-industry-talent-shortage-new-report>)
 - WE Forum: *“global talent shortage, which spans nations states and industries, could reach 85 million workers by 2030, causing approximately \$8.5 trillion in unrealized annual revenue”*
 - Challenging & Fun
 - 29K CVEs in 2023
 - Always new attacks / defences / settings

Programme Structure

Curriculum

- Cybersecurity is multi-disciplinary
 - System + Management aspects.
 - Domain specific knowledge.
 - Theory + Principles

- Provide
 - General breadth *(NUS requirement)*
 - Solid technical background *(Foundation +Core)*
 - In-depth studies in chosen domains *(Elective, FYP)*
 - Industrial Relevance *(Internship, selected modules)*

Degree Requirements

Refer to the official SoC website and NUS Bulletin for complete, up-to-date information.

2024/2025 Cohort:

<https://www.comp.nus.edu.sg/cug/per-cohort/isc/isc-24-25>

Choose your cohort.



Information Security Cohort 2024/2025

Overview

The Bachelor of Computing in Information Security aims to:

- To provide a broad-based, inter-disciplinary information security undergraduate programme within NUS.
- To contribute to the national focus on growing the pool of cyber security professionals in Singapore.
- To produce graduates who are able to understand information security issues and practices from both technical and organisational points of view.

Graduates of this programme are expected to have possible career choices as software engineers, systems administrators, malware researchers, security analyst, cybersecurity incident responder, and security consultant. They are expected to find employment in industries that deal with sensitive information (e.g., banks, insurance, defence), government organisations, and firms that provide security consultation/systems/services.

From <https://www.comp.nus.edu.sg/cug/per-cohort/isc/isc-24-25>

Summary of degree requirement for Bachelor of Computing in Information Security

Courses	Units	Subtotal
COMMON CURRICULUM REQUIREMENTS¹		40
University Level Requirements: 6 University Pillars	24	
Digital Literacy — CS1010 Programming Methodology	4	
Critique and Expression — GEX%	4	
Cultures and Connections — DECK	4	
Data Literacy — Ether GEAI000, BT1101, ST1131 or DSE1101	4	
Singapore Studies — GEX%	4	
Communities and Engagement — GENV	4	
Computer Ethics	4	
IS1108 Digital Ethics and Data Privacy	4	
Interdisciplinary & Cross-Disciplinary Education	12	
Comprises of Interdisciplinary (ID) courses and Cross-disciplinary (CD) courses		
Students are required to take 12 units from the above courses with at least two ID courses and no more than one CD course to satisfy the 12 units required in this group.		
PROGRAMME REQUIREMENTS		84
Computing Foundation	32	
CS1231S Discrete Structures	4	
CS2030 Programming Methodology II	4	
CS2040C Data Structures and Algorithms	4	
CS2100 Computer Organisation	4	
CS2101 Effective Communication for Computing Professionals and CS2103IT Software Engineering ²	8	
CS2105 Introduction to Computer Networks	4	
CS2106 Introduction to Operating Systems	4	
Information Security Requirements	28	
CS2107 Introduction to Information Security	4	
CS3235 Computer Security	4	
Either IF4205 Information Security Capstone Project	8	
or IC54238 Computer Security Practice and IF54103 Penetration Testing Practice)		
IS4231 Information Security Management	4	
Programme Electives	8	
Complete 8 units from the following list of courses:		
CS4230 Foundations of Modern Cryptography		
Either		
CS4236 Cryptography Theory and Practice; or		
MA4281 Coding and Cryptography		
CS4238 Computer Security Practice		
CS4239 Software Security		
CS4257 Algorithmic Foundations of Privacy		
CS4276 IoT Security		
CS5213 Systems Security		
CS5321 Network Security		
CS5322 Database Security		
CS5331 Web Security		
CS5332 Biometric Authentication		
IF54101 Legal Aspects of Information Security		
IF54102 Digital Forensics		
IF54103 Penetration Testing Practice		
IS4204 IT Governance		
IS4233 Legal Aspects of Information Technology		
IS4234 Governance, Regulation, and Compliance Technology		
IS4238 Strategic Cybersecurity		
IS4302 Blockchain and Distributed Ledger Technologies		
Other courses at level 4000 or above approved by the School of Computing UG Office		
Computing Requirements	12	
Complete 12 units of CS-coded, IS-coded, or CP-coded courses subject to the following conditions:		
<ul style="list-style-type: none"> • CS-coded and IS-coded courses must be at level 3000 or above. • At least 6 units must consist of industrial experience courses. 		
The industry experience courses are as follows:		
<ul style="list-style-type: none"> • A 6-month internship through CP3880 Advanced Technology Attachment Programme (12 units), IS4010 Industry Internship Programme (12 units), or TR3202 Start-up Internship Programme (12 units); • A 3-month internships through one of the followings: CP3200 Internship (6 units), CP3202 Internship II (6 units), CP3107 Computing for Voluntary Welfare Organisations (6 units), CP3110 Computing for Voluntary Welfare Organisations II (6 units); 		

(40): Common Curriculum

What a NUS (SoC) graduate should know

(32): Foundation

Computing Foundation

(12): Math

(28): Infosec requirement

Infosec must know

(12): CS/Intern

CS breadth/Intern/FYP

(36): Unrestrictive UE

Choose what suits you

160 MC (total)



Read the fine print!

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<i>University Level Requirements: 6 University Pillars</i>	24	
Digital Literacy — CS1010 Programming Methodology	4	
Critique and Expression — GEX%	4	
Cultures and Connections — GEC%	4	
Data Literacy — Either GEA1000, BT1101, ST1131 or DSE1101	4	
Singapore Studies — GES%	4	
Communities and Engagement — GEN%	4	
Computer Ethics	4	
IS1108 Digital Ethics and Data Privacy	4	
Interdisciplinary & Cross-Disciplinary Education	12	
Comprises of Interdisciplinary (ID) courses and Cross-disciplinary (CD) courses		
Students are required to take 12 units from the above courses with at least two ID courses and no more than one CD course to satisfy the 12 units required in this group.		
PROGRAMME REQUIREMENTS		84

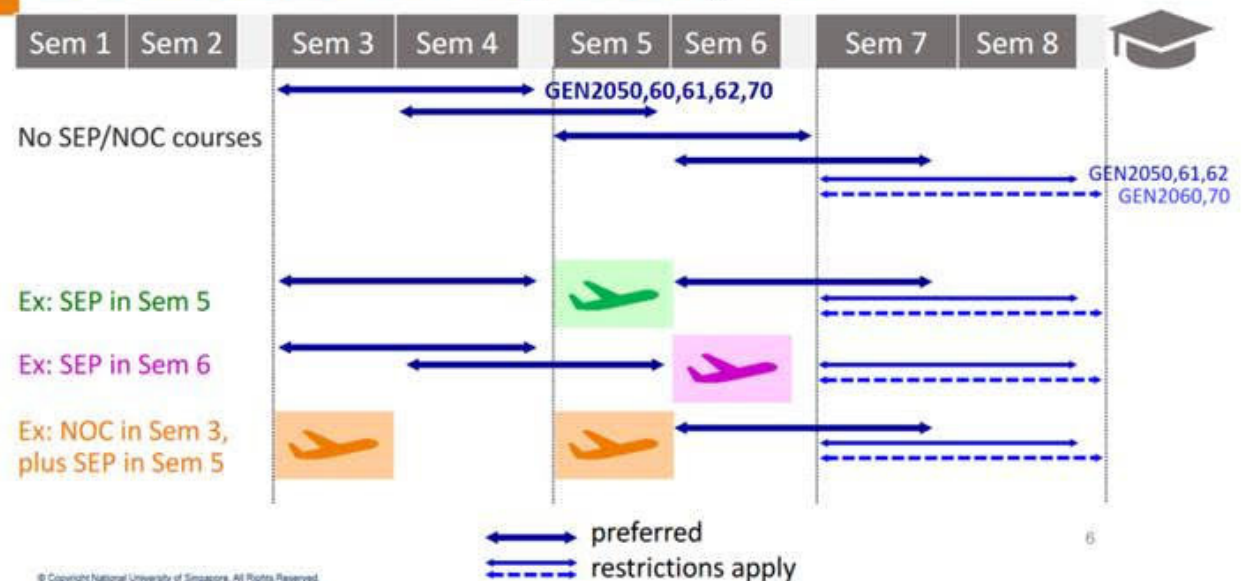
CS1010 is a pre-req of most Computing Courses

Communities and Engagement

- **Communities and Engagement — GEN%**

- One of the **Pillars** under **Common Curriculum**
- Communities and Engagement courses (coded as GEN%) may be **semester** or **Year long** (see below)
- <https://www.nus.edu.sg/registrar/academic-information-policies/undergraduate-students/general-education/communities-and-engagement-pillar>
- Issues: **semester-long** GEN courses have **limited capacity** per **semester** – alternative is **year-long GEN course** (i.e. service learning), students planning for **enrichment programmes** (Student Exchange Prog (SEP), NOC and/or internships) may need to take year-long GEN option – recommend not leaving the GEN course too late, see diagram

Include Service Learning in Study Plan



CORE

- CS2107 Intro to InfoSec.
 - Illustrates how system fails. Focus on communication security (basic crypto + network).
- CS3235 Computer Security.
 - In-depth. System, Web/mobile. Focus on System security

- (IFS4103 + CS4238) **or** (IFS4205)
 - IFS4103: (Pentesting) Let's pentest NUS systems
 - CS4238: (Lab) Let's hack some virtual environment. Attack kill chain.
 - IFS4205: (Capstone Project) Let's build a security system.
 - Possible to do both IFS4103 + CS4238 + IFS4205 (in principle)

- IS4231 Infosec Management.
 - Not just software. Let's manage it.

ELECTIVES

e.g.

Treat these two as a single overloaded first course in security

CS4239 Software Security

CS4238 Computer Security Practice

IFS4101 Legal Aspects

...

Unrestricted Electives

- UE – may need to consider what other CS / InfoSec courses you want
 - E.g. CS2102 Database Systems
 - Not pre-req but useful for practical security such as pentesting (IFS4103)
 - CS3230 Design and Analysis of Algorithms
 - Needed for CS4230 Foundations of Modern Cryptography

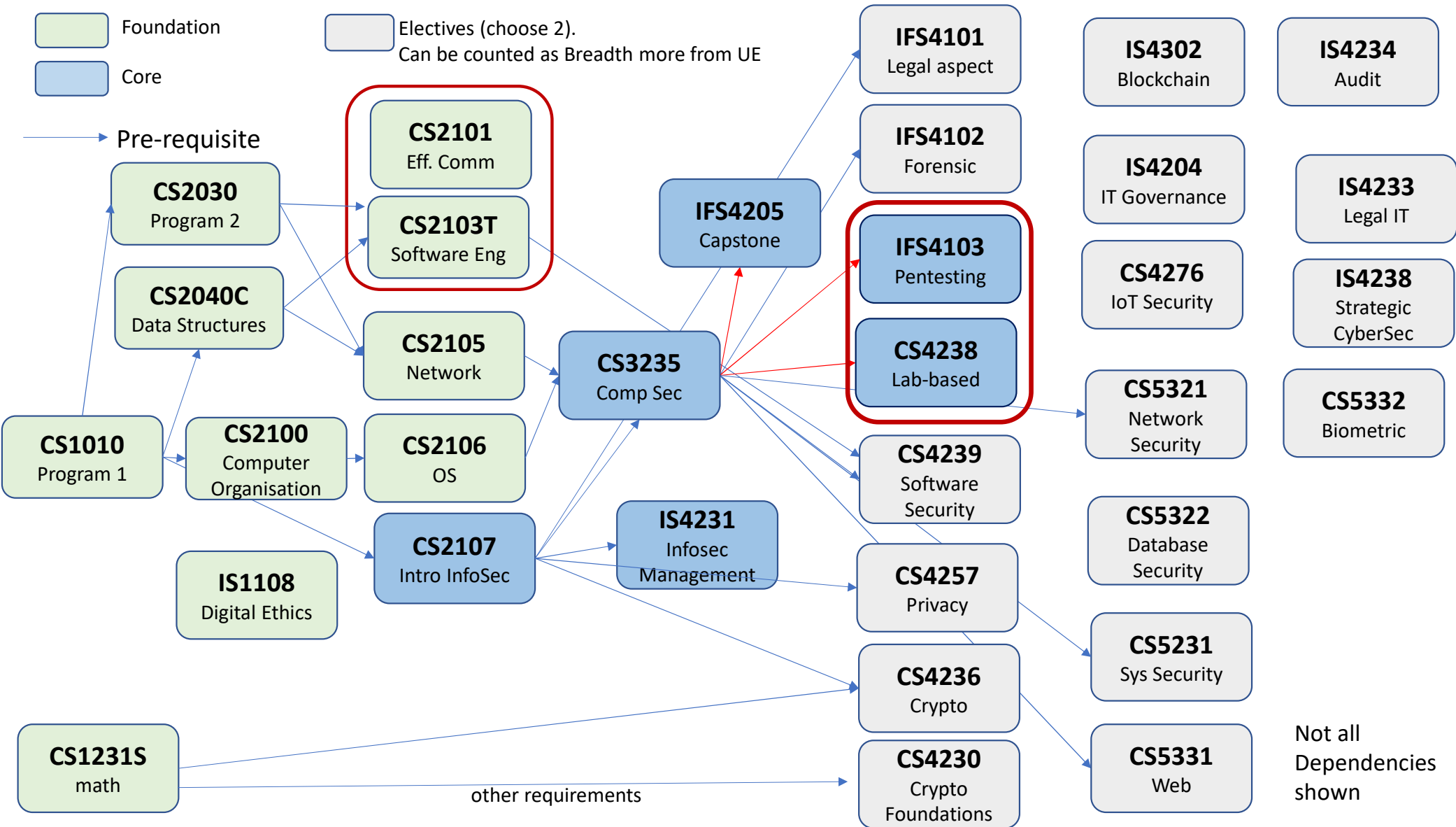
FYP + UROP

- CP4101 BComp Dissertation (FYP)
 - Individual (possible to be small group) project
 - Nature: Research or substantial Development
 - Can be used to as to satisfy CP requirements in lieu of internship (matches 12 units of Computing (CP) requirement)
 - Students with **GPA** of **4.00** or higher at the end of their fifth semester of undergraduate study may opt to replace the Industry Experience Requirement by BComp Dissertation
 - Students who aim for **Honours** (Highest Distinction) must pass the **CP4101 BComp Dissertation**
- UROP (CP3209): for students interested in exploring research (note: 8 units)

Foundation
Core

Electives (choose 2).
Can be counted as Breadth more from UE

Pre-requisite



Not all Dependencies shown

Remarks

- CS2107 (Intro) is the first InfoSec course. Needed for CS3235
- CS3235 (System Sec) is the pre-req of many advanced courses. **Complete it early.**
- CS3230 (Algo) is a core in BCOMP CS but not in InfoSec. Algorithm Analysis is fundamental. **Encourage** although not core. CS4230 requires CS3230
- CS2107 (Intro).
 - Previously, students graduated from security-focus diploma could waive CS2017. No waiver for AY21/22 onward.

Sample Study Plan (AY24/25): *This is a guide for reference, not the “OFFICAL” recommended plan (many possibilities)*

Year 1		Year 2		Year 3			Year 4		
Sem 1	Sem 2	Sem 1	Sem 2	Sem 1	Sem 2	Special	Sem 1	Sem 2	
MA1521 Calculus	MA1522 Linear Algebra	CS2030 Program. 2	CS2103T S/W Engineering + CS2101 Effective Comm.	InfoSec Elective 1	ATAP (12 units) + IS4231 ³ subject to approval	ATAP (cont.)	InfoSec Elective 2	UE 5	
Pillar 1 CS1010 ¹ Program. 1	ST2334 Probability OR CS2107 ²	CS2107 Intro to InfoSec OR ST2334		IFS4205 ² Capstone Project (8 units)			UE 2	UE 6	
CS1231S Discrete Structures	CS2100 Comp. Org.	CS2106 Operating Sys.	CS3235 Computer Security	IS1108 Digital Ethics			UE 3	UE 7	
Pillar 2	CS2040C Data Struct.	CS2105 Network	Pillar 3	Pillar 6			UE 4	UE 8	
CC 1	UE 1	CC 2	Pillar 4					CC 3	UE 9
			Pillar 5						
20 units	20 units	20 units	24 units	20 units	16 units		20 units	20 units	

Footnote

1. CS1010 is a Pillar (part of ULR)
2. Core requirement is (IFS4205) or (CS4238+IFS4203). If take all 3 , can use as InfoSec Elective or UE.
3. IS4231 (only offered once per AY) is on management and some (work) experience is useful . Preferably during or after ATAP. Double check that it won't hinder graduation plan. Currently it is offered in Semester 2. Not recommended to complete it in your last semester.
4. It is possible to take CS2107 earlier in 1st year. However, more difficult without Network knowledge . If possible, take it concurrently with CS2105.

Other Remarks.

1. Try to clear core as early as possible so as not to disrupt graduation plan.

Many variations/options:

- NOC
- ATAP/SIP/FYP/Start-up/...
- Co-op (only MINDEF)
- Double degree, 2nd Major, Minor.
- Exchange

Second Major/Minor

Some options:

- Second Major in Mathematics
- Second Major in Statistics
- Minor in Mathematics
- Minor in Statistics
- Minor in Financial Mathematics
- Minor in Life Science
- Minor in Geography Information Systems
- Minor in Interactive Media Development
- Minor in Management
- Minor in Technopreneurship
- and many others
- <https://www.nus.edu.sg/registrar/academic-information-policies/undergraduate-students/special-programmes/minor-programmes>

Co-op (Infosec) & MINDEF work-learn scheme

- This is only for students in NUS-MINDEF work-learn scheme.
- Other Co-op not recommended

Admin

- Joint Academic Committee (InfoSec)
 - A/P Roland Yap
 - A/P Liang Zhenkai

Enquiry, question: send to SOC Undergraduate Office
socug@comp.nus.edu.sg

The email will be redirected to admin officer in-charge.

Security Cluster



Abhik Roychoudhury
Binary Analysis
Trustworthy Software
Software Security



Liang Zhenkai
Binary hardening
System Security



Prateek Saxena
System Security Data
Protection
Fintech



Chang Ee-Chien
Multimedia Security
Data Privacy
Cloud Security



Xiao Xiaokui
Privacy



Reza Shokri
Computer Security &
Privacy



Divesh Aggarwal
Information Theoretic
Cryptography



**Prashant Nalini
Vasudevan**
Cryptography, Complexity
theory



Roland Yap
System Security
Cloud Computing
Programming Languages

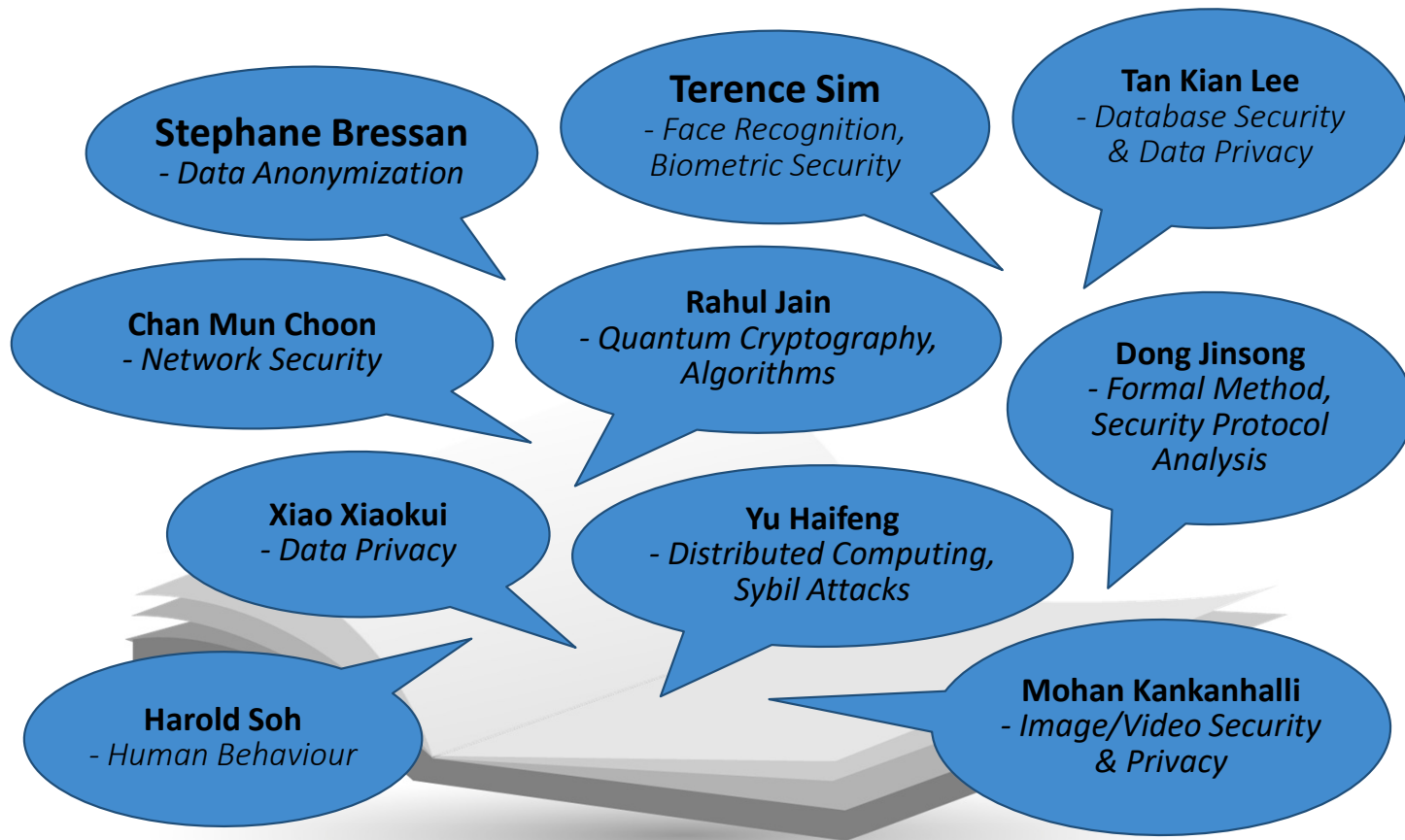


Sufatrio
System Security



Zhang Jiaheng
Cryptography,
Blockchain, ML

Other Researchers ...



Student Achievements

- **Fan Yuting.** *NUS Outstanding Undergraduate Researcher Prize, 2020.*
 - **Ngo Wei Lin.** *Team member. 2nd Place in 10th Singapore Cyber Conquest (SCC), 2019.*
 - **Andrea Thniah.** *Team member. 1st place at the Elevate Tech Jam Hackathon, Toronto, 2019.*
 - **Ahn Tae Gyu & Ngo Wei Lin.** *Obtained prizes from NUS bug bounty, 2019.*
 - **Lee Yu Choy, Yeo Chen Hong,** *Team member. 3rd place in Open Category, Cyber Defenders Discovery Camp 2018.*
 - **Jeremy Heng,** *AiSP Cybersecurity Award (Student Category), 2018.*
 - **Jeremy Heng,** *Team member. 1st place, Singapore Cyber Conquest, 2018.*
- ...

Note: These are awards that I'm aware of. Many students are too shy to inform me about their achievement.

NUS Bug Bounty Hall of Fame 2019

The NUS Bug Bounty Programme is an initiative that empowers our students to discover and report security vulnerabilities on our applications and systems. Through this, we aim to bridge the cyber security skill gap and improve the overall IT security posture in NUS. The programme was inaugurated by [NUS IT](#) in 2019, in partnership with [HackerOne](#) and [NUS School of Computing](#).

During the Bug Bounty challenge in Aug 2019, there were 9 winners awarded a total of USD6,050 and elected into the NUS Hall of Fame.

No	Name	Vulnerability	Bounty (USD)
1	BELLANTE ARMANDO (ikaga1)	Remote Code Execution x 2	\$3,000
2	AHN TAEGYU (letm3through)	Information Disclosure (x2), Reflected Cross Site Scripting (x1)	\$1,500
3	NGO WEI LIN (creastery)	Information Disclosure (x1) Security Misconfiguration (X1)	\$500
4	MIKOLAJ PARANIAK (stellamaris11)	Reflected Cross Site Scripting x 1	\$250
5	MARILYN CHUA MIN XUAN (muffled)	Improper Authentication x 1	\$250
6	KOH ZHENG WEI (dahdah)	Improper Authentication x 1	\$250
7	KINGSTON KUAN JUN XIANG	Information Disclosure x 1	\$100
8	DIPTY OJHA	Improper Authentication x 1	\$100
9	LIU SU (ethanyz)	Improper Authentication x 1	\$100

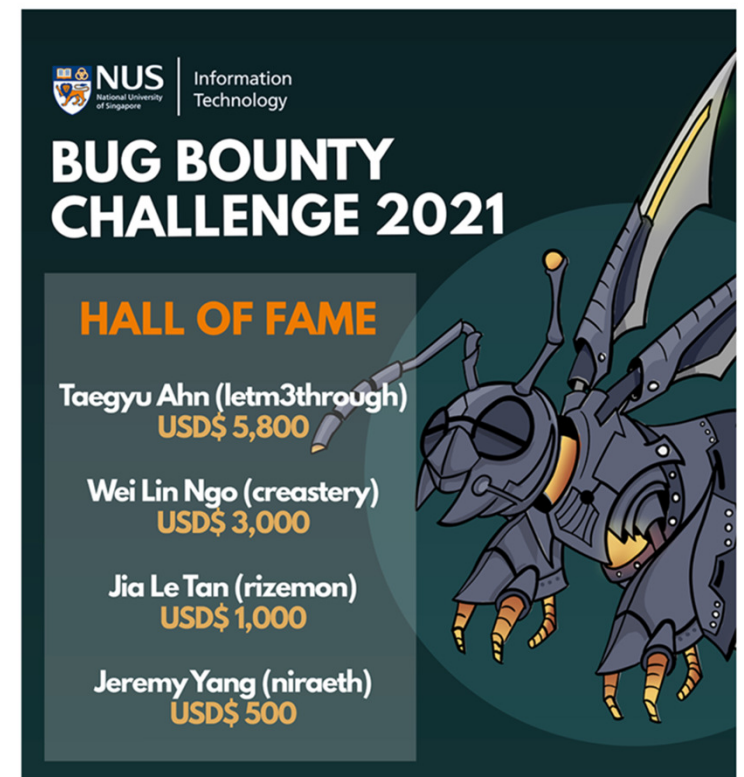
SPECIAL CONTRIBUTIONS

The following issues were uncovered by NUS Greyhats and/or School of Computing Students (as part of penetration testing modules).

No	Profile	Vulnerability	Severity
1	Ngo Wei Lin, Lee Yu Choy, Glenice Tan Yu Xin, Tan Quan Rong Kaiser	Information Disclosure (x2)	Medium

<https://nusit.nus.edu.sg/its/announcements/nus-bug-bounty-hall-of-fame-2019/>

<https://nusit.nus.edu.sg/its/announcements/bug-bounty-challenge-2021-fame/>



note: all infosec students.

Advise & suggestions

- Prepare for the “culture-shock”:
 - Different emphasis. The math are different!
 - Classmates are academically strong!
- Be openminded.
- Learn how to learn.

- Cybersecurity is multidisciplinary.
- ***We are the good guys.***



We are ***white hats!***

Thank You!
Q&A

Let's secure the cyberworld