Information Security Degree Programme @ SoC
2025

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School of Computing, NUS

Information Security

- aka
  - Cyber Security
  - Computer Security
  - **InfoSec** – I will just use InfoSec in this talk

Worldwide Impact of Security Vulnerabilities

19 Jul 2024

Sky News ✔ @SkyNews · **Follow**

Watch live: Massive IT outage around the world with Sky News affected.
Follow live updates: trib.al/By5V2Ih

Watch on X

BREAKING NEWS Mass IT outage affects global travel & GP surgeries
sky news .com FTSE 8148.44 iolent disorder in Leeds and "further arrests will be made over the next

1d ago / 5:17 PM GMT+8

US transportation, police and hospital systems stricken by global CrowdStrike IT outage

US wakes up to Microsoft system collapse from software update that has crippled world IT systems

Share (

House cybersecurity member says airlines have ordered a "global ground stop"

Patrick Smith Patrick Smith is a London-based editor and reporter for NBC News Digital.

Three major U.S. airlines, United, American and Delta, have all ordered global ground stops, according to a senior Democratic member of the House Cybersecurity Committee.

Mobile Guardian cyber-security breach

MOE to remove Mobile Guardian app from all students' devices after global cyber-security breach

UPDATED AUG 05, 2024, 11:23 PM ▾

f ◁

SINGAPORE – The Mobile Guardian app will be removed from all students' personal learning devices, after a global cyber-security breach affected 13,000 students from 26 secondary schools in Singapore.

In a statement on Aug 5, the Ministry of Education (MOE) said the app will be removed from all iPads and Chromebooks as a precautionary measure, and that efforts are under way to safely restore these devices for normal use.

Mobile Guardian is a device management app that helps parents manage their children's device use, restricting screen time and access to specific websites and apps.

Mobile Guardian is a MDM (Mobile Device Management) allowing remote Management of devices available on iOS, Android, …

Necessity – Major Incidents

- **2018 SingHealth**
  - 27 June-4 July: Data Breach, 1.5 million SingHealth patients data leaked
- **2011 Sony Playstation Network** - cyberattack exposed 77M users
- **2016 Dao Hack** siphon $50M (ethereum)
- **2017 NotPetya** Ransomware took down world shipping @Maersk, costs $250-$300M (est.)
- **2021 Colonial Pipeline** (oil pipeline in SE US), ransomware attack halted all ops
  - regional emergency declaration for 17 states and Washington, D.C
  - largest cyberattack on oil infrastructure target in US
- **2024 Jun 24 Indonesia National Data Centre** attack
  - disrupted many public services (immigration & airport), ≥ 4 days
- **2024 Jul 19 CrowdStrike** (*Falcon* endpoint detection)
  - update of bad config file crashed Windows running Falcon worldwide, major disruption mainly enterprises, airlines

InfoSec

- **Why InfoSec?**
  - **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**
    - 40K CVEs in 2024 (28K in 2023)
    - Always new attacks / defences / settings
    - new scenarios: privacy, AI, ...

A Peek

- How do I make system **X** secure? e.g. X = *web server*
- How to do hacking?
    - *not Hollywood*
- How do I keep my data secret?
- Is Bitcoin safe?
- How do I publish data summary but have individual privacy?
- Can my program/app/server be hacked?

- **Difference with CS (Computer Science)?**
    - InfoSec sub-discipline in CS but has additional aspects outside CS

BComp Information Security Degree Programme

- Introduced in 2015. Enhanced and replaced *Specialisation in Information Security.*
- For students whose **main interest** is **InfoSec** / aiming to be **InfoSec professional**
- Core is CS + many InfoSec requirements

InfoSec Degree Programme

- Cybersecurity is **multi-disciplinary**
  - System + Management aspects.
  - Domain specific knowledge.
  - Theory + Principles + Practice
  - Courses are CS*, IFS*, IS*

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

InfoSec Degree Requirements

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

2025/2026 Cohort:

https://www.comp.nus.edu.sg/cug/per-cohort/isc/isc-25-26/

Choose your cohort.

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Information Security Cohort 2025/2026

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.

Summary of degree requirement for Bachelor of Computing in Information Security

Courses	Units	Subtotals
COMMON CURRICULUM REQUIREMENTS [1]		40
University Level Requirements: 6 University Pillars	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
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 CS2103T 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 IFS4205 Information Security Capstone Project or (CS4238 Computer Security Practice and IFS4103 Penetration Testing Practice)	8	
IS4231 Information Security Management	4	
Programme Electives Complete 8 units from the following list of courses: CS4230 Foundations of Modern Cryptography Either CS4236 Cryptography Theory and Practice; or MA4261 Coding and Cryptography CS4238 Computer Security Practice CS4239 Software Security CS4257 Algorithmic Foundations of Privacy CS4276 IoT Security CS5231 Systems Security CS5321 Network Security CS5322 Database Security CS5331 Web Security CS5332 Biometric Authentication IFS4101 Legal Aspects of Information Security IFS4102 Digital Forensics IFS4103 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	8	
Computing Requirements	12	
Complete 12 units of CS-coded, IS-coded, or CP-coded courses subject to the following conditions: • 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: • 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);	12	

Read the fine print!

(40): Common Curriculum — *What a NUS (SoC) graduate should know*

(32): Foundation

(12): Math — *Computing Foundation*

(28): Infosec requirement — *Infosec must know*

(12): CS/Intern — *CS breadth/Intern/FYP*

(36): Unrestrictive UE — *Choose what suits you*

160 MC (total)

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CS1010 is a pre-req of most Computing Courses

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GEMxxxx 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

Legend

- Foundation
- Core
- Pre-requisite

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

Foundation courses:
- CS2030 Program 2
- CS2040C Data Structures
- CS1010 Program 1
- CS2100 Computer Organisation
- CS2101 Eff. Comm
- CS2103T Software Eng
- CS2105 Network
- CS2106 OS
- IS1108 Digital Ethics
- CS1231S math

Core courses:
- CS3235 Comp Sec
- CS2107 Intro InfoSec
- IFS4205 Capstone
- IFS4103 Pentesting
- CS4238 Lab-based
- IS4231 Infosec Management

Electives:
- IFS4101 Legal aspect
- IFS4102 Forensic
- IS4302 Blockchain
- IS4234 Audit
- IS4204 IT Governance
- IS4233 Legal IT
- CS4276 IoT Security
- IS4238 Strategic CyberSec
- CS4239 Software Security
- CS5321 Network Security
- CS5332 Biometric
- CS4257 Privacy
- CS5322 Database Security
- CS5231 Sys Security
- CS4236 Crypto
- CS4230 Crypto Foundations
- CS5331 Web

other requirements

Not all Dependencies shown

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 (within lab)

  - IFS4205: (Capstone Project) Let's build a security system / secure system.
    - Possible to do both IFS4103 + CS4238 + IFS4205 (in principle)

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

Treat these two as a single overloaded first course in security

ELECTIVES

e.g.

CS4239   Software Security

CS4238   Computer Security Practice

IFS4101 Legal Aspects

...

Unrestricted Electives & Dependencies

- 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 – InfoSec Research / Projects

- 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)

Examples of InfoSec Undergraduate Research

- some of my UROP / FYP students

- UROP
  - NUS Outstanding Undergraduate Researcher Prize
    - G.J. Duck, **Y. Zhang**, R. Yap, Hardening binaries against more memory errors, EuroSys 2022

- FYP
  - investigates how good are disassemblers in practice
    - L. Wijayadi, Y. Jiang, R. Yap, Z. Liang, **Zhuohao Liu**, AsiaCCS 2025

Course Planning 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

Many variations/options:

- NOC
- ATAP/SIP/FYP/Start-up/…
- NUS-MINDEF Cyber NSF
- 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

Security Profs

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

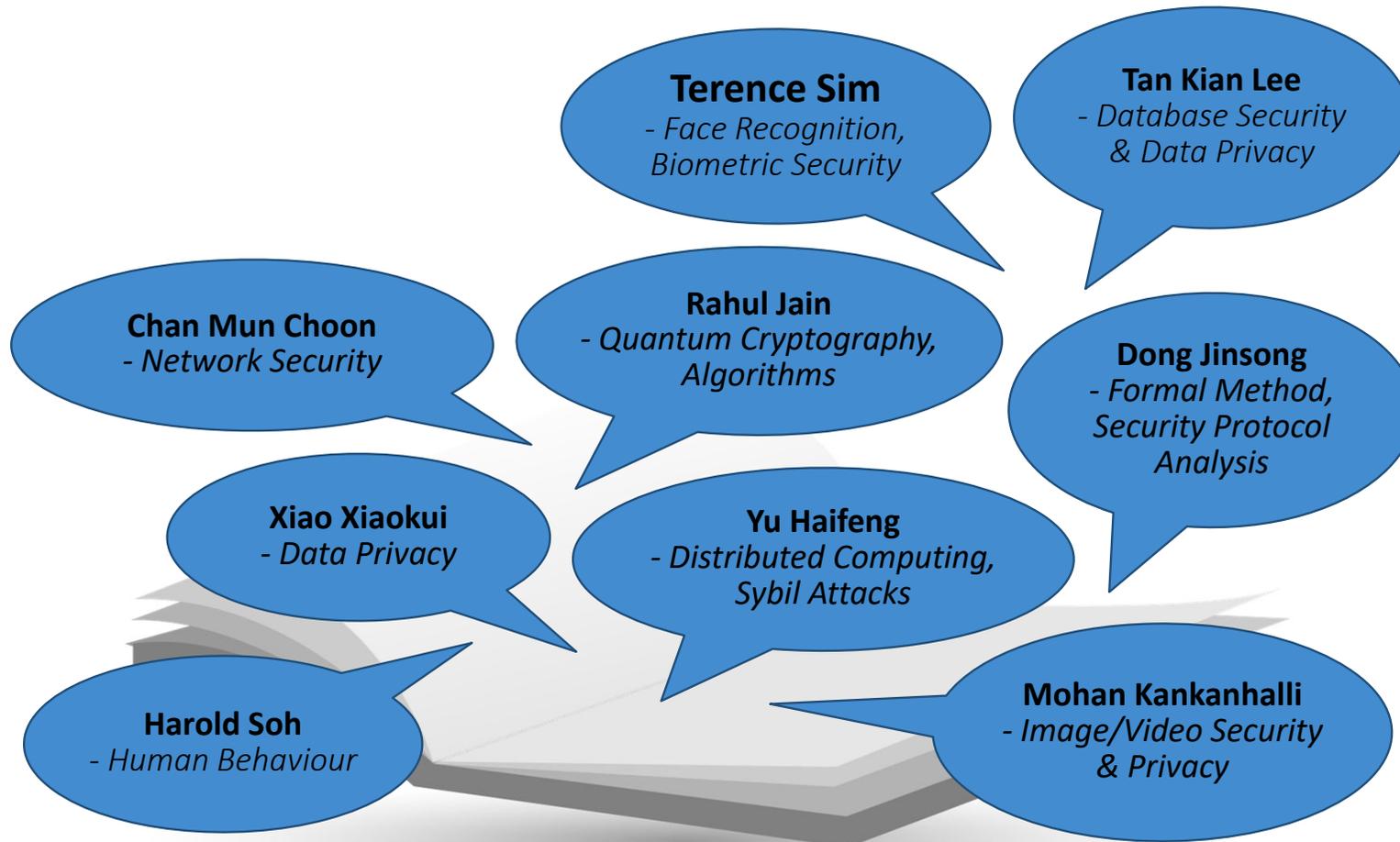**Prashant Nalini
Vasdudevan**
Cryptography, Complexity
theory

Roland *Yap*
System Security
Cloud Computing
Programming Languages

Zhang Jiaheng
Cryptography,
Blockchain, ML

Other Profs ...

Student Activity and Selected Alumni profiles

Glenice Tan

- Enrolled in 2016.
- End of Year 1 – Intern at CSA.
  Penetration Testing.   (Credited as SIP)
- End of Year 3 – Intern at GovTech.
  Red teaming.
- Exchange at National Chiao Tung University (NCTU), Taiwan.
- Final Year Project. Evasive Malwares
- Graduated with Honours (Highest Distinction) in 2020.
- Joined GovTech.

- Activities
  - CTF in Romania with NUS Greyhats in 2017.
  - Teaching Assistant.   *CS2107, (2018-2020)*
  - NUS Greyhats,   *Core Team Member*
  - ISACA Student Chapter,   *President*
  - USP Mentorship Programme, *Peer Mentor*
  - Dean's List (2019).
  - LIT Hackakaton (2019,   *First runner-up & Special Recognition*
  - Hack and Roll (2019),   *Most Annoying Hack*.
  - Code Xtreme Apps (2018),   *Second Runner-up.*
  - Junior Defenders Camp (2017), *Second Runner-up*
  - Cyber Defenders Discovery Camp (2017),   *Silver*
  - iMDA iPrep (2017), *participant*.

Jeremy W.M. Heng

- Enrolled in 2015.

- Summer 2016 - Intern at DSO

- Summer 2017, 2018 – Intern at Apple Inc. San Francisco

- Graduated in 2020, Honours (Distinction)

- Joined Apple Information Security, San Francisco as Security Engineer.

- Activities

  - NUS Greyhats, Core Member

  - DEFCON Singapore Group (DC65), Founder

  - Singapore Cybersecurity Awards, Student Category, 2018

  - ASEAN Cyber SEA Games, 2nd Place (Team Singapore), 2017

  - Amazon MicroCTF Bsides Las Vegas, Champion, 2016

  - Singapore Cyber Conquest Championship, Champion, 2017

  - Singapore Cyber Conquest Championship, Champion, 2016,

  - CVE-2017-15587, CVE-2017-14994, CVE-2017-7687, CVE-2017-9790

  - Nandy Narwhals Security Blog, Author.

  - Involved in organizing: CrossCTF 2017, NUS Grehyats X-CTF 2017, NUS Greyhats CTF101 Workshop, … .

  …

Advice & Suggestions

- Prepare for the "**culture-shock**":
    - Different emphasis. The maths is different!
    - Classmates are academically strong!
    - Deal with the **Real World**

- 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