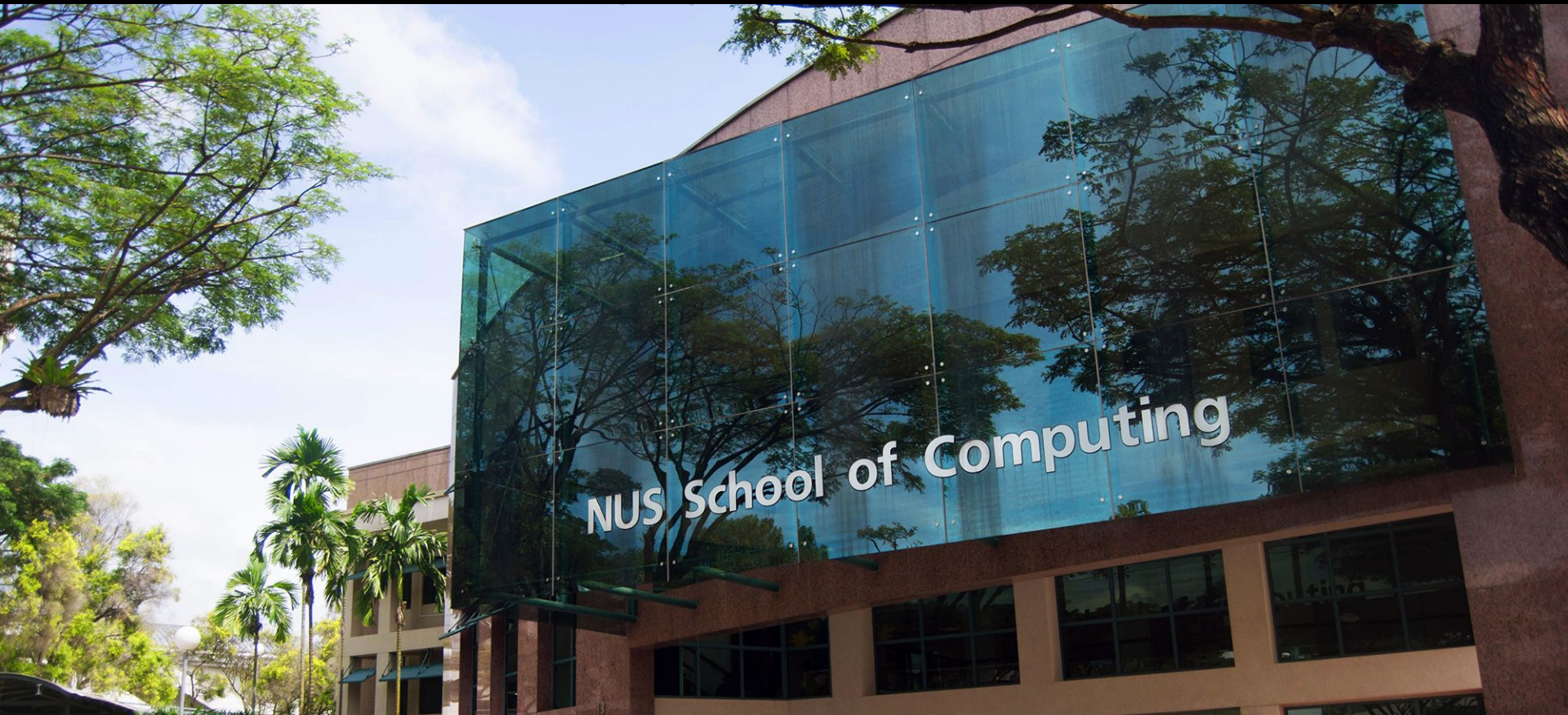# Welcome!

CS Curriculum

(Seth Gilbert)

University Life

classes

socializing

extracurriculars

University Life

classes

socializing

extracurriculuars

"What should I do now?"

Disclaimer

Information on these slides is simplified for this presentation and should not be treated as official degree requirements.

Students should *always* refer to the official SoC Website and NUS Bulletin for complete up-to-date information.

Please check with the SoC Undergraduate Office to clarify any requirements that are unclear.

Disclaimer

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Please check with the SoC Undergraduate Office to clarify any requirements that are unclear.

Focus today: BComp(CS) degree requirements.

Other programs (Turing, DDP, etc.) are similar.

BComp(CS) Degree Requirements

*Special programmes and double degree programs are slightly different.

CS Program Requirements

SoC Common Core

80 units	40 units	40 units

Unrestricted Electives

CS Goals

Strong technical foundations.

Excellent problem solving skills.

Broad knowledge of the field.

In-depth knowledge of (at least) one specialized area.

Good communication and teamwork skills.

BComp(CS) Degree Requirements

CS Program
Requirements

80 units

40 u

Unres
Elec

36 units (9 courses)	32 units (~7 courses)	12 units (3 courses)
CS Foundations	Breadth & Depth Industrial Experience	Math & Sci

CS Foundations

Algorithms and Theory

What do you want to do?

How do you do it efficiently?

Programming and Software Engineering

How do you translate your idea into code?

How do you build it?

How do you work on a team?

Computer Systems

What is really happening underneath the abstractions?

How does a computer work?

How does a network work?

AI & ML

How do we design intelligent systems?

Big data

How do computers learn?

CS Foundations

Areas not covered in the CS Foundations:
- Security
- Databases
- Media
- Computational Biology

Algorithms and Theory

What do you want to do?

How do you do it efficiently?

Programming and Software Engineering

How do you translate your idea into code?

How do you build it?

How do you work on a team?

Computer Systems

What is really happening underneath the abstractions?

How does a computer work?

How does a network work?

AI & ML

How do we design intelligent systems?

Big data

How do computers learn?

CS Foundations

The Beginning

Algorithms and Theory

Programming and Software Engineering

Computer Systems

AI & ML

CS Foundations

The Beginning
CS1101s Programming Methodology
CS1231s Discrete Structures

Algorithms and Theory

Programming and Software Engineering

Computer Systems

AI & ML

CS Foundations

The Beginning

CS1101s
Programming
Methodology

CS1231s
Discrete
Structures

Algorithms and Theory

CS2040S
Data Structures
& Algorithms

CS3230
Design & Analysis
of Algorithms

Programming and Software Engineering

Computer Systems

AI & ML

CS Foundations

The Beginning

CS1101s
Programming Methodology

CS1231s
Discrete Structures

Algorithms and Theory

CS2040S
Data Structures & Algorithms

CS3230
Design & Analysis of Algorithms

Programming and Software Engineering

CS2030S
Programming Methodology II

CS2103T
Software Engineering

CS2101
Effective Communication

Computer Systems

AI & ML

CS Foundations

The Beginning

CS1101s
Programming
Methodology

CS1231s
Discrete
Structures

Algorithms and Theory

CS2040S
Data Structures
& Algorithms

CS3230
Design & Analysis
of Algorithms

Programming and Software Engineering

CS2030S
Programming
Methodology II

CS2103T
Software
Engineering

CS2101
Effective
Communication

Computer Systems

CS2100
Computer
Organization

CS2106
Intro to Operating
Systems

AI & ML

CS Foundations

The Beginning

CS1101s
Programming
Methodology

CS1231s
Discrete
Structures

Algorithms and Theory

CS2040S
Data Structures
& Algorithms

CS3230
Design & Analysis
of Algorithms

Programming and Software Engineering

CS2030S
Programming
Methodology II

CS2103T
Software
Engineering

CS2101
Effective
Communication

Computer Systems

CS2100
Computer
Organization

CS2106
Intro to Operating
Systems

AI & ML

CS2109S
Intro to AI and
Machine Learning

Semester 1	Semesters 2 & 3	Semesters 3 & 4

The Beginning

CS1101s
Programming
Methodology

CS1231s
Discrete
Structures

Algorithms and Theory

CS2040S
Data Structures
& Algorithms

CS3230
Design & Analysis
of Algorithms

Programming and Software Engineering

CS2030S
Programming
Methodology II

CS2103T
Software
Engineering

CS2101
Effective
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Computer Systems

CS2100
Computer
Organization

CS2106
Intro to Operating
Systems

AI & ML

CS2109S
Intro to AI and
Machine Learning

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Design & Analysis
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CS2030S
Programming
Methodology II

CS2103T
Software
Engineering

CS2101
Effective
Communication

Computer Systems

CS2100
Computer
Organization

CS2106
Intro to Operating
Systems

AI & ML

CS2109S
Intro to AI and
Machine Learning

Industry
Experience

Semester
abroad /
exchange /
NOC / SEP

BComp(CS) Degree Requirements

CS Program
Requirements

| 80 units | 40 u |

Unres
Elec

| 36 units (9 courses) | 32 units (~7 courses) | 12 units (3 courses) |

CS
Foundations

Breadth &
Depth

Industrial
Experience

Math

http://www.nus.edu.sg/nusbulletin/school-of-computing/undergraduate-education/degree-requirements/bachelor-of-computing-in-computer-science/

Breadth & Depth

1. Complete 12 units at level 4000 or above.

2. Satisfy a focus area:

   Complete 3 "primary" courses in an area (at least one level 4000).

3. Get industrial experience:

   Complete 3 month (6 unit) or 6 month (12 unit) industrial experience.

10 Focus Areas

1. Algorithms and Theory
2. Artificial Intelligence
3. Computer Graphics and Games
4. Computer Security
5. Database Systems
6. Multimedia Information Retrieval
7. Networking and Distributed Systems
8. Parallel Computing
9. Programming Languages
10. Software Engineering

Algorithms & Theory

CS3230
Design and Analysis of Algorithms

CS3236
Introduction to Information Theory

CS4231
Parallel and Distributed Algorithms

CS3231
Theory of Computation

CS3234
Optimisation Algorithms

Artificial Intelligence

CS2109S
Intro to AI and
Machine Learning

CS3263
Foundations of
Artificial Intelligence

CS3264
Foundations of
Machine Learning

CS4243
Computer Vision and
Pattern Recognition

CS4244
Knowledge Representation
and Reasoning

CS4246
AI Planning and
Decision Making

CS4248
Natural Language
Processing

Computer Graphics and Games

CS3241
Computer Graphics

CS3247
Game Development

CS3242
3D Modelling and Animation

CS4247
Graphics Rendering Techniques

CS4350
Game Development Project

Computer Security

CS2107
Introduction to
Information Security

CS4236
Cryptography Theory
and Practice

CS3235
Computer Security

CS4238
Computer Security
Practice

CS4239
Software Security

Database Systems

CS2102
Database Systems

CS4221
Database Applications
Design and Tuning

CS3223
Database Systems
Implementation

CS4224
Distributed Databases

CS4225
Big Data Systems for Data
Science
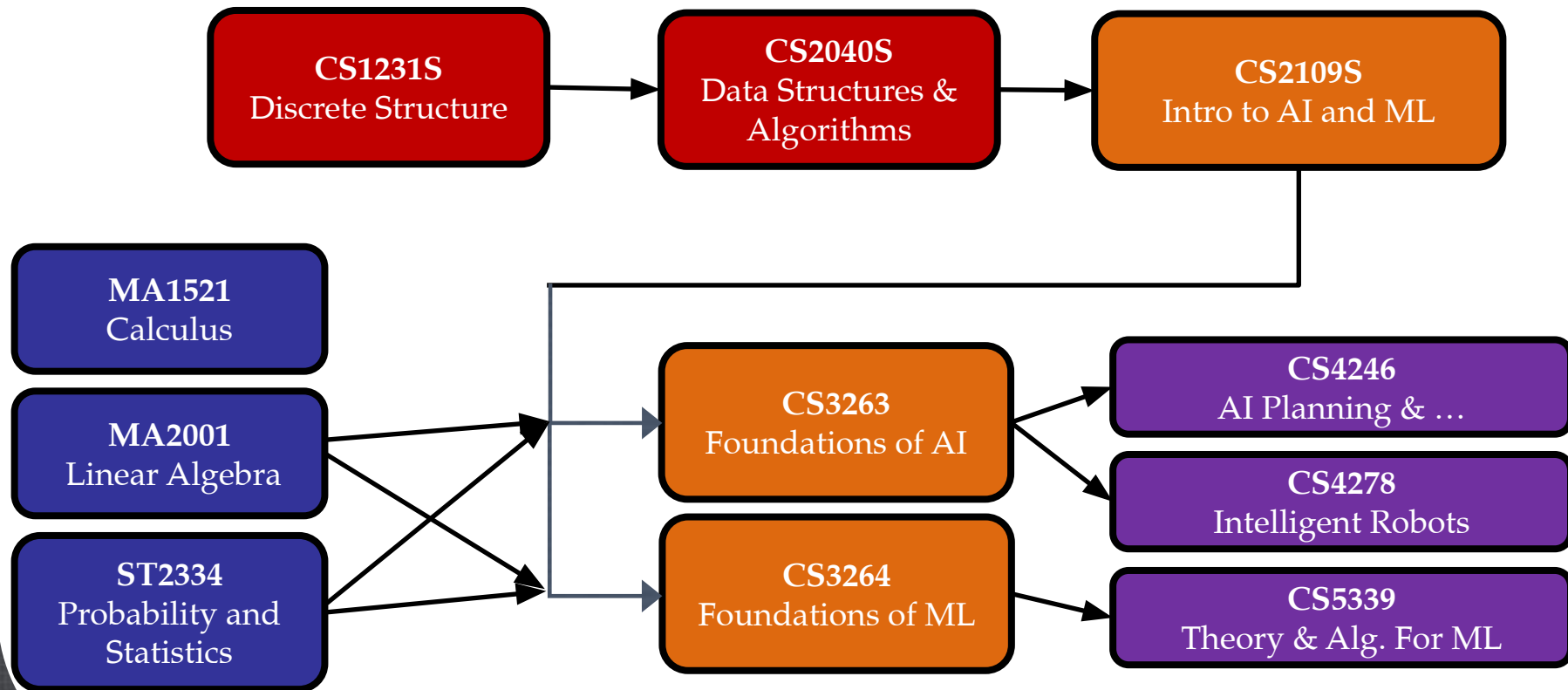
Warning: Check Prerequisites

Example: Artificial Intelligence
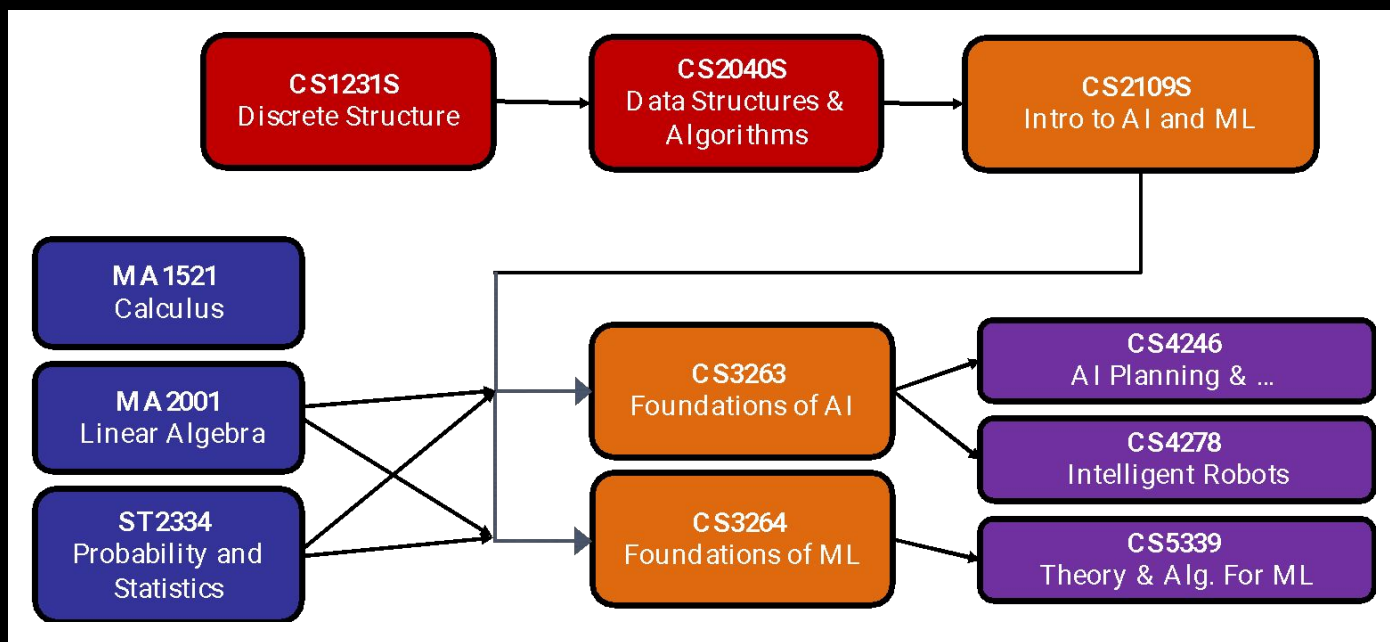
Warning: Check Prerequisites

Example: Computer Graphics & Games
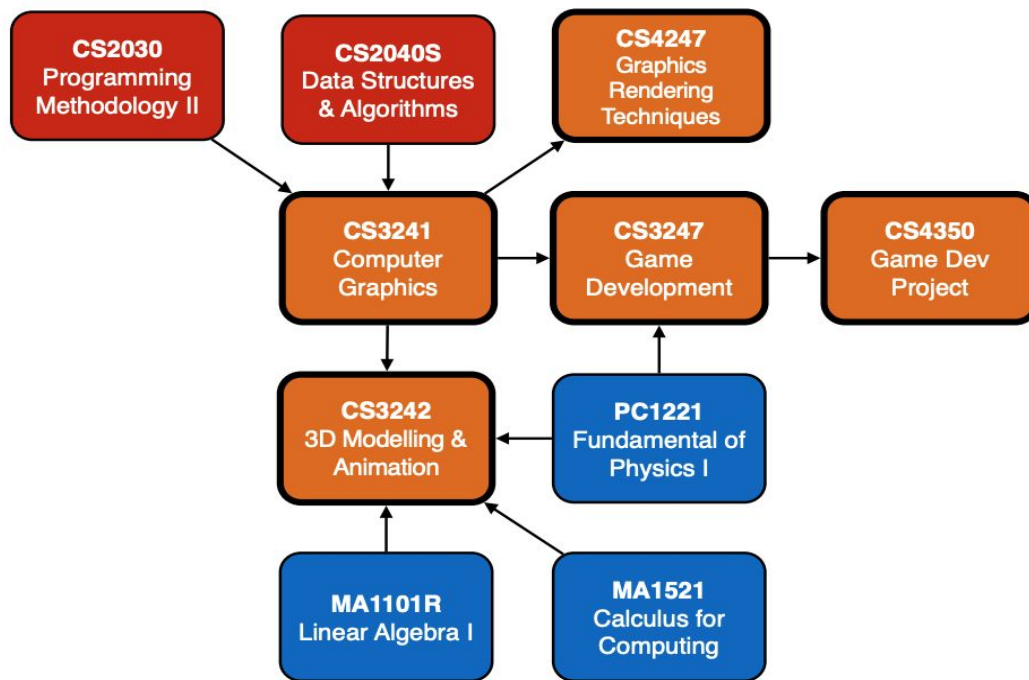
Focus area electives

Each focus areas has a set of "electives" for students who want to learn more about the area.

Breadth & Depth

1. Complete 12 units at level 4000 or above.

2. Satisfy a focus area:

   Complete 3 "primary" courses in an area (at least one level 4000).

3. Get industrial experience:

   Complete 3 month (6 unit) or 6 month (12 unit) industrial experience.

Industrial Experience

"Complete 3 month (6 unit) or 6 month (12 unit) industrial experience."

ATAP
Advanced Technology Attachment Program

IIC
Industry Internship Program

SIP
Student Internship Program

CVWO
Computing Voluntary Welfare Organization

NOC
NUS Overseas College

Other…

Students with CAP of 4.00 or higher may replace Industry Experience with a dissertation (Final Year Project: CP4101).

Students who aim for Honours (Highest Distinction) must pass the programme's dissertation course (i.e. CP4101).

BComp(CS) Degree Requirements

CS Program
Requirements

80 units   40 u

Unres
Elec

36 units (9 courses)	32 units (~7 courses)	12 units (3 courses)
CS Foundations	Breadth & Depth	Industrial Experience	Math

BComp(CS) Degree Requirements

36 units
(9 courses)

32 units
(~7 courses)

12 units
(3 courses)

MA1521
Calculus for
Computing

MA1522
Linear
Algebra

ST2334
Probability &
Statistics

Math courses

BComp(CS) Degree Requirements

*Special programmes and double degree programs are slightly different.

CS Program
Requirements

SoC
Common Core

| 80 units | 40 units | 40 units |

Unrestricted
Electives

BComp(CS) Degree Requirements

Unrestricted Electives

SoC Common Core

| 40 units | 40 units |

| 4 units
(1 course) | 24 units
(6 courses) | 12 units
(3 courses) |

Ethics: IS1108 Digital Ethics and Privacy

University Pillars

Interdisciplinary/ Cross-Disciplinary Courses

BComp(CS) Degree Requirements

https://www.nus.edu.sg/registrar/academic-information-policies/undergraduate-students/general-education/for-students-admitted-from-AY2021-22

University Pillars

Cultures & Connections	Critique & Expression	Data Literacy	Digital Literacy	Singapore Studies	Communities & Engagement

BComp(CS) Degree Requirements

BComp(CS) Degree Requirements

University Pillars

Data Literacy:
- Preregistered: GEA1000
- Other options: DSA1101, STA1131
- Can drop GEA1000 and apply for other options

Cultures & Connections	Critique & Expression	Data Literacy	Digital Literacy	Singapore Studies	Communities & Engagement

ES2660
Communicating in the Information Age

CS1101S
Programming Methodology

Data Literacy

GEA1000: Quantitative Reasoning
- Intro to statistics
- Data analysis
- Data analysis project

Broader
Less mathematical
Less programming

ST1131: Introduction to Statistics and Statistical Computing
- Statistics
- R programming
- Data analysis

DSA1101: Introduction to Data Science
- Basic probability and statistics
- Data manipulation
- Data analysis

Targeted at DSA students
Fewer seats available
More overlap with CS courses

Data Literacy

GEA1000: Quantitative Reasoning
- Intro to statistics
- Data analysis
- Data analysis project

Computational/programming centered
Mathematically rigorous
Good preparation for CS courses in AI/ML

ST1131: Introduction to Statistics and Statistical Computing
- Statistics
- R programming
- Data analysis

DSA1101: Introduction to Data Science
- Basic probability and statistics
- Data manipulation
- Data analysis

BComp(CS) Degree Requirements

Interdisciplinary / Cross-disciplinary courses

- Choose three courses from the specified course lists.

- At least two must be interdisciplinary.

Interdisciplinary = integrates more than one discipline

Cross-disciplinary = a field different from CS that has interesting connections to CS.

BComp(CS) Degree Requirements

Examples: Interdisciplinary courses

- IS1128 IT, Management and Organisation

- IS2238 Economics of IT and AI

- HSH1000 The Human Condition

- HSI2001 Scientific Inquiry & Health: Good Science, Bad Science

- HSI2011 The World of Quantum

- DTK1234 Design Thinking

- EG2501 Liveable Cities

- IE2141 Systems Thinking and Dynamics

- PF1101 Fundamentals of Project Management

BComp(CS) Degree Requirements

Examples: Cross-disciplinary courses

- DAO2703 Operations and Technology Management

- EL1101E The Nature of Language

- SPH2002 Public Health and Epidemiology

- NUR1113A Healthy Ageing and Well-being

- EG2201A User-Centred Collaborative Design

- EG2310 Fundamentals of Systems Design

- Any Chemistry, Physics, or Biological Sciences (PC, CM, or LSM coded)

BComp(CS) Degree Requirements

Unrestricted Electives

SoC Common Core

40 units

40 units

4 units
(1 course)

24 units
(6 courses)

12 units
(3 courses)

Ethics: IS1108
Digital Ethics
and Privacy

University Pillars

Interdisciplinary/
Cross-Disciplinary
courses

BComp(CS) Degree Requirements

CS Program
Requirements

SoC
Common Core

| 80 units | 40 units | 40 units |

Unrestricted
Electives

Some options:

- Second major in mathematics.
- Second major in statistics.
- Minor in mathematics.
- Minor in statistics.
- Minor in financial mathematics.
- Minor in life sciences.
- Minor in geographic information systems.

- Minor in interactive media development.
- Minor in management.
- Minor in management of technology.
- Minor in entrepreneurship.

And many more…

40 units of Unrestricted Electives are useful here…

How should I plan my time?

Year 1: The Basic Foundation

CS1101s Programming Methodology

CS2040s Data Structures & Algorithms

IS1108 Privacy/Ethics in Computing

CS2030s Programming Methodology II

CS1231s Discrete Structures

CS2100 Computer Organization

How to think computationally.
How to solve computational problems.
How to program.
How does a computer work.
Basic computing math.
Ethical/legal/social issues.

Data Literacy course

Math

University Pillar or Interdisciplinary

Math

Year 2: The CS Core

CS2103T Software Engineering

CS2106 Intro. to Operating Systems

CS2101 Communication

ES2660 Communication

CS3230 Design & Analysis of Algorithms

CS2109S Intro to AI and Machine Learning

How to deal with complex systems.
How to deal with complex software.
How to solve hard problems.
Advanced algorithmic techniques.
Begin to specialize.
Develop software skills.

University Pillar or Interdisciplinary

Math

University Pillar or Interdisciplinary

University Pillar or Interdisciplinary

Year 3: The Practical Year

Focus Area Primary	Industrial Experience

Apply knowledge to projects.
Learn practical skills on internships or NOC.
Drill deeper into focus area.

Focus Area Primary	Breadth & Depth	University Pillar or Interdisciplinary	University Pillar or Interdisciplinary
Breadth & Depth	Elective	Elective	Math

Year 4:
Choose Your Own Adventure

Focus Area Primary

Breadth & Depth

Study advanced courses.
Do research.
Work on projects.
Broaden your knowledge.

Breadth & Depth

Breadth & Depth

Elective

Elective

Breadth & Depth

Elective

Elective

Elective

What if I can't take XXX in Year 1?

Example: Student cannot take CS1231S in Semester 1
- Semester 1: MA1100
- Semester 2: CS1231S
- Semester 3: CS2040S
- Semester 4: CS2103T

It's okay!

As long as CS Foundations are *mostly* finished by the end of Year 2, you are on track!

What should I do during the summer?

What should I do during the summer?

- Orbital
- CVWO
- Internship
- Summer School
- Research
- Independent project
- Etc.

Research at SOC

Lots of exciting research happening in Computer Science!

Examples:

- SINGA: platform for deep learning.

- Self-driving car(t)s.

- Drones.

- Singapore Cyber-security Consortium

- Cryptocurrencies.

- Cancer data analysis.

- SeSaMe: Sensor-enhanced Social Media.

- TSUNAMi: Trustworthy Systems from UN-trusted component AMalgamations

Undergraduate Research at SOC

You can be part of it…

Error Correction of Reads in DNA Fragment Assembly
By Zheng Jia

Secure and Lightweight Acknowledgment for Peer-to-Peer Overlay Networks
By Lim Chee Liang

Directed Novelty and Redundancy in Information Retrieval
By Joseph Tan Kai Huang

Algorithms for Peptide Sequencing via Tandem Mass Spectrometry
By Ye Nan

Recognition of Polyadenylation Sites from Genomic Arabidopsis Sequences
By Koh Chuan Hock

A Repetition-Based Framework for Lyric Alignment in Popular Songs
By Luong Minh Thang

Performance Analysis of Two Data Delivery Schemes for Underwater Sensor Networks
By Pius W. Q. Lee

Modeling from Photographs
By Tan Min Rui
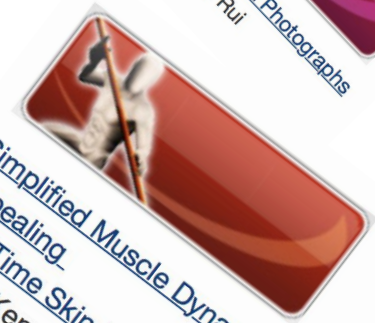
Simplified Muscle Dynamics For Appealing Real-Time Skin Deformation
By Lee Keng Siang

Turing Programme

Alan Turing

Turing Programme:

- Take CS2309: Research Methodology.

- Do a UROP (Undergraduate Research Opportunity Project)

- Do an FYP (Final Year Project)

Similar requirements, with additional research.

Why?

- You are interested in research!

- You may want to pursue a career in research (either industrial or academic).

- "Honors" program for our most successful students.

- Networking opportunities.

- Mentor in research.

By invitation only.
Based on recommendation from
CS2309 instructor or UROP advisor.

http://researchweek.comp.nus.edu.sg

http://researchweek.comp.nus.edu.sg/computing/

A few words of advice… from your seniors…

Notes to CS Freshman from the Future

Slides from this talk

https://bit.ly/CSBrief20

Welcome!