Welcome!

CS Curriculum
(Seth Gilbert)
University Life

classes

socializing

extracurriculars
University Life

classes

socializing

extracurriculars
“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.
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**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.

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<th>CS Program Requirements</th>
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<td>80 units</td>
<td>40 units</td>
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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

36 units (9 courses)
CS Foundations

32 units (~7 courses)
Breadth & Depth

12 units (3 courses)
Industrial Experience

12 units (3 courses)
Math & Sci

Unres Elec

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<td>What do you want to do?</td>
<td>How do you translate your idea into code?</td>
<td>How does a computer work?</td>
<td>How do we design intelligent systems?</td>
<td>How do computers learn?</td>
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<td></td>
<td>How do you do it efficiently?</td>
<td>How do you build it?</td>
<td>How does a network work?</td>
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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
- How does a computer work?
- What is really happening underneath the abstractions?
- How does a network work?

AI & ML
- How do we design intelligent systems?
- How do computers learn?

Big data

How do computers learn?
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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
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<td>CS2030S Programming Methodology II</td>
<td>CS3230 Design &amp; Analysis of Algorithms</td>
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<tr>
<td>CS1231s Discrete Structures</td>
<td>CS2040S Data Structures &amp; Algorithms</td>
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<td></td>
<td>CS2103T Software Engineering</td>
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<td>CS2101 Effective Communication</td>
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<tr>
<td>Computer Systems</td>
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Semester 1

The Beginning
- CS1101s Programming Methodology
- CS1231s Discrete Structures

Semesters 2 & 3

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

Semesters 3 & 4

- CS2109S Intro to AI and Machine Learning
BComp(CS) Degree Requirements

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

- Math

Unres Elect

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

CS4231
Parallel and Distributed Algorithms

CS3231
Theory of Computation

CS3234
Optimisation Algorithms

CS3236
Introduction to Information Theory
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

CS3242
3D Modelling and Animation

CS4247
Graphics Rendering Techniques

CS3247
Game Development

CS4350
Game Development Project
Warning: Check Prerequisites

Example: Artificial Intelligence
Warning: Check Prerequisites

Example: Computer Graphics & Games
Each focus area 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.”

Students with GPA 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).

**ATAP**
Advanced Technology Attachment Program

**IIC**
Industry Internship Program

**SIP**
Student Internship Program

**CVWO**
Computing Voluntary Welfare Organization

**NOC**
NUS Overseas College

**Other…**
BComp(CS) Degree Requirements

CS Program Requirements

80 units
40 units

Unrestricted Electives

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)

Math courses:
- MA1521 Calculus for Computing
- MA1522 Linear Algebra
- ST2334 Probability & Statistics
BComp(CS) Degree Requirements

*Special programmes and double degree programs are slightly different.

CS Program Requirements

80 units

SoC Common Core

40 units

40 units

Unrestricted Electives

BComp(CS) Degree Requirements

- **Unrestricted Electives**: 40 units
- **SoC Common Core**: 40 units

  - **Ethics: IS1108 Digital Ethics and Privacy**: 4 units (1 course)
  - **University Pillars**: 24 units (6 courses)
  - **Interdisciplinary/Cross-Disciplinary Courses**: 12 units (3 courses)
BComp(CS) Degree Requirements

https://www.nus.edu.sg/registrar/academic-information-policies/undergraduate-students/general-education/for-students-admitted-from-AY2021-22
BComp(CS) Degree Requirements

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University Pillars

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

ES2660
Communicating in the Information Age

CS1101S
Programming Methodology
BComp(CS) Degree Requirements

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

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

University Pillars

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

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

Broader
Less mathematical
Less programming

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

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

Computational/programming centered
Mathematically rigorous
Good preparation for CS courses in AI/ML
BComp(CS) Degree Requirements

University Pillars

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

Communities & Engagement
- One of the Pillars under Common Curriculum
- GEN courses may be Semester or Year long

ES2660 Communicating in the Information Age

CS1101S Programming Methodology

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

Issues: semester-long GEN courses have limited capacity per semester – alternative is year-long GEN Courses (i.e. Service Learning)

Students planning for enrichment programmes (Student Exchange Prog (SEP), NOC and/or internships) who wish to take year-long GEN option – recommend not leaving the GEN course too late and recommend to include Servicing Learning in their Study Plan.

Include Service Learning in Study Plan

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<th>Sem 2</th>
<th>Sem 3</th>
<th>Sem 4</th>
<th>Sem 5</th>
<th>Sem 6</th>
<th>Sem 7</th>
<th>Sem 8</th>
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<tbody>
<tr>
<td>No SEP/NOC courses</td>
<td>GEN2050,60,61,62,70</td>
<td>GEN2050,61,62</td>
<td>GEN2060,70</td>
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<tr>
<td>Ex: SEP in Sem 5</td>
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<td>Ex: SEP in Sem 6</td>
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<tr>
<td>Ex: NOC in Sem 3, plus SEP in Sem 5</td>
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preferred restrictions apply
BComp(CS) Degree Requirements

Unrestricted Electives: 40 units

SoC Common Core:
- 4 units (1 course): Ethics: IS1108 Digital Ethics and Privacy
- 24 units (6 courses): University Pillars
- 12 units (3 courses): Interdisciplinary / Cross-Disciplinary Courses
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: 40 units

SoC Common Core: 40 units

- Ethics: IS1108 Digital Ethics and Privacy: 4 units (1 course)
- University Pillars: 24 units (6 courses)
- Interdisciplinary/Cross-Disciplinary courses: 12 units (3 courses)
BComp(CS) Degree Requirements

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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
- University Pillar or Interdisciplinary
- Math
- 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.

Breadth & Depth

University Pillar or Interdisciplinary

Focus Area Primary

Breadth & Depth

University Pillar or Interdisciplinary

Breadth & Depth

Elective

Elective

Elective

Math
Year 4: Choose Your Own Adventure

- **Focus Area Primary**
- **Breadth & Depth**
- **Breadth & Depth**
- **Breadth & Depth**
- **Elective**
- **Elective**
- **Elective**

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

Algorithms for Peptide Sequencing via Tandem Mass Spectrometry
By Ye Nan

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

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

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

Simplified Muscle Dynamics For Appealing Real-Time Skin Deformation
By Lee Keng Siang

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