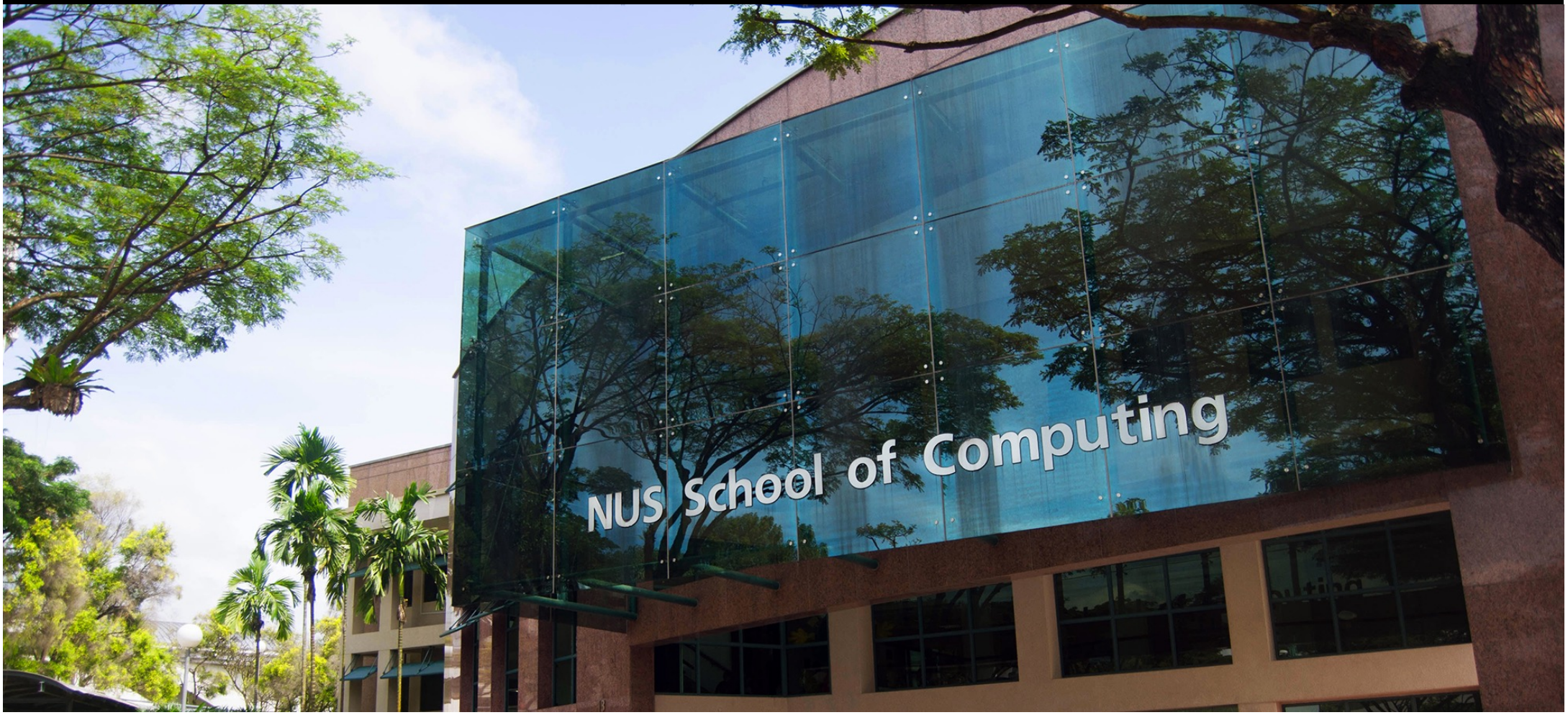
Welcome!

CS Curriculum

(Seth Gilbert)



University Life

classes

socializing

extracurriculars

NUS HACKERS

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.

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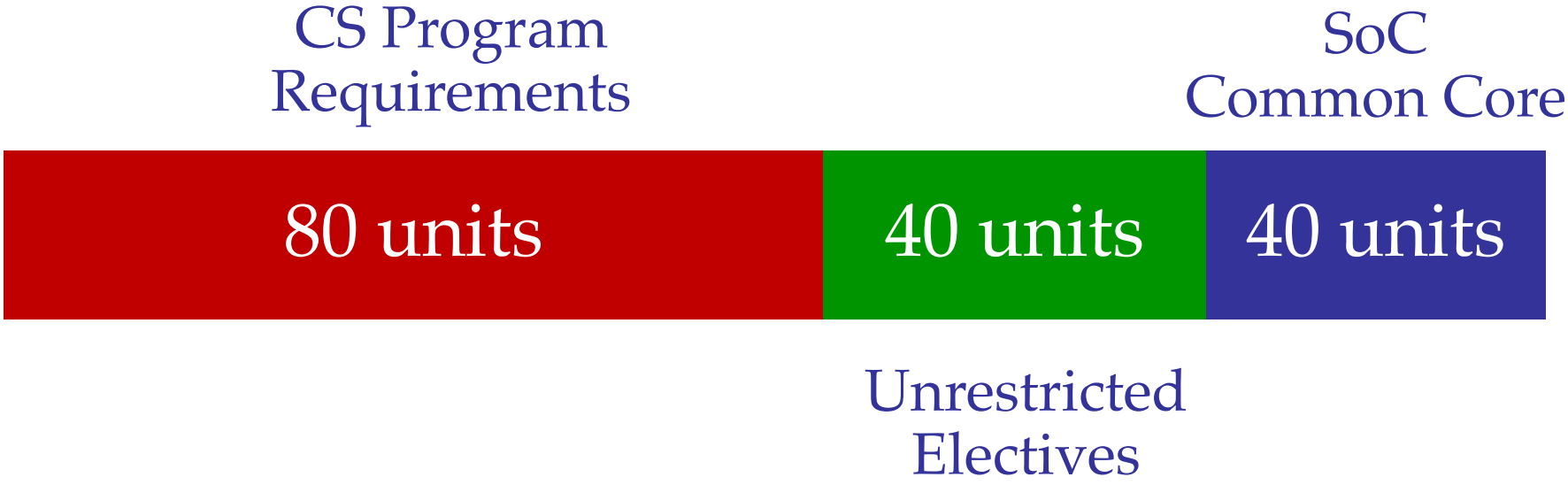
Focus today: BComp(CS) degree requirements.

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

BComp(CS) Degree Requirements

*Special programmes and double degree programs are slightly different.



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

CS Goals

Strong technical foundations.

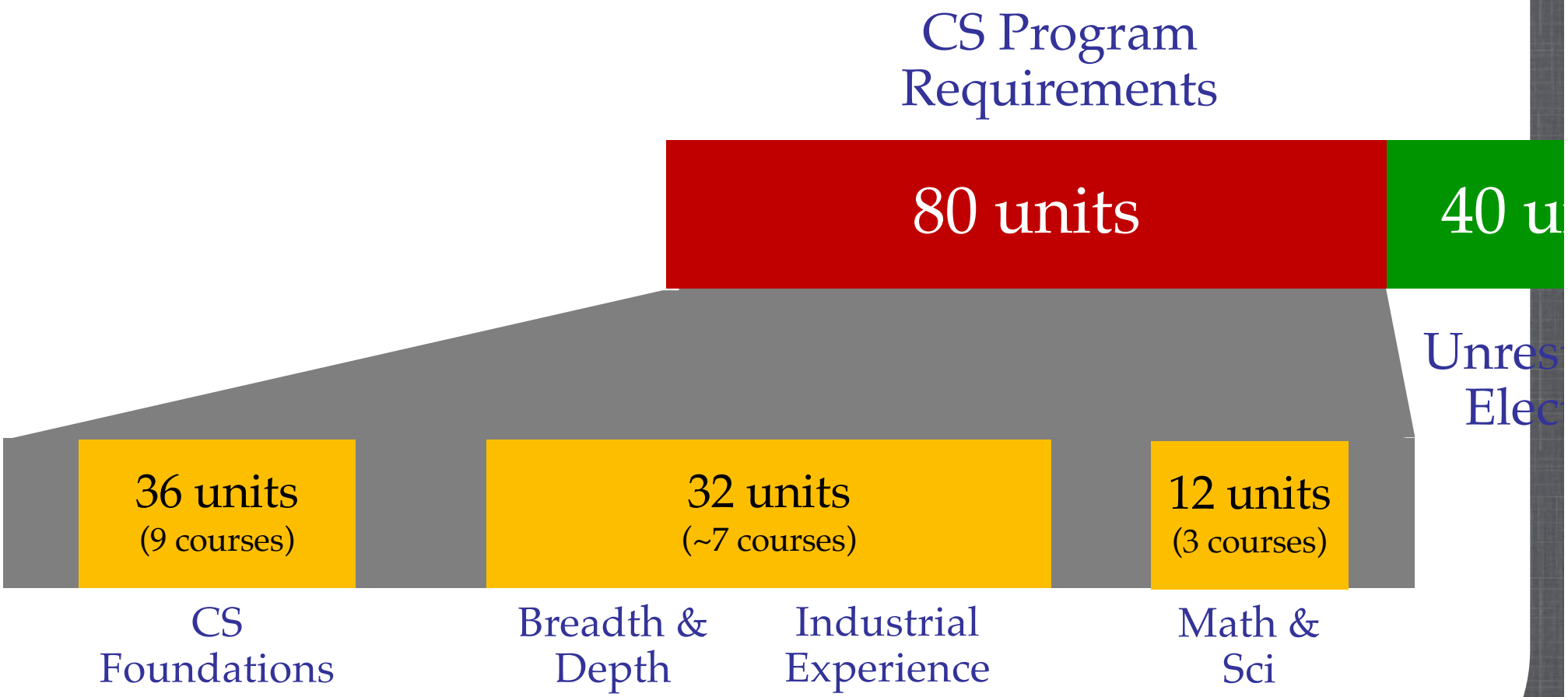
Excellent problem solving skills.

Broad knowledge of the field.

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

Good communication and teamwork skills.

BComp(CS) Degree Requirements



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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

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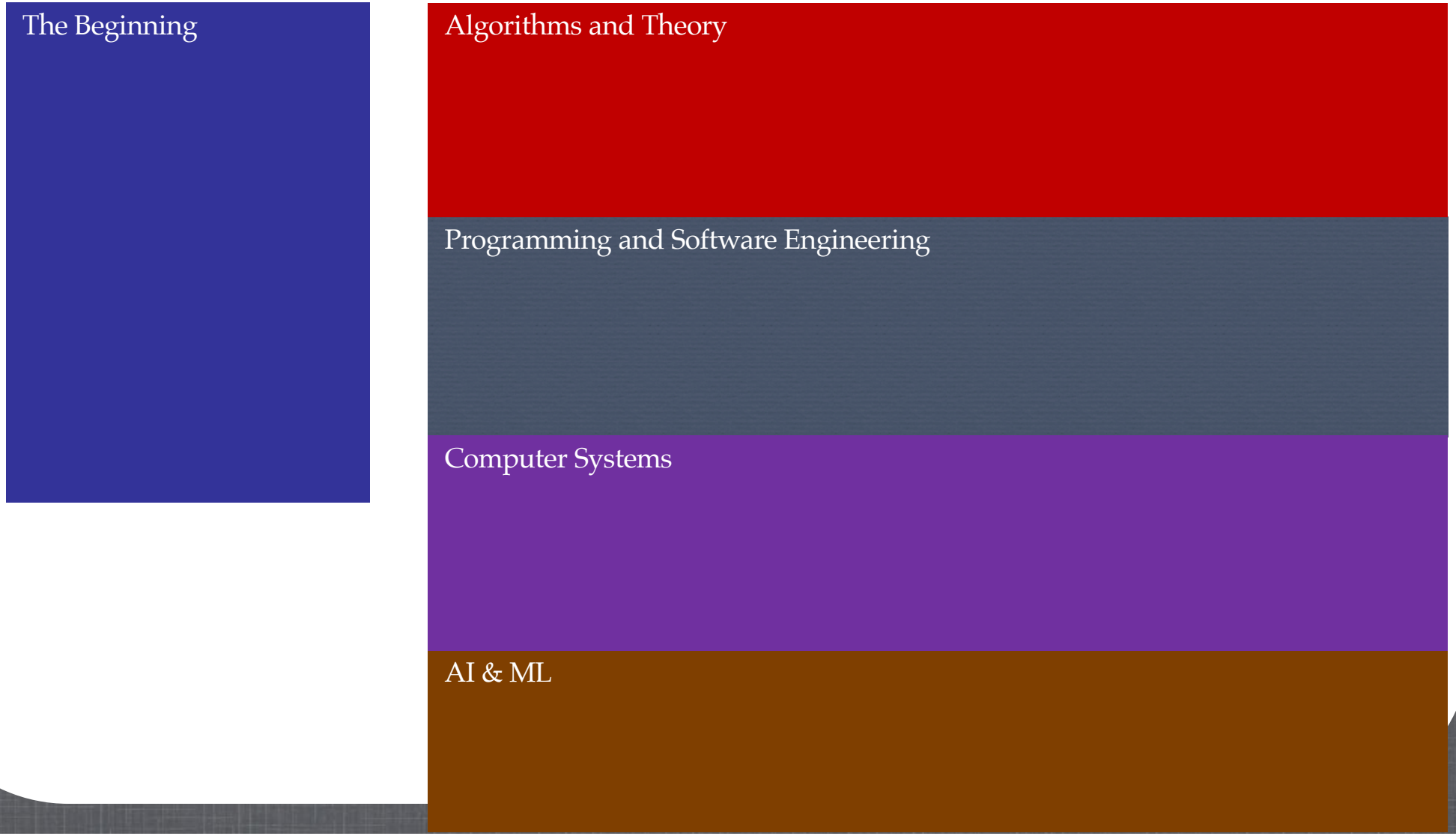
CS Foundations



CS Foundations

The Beginning

CS1101s
Programming
Methodology

CS1231s
Discrete
Structures

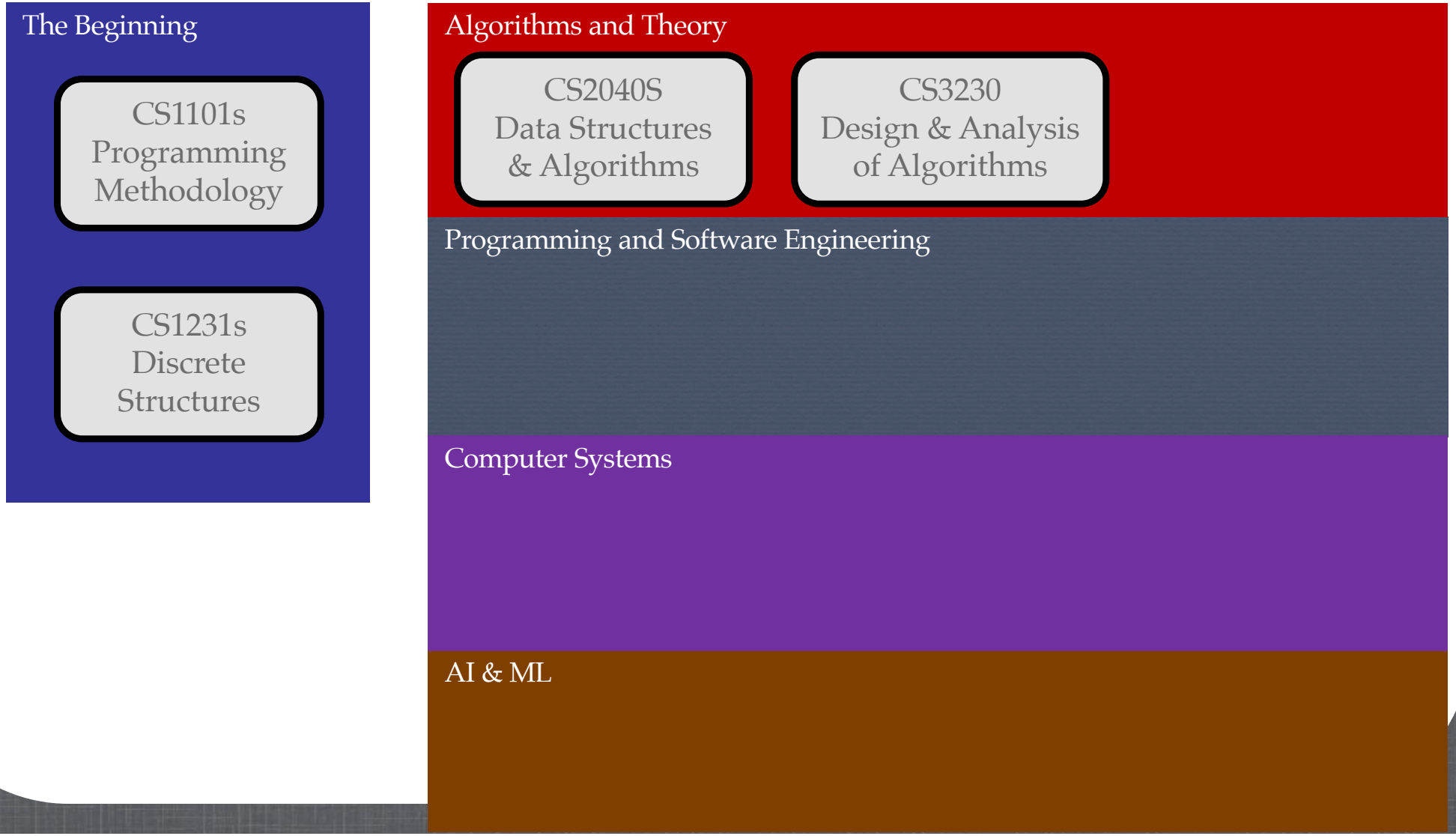
Algorithms and Theory

Programming and Software Engineering

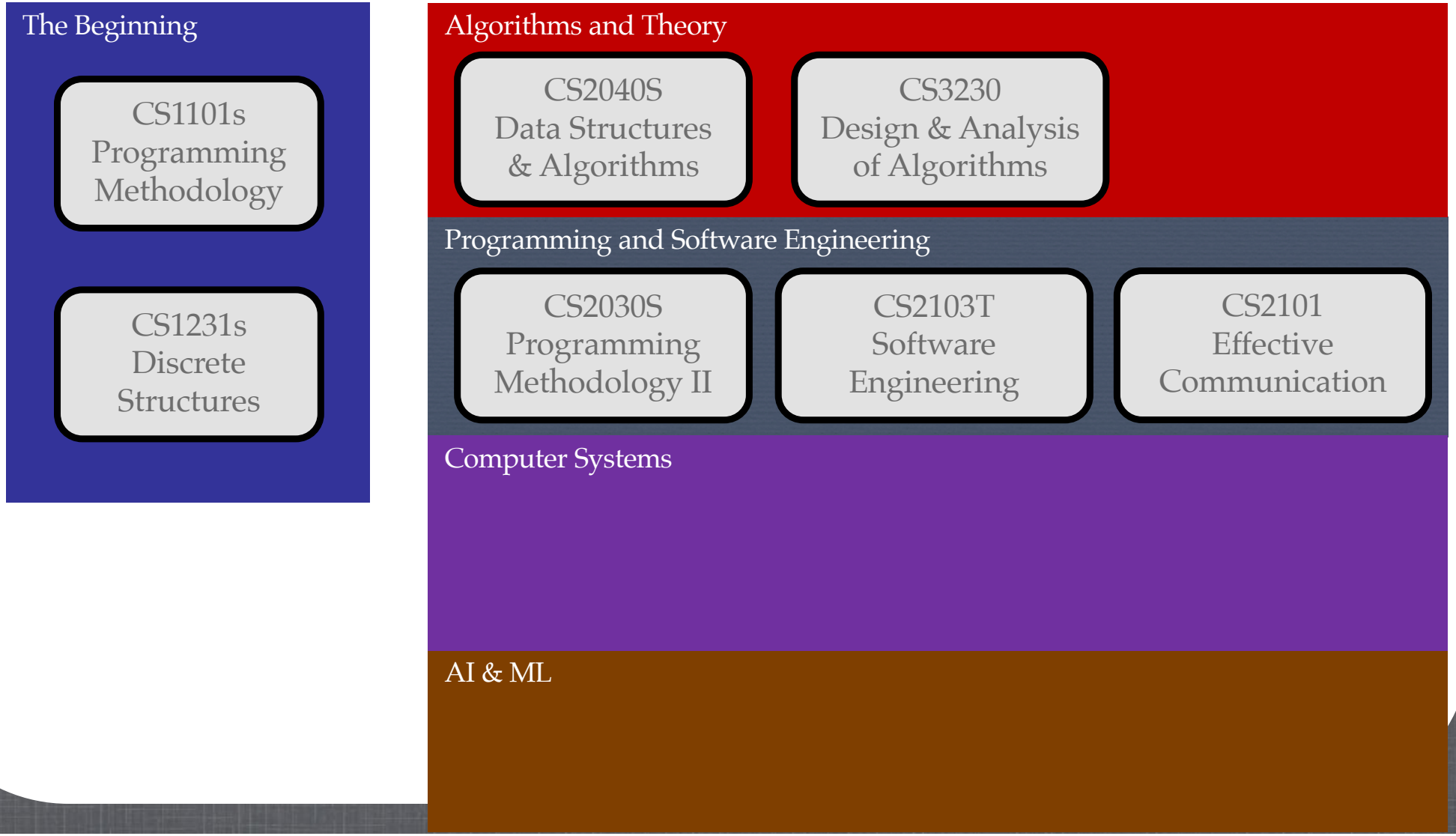
Computer Systems

AI & ML

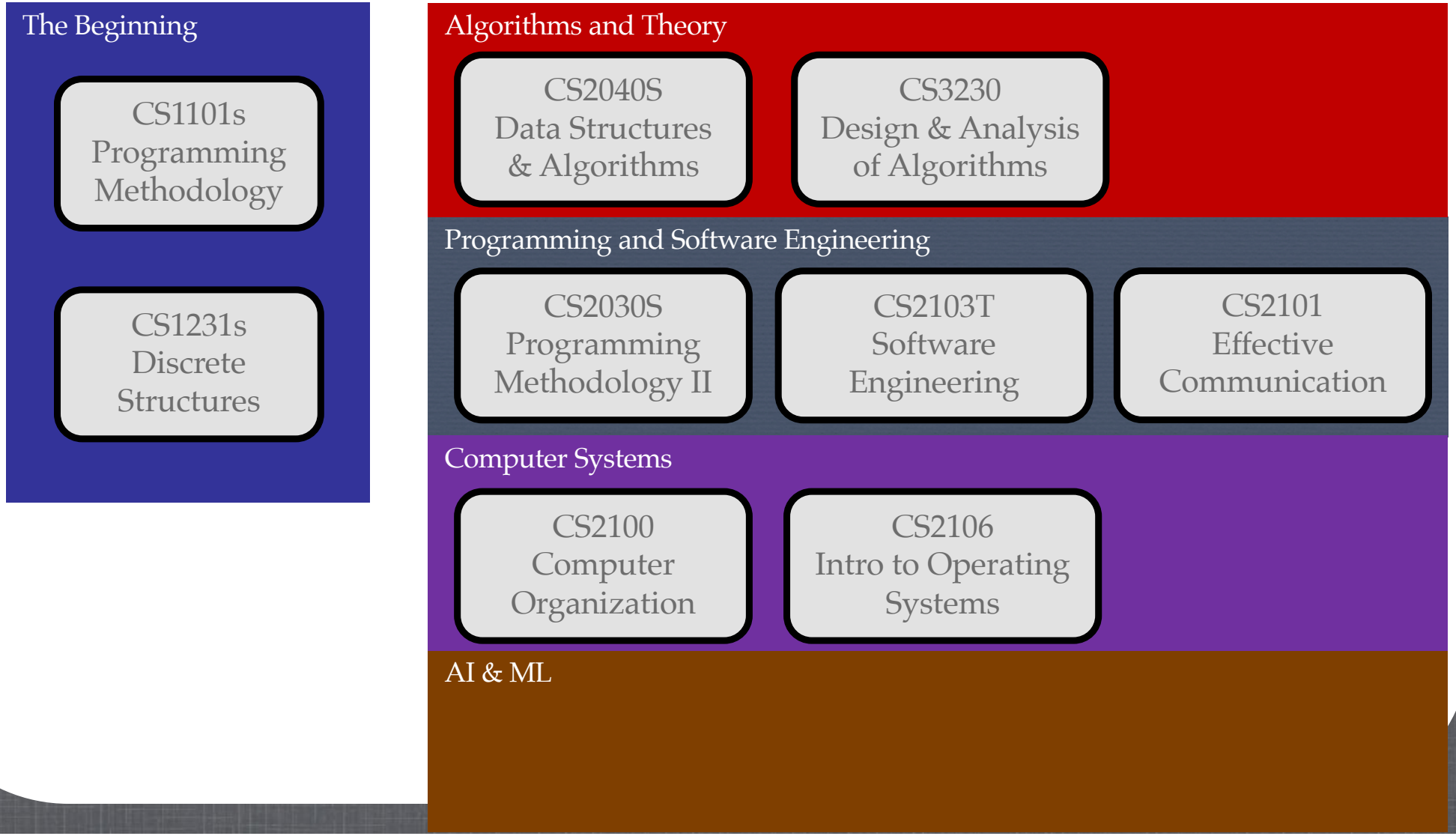
CS Foundations



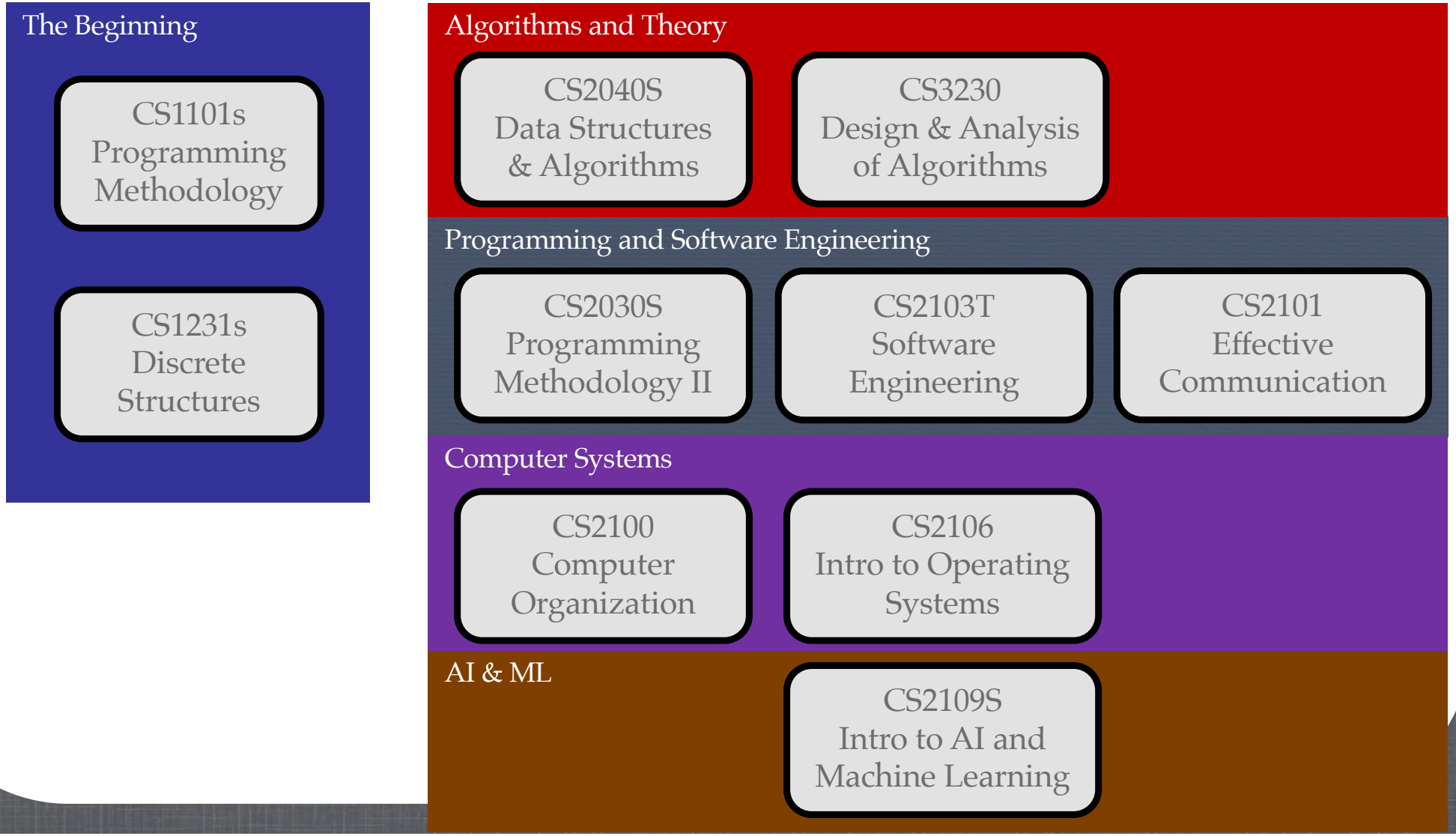
CS Foundations

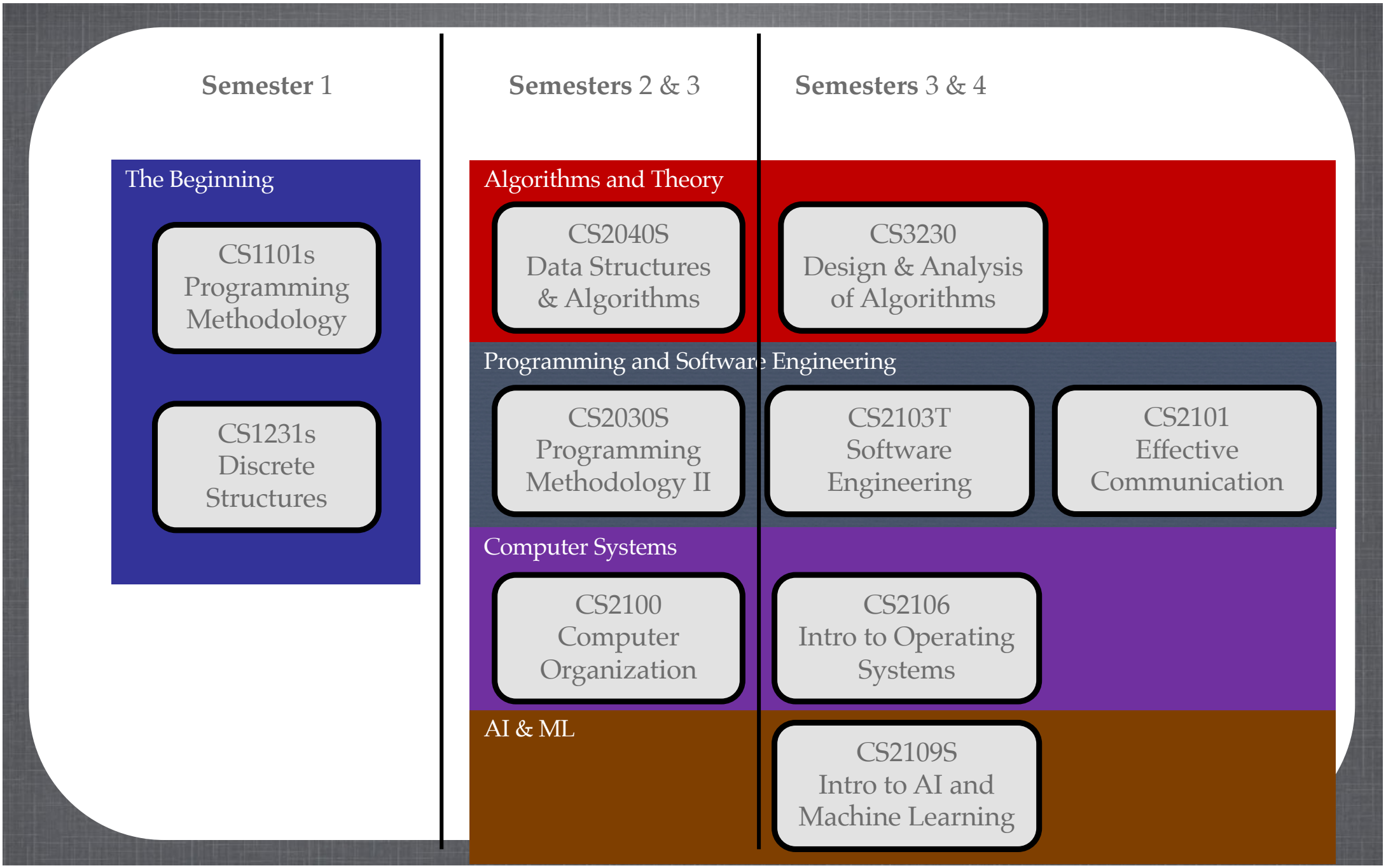


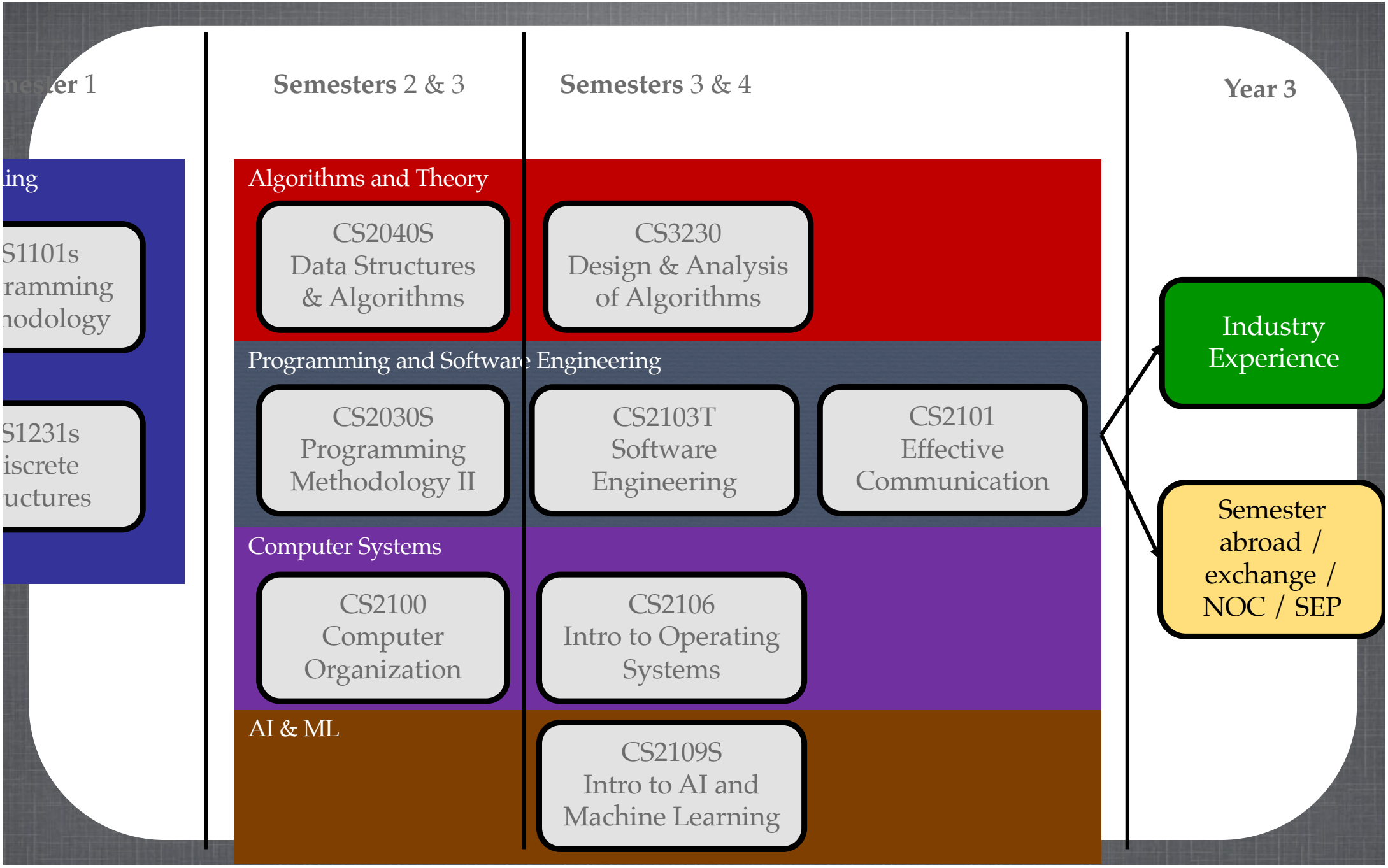
CS Foundations



CS Foundations




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 Communication
Computer Systems
CS2100 Computer Organization
CS2106 Intro to Operating Systems
AI & ML
CS2109S Intro to AI and Machine Learning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Semesters 2 & 3
Semesters 3 & 4
Year 3
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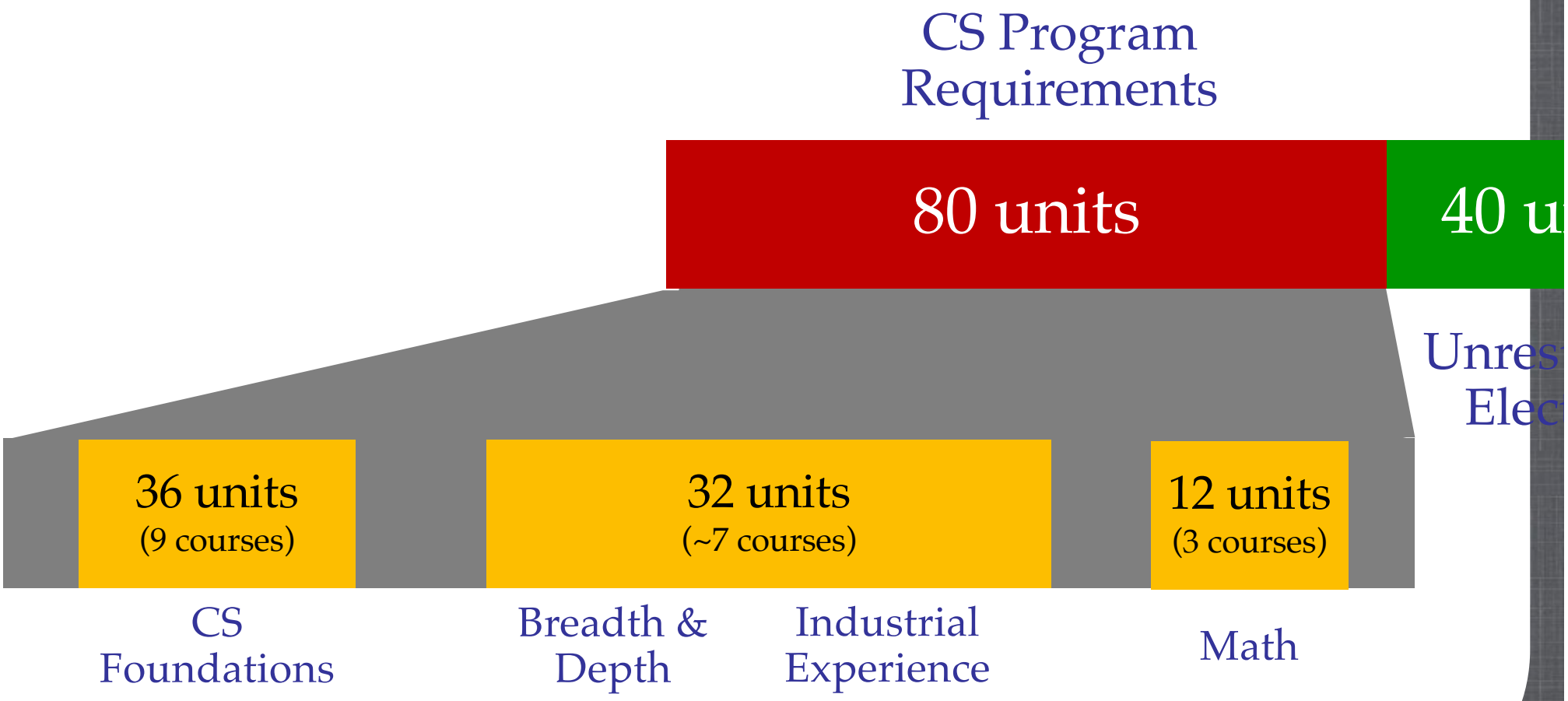
Algorithms and Theory
CS2040S
Data Structures
& Algorithms
CS3230
Design & Analysis
of Algorithms
Programming and Software Engineering
CS2030S
Programming
Methodology II
CS2103T
Software
Engineering
CS2101
Effective
Communication
Computer Systems
CS2100
Computer
Organization
CS2106
Intro to Operating
Systems
AI & ML
CS2109S
Intro to AI and
Machine Learning
Industry
Experience
Semester
abroad /
exchange /
NOC / SEP

BComp(CS) Degree Requirements



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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

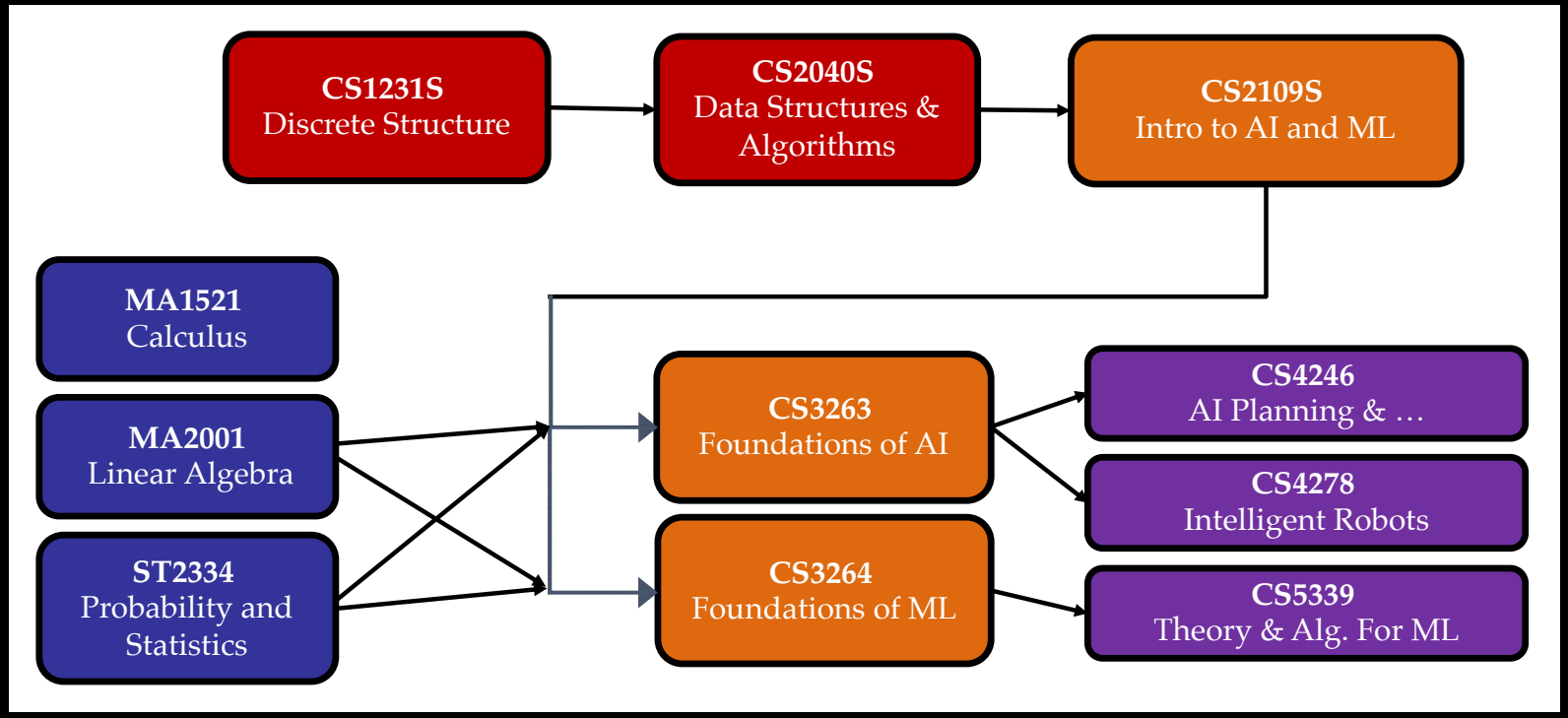
CS3223
Database Systems Implementation

CS4224
Distributed Databases

CS4225
Big Data Systems for Data Science

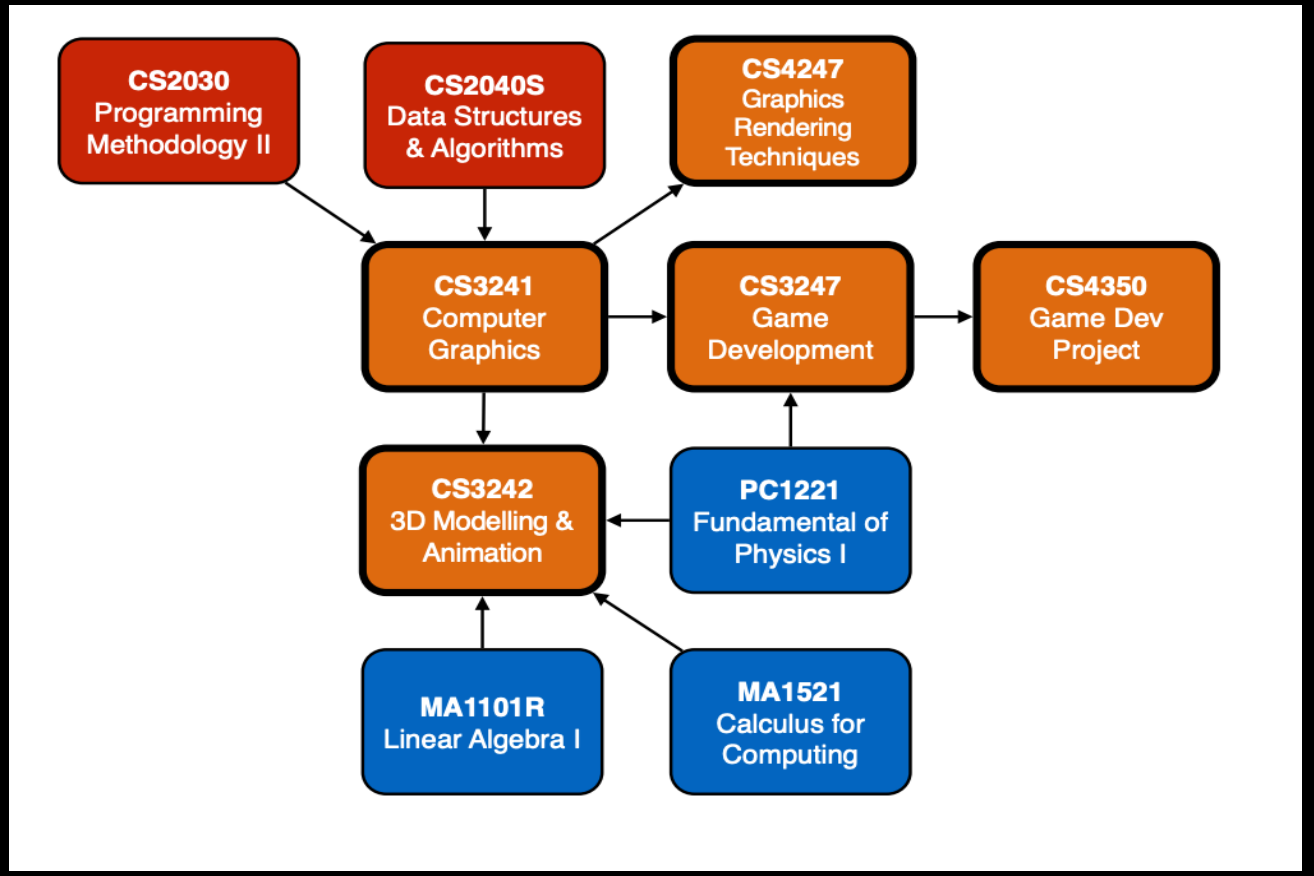
Warning: Check Prerequisites

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

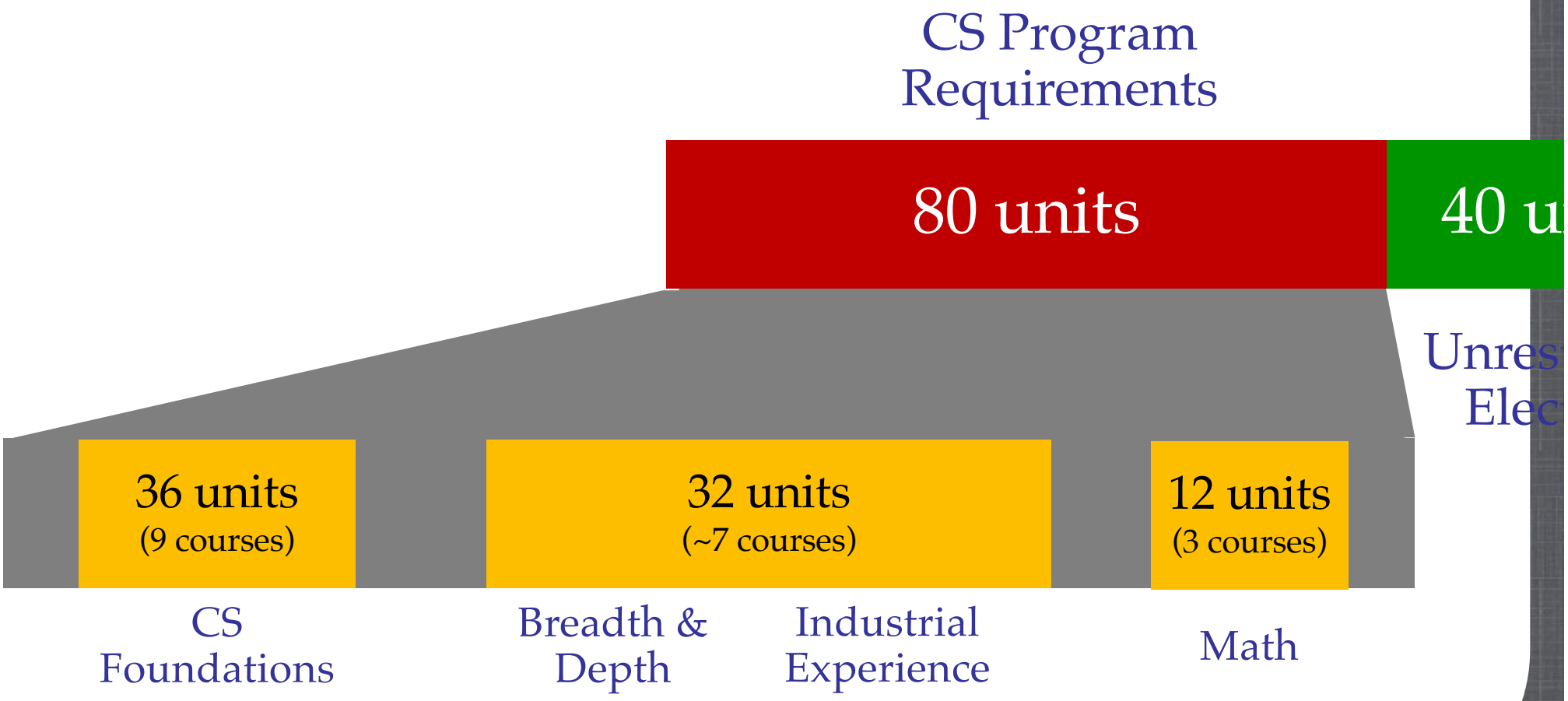
NOC
NUS Overseas College

Other…

Students with 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).

BComp(CS) Degree Requirements



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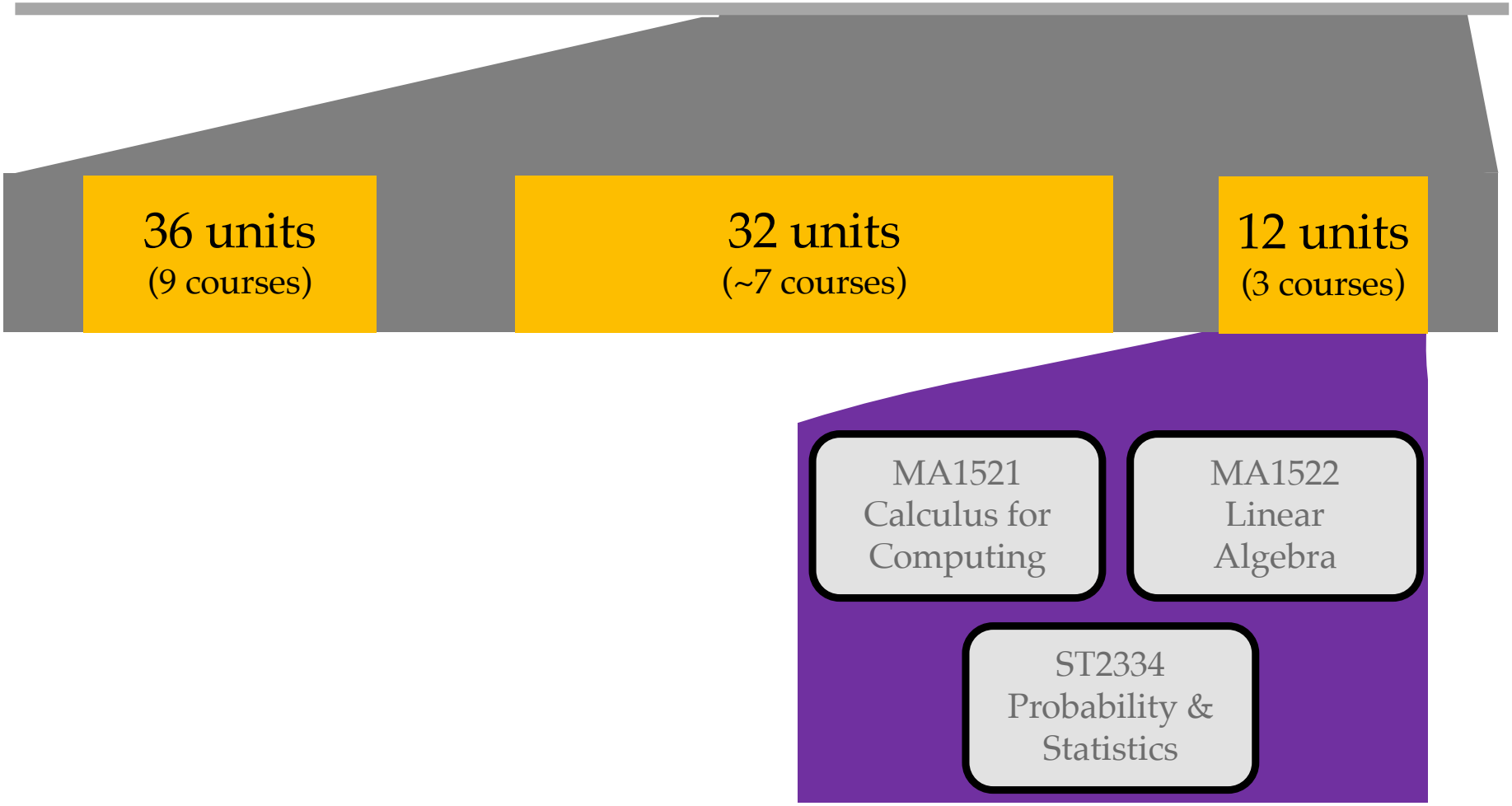

BComp(CS) Degree Requirements

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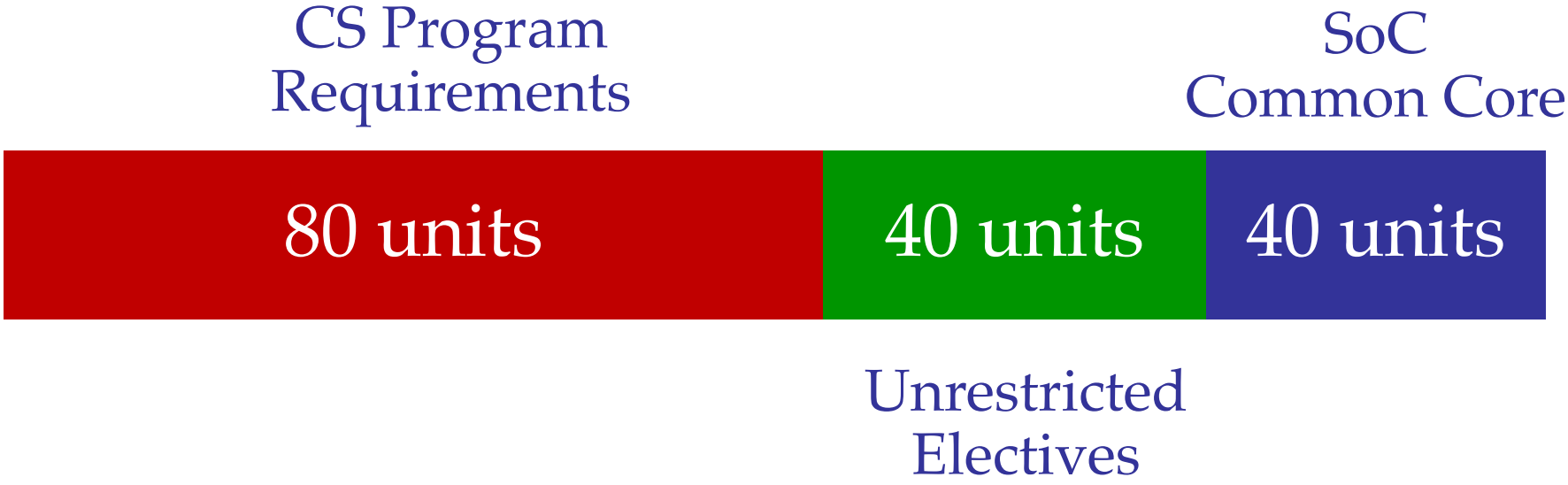

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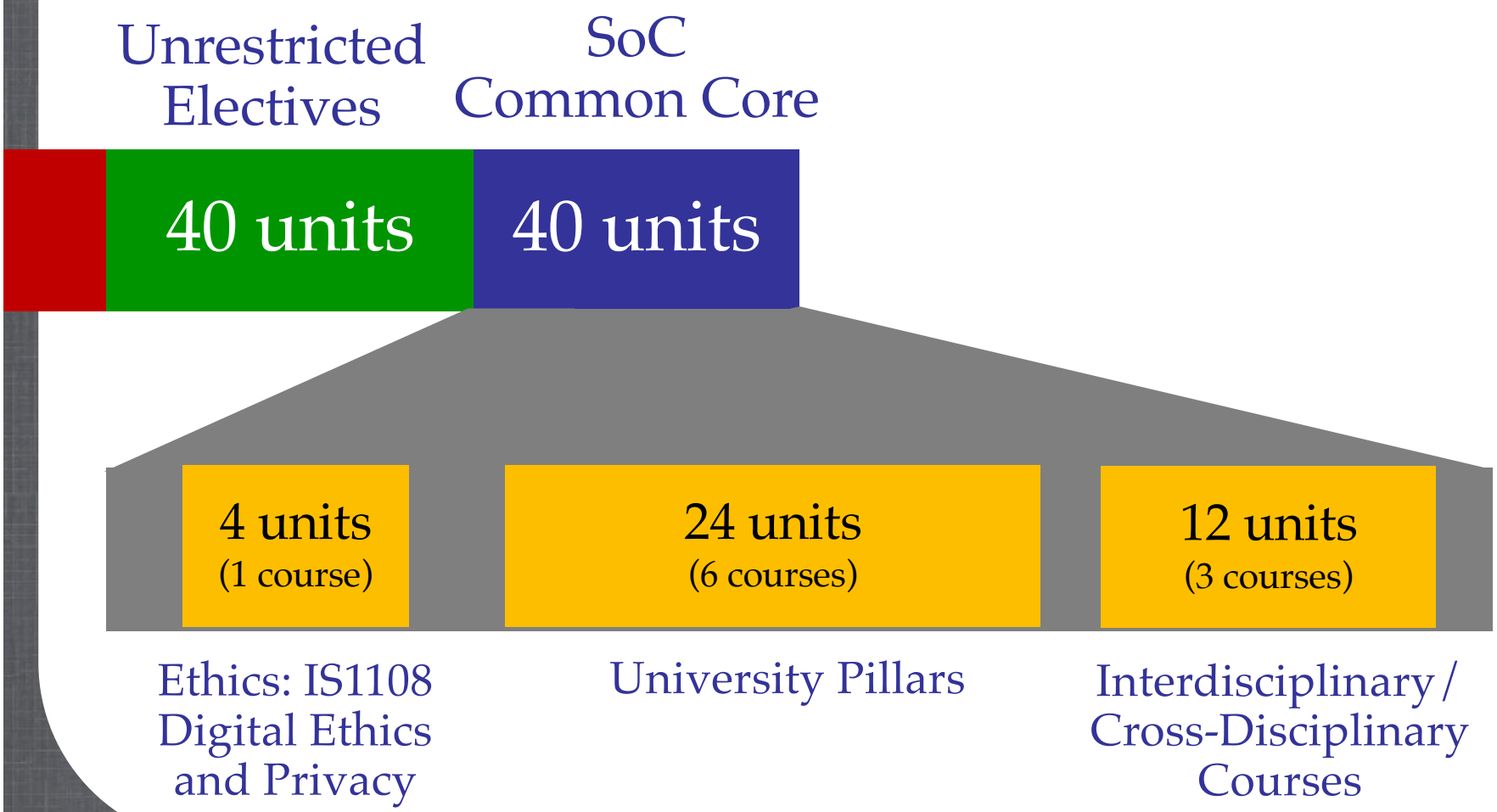

BComp(CS) Degree Requirements

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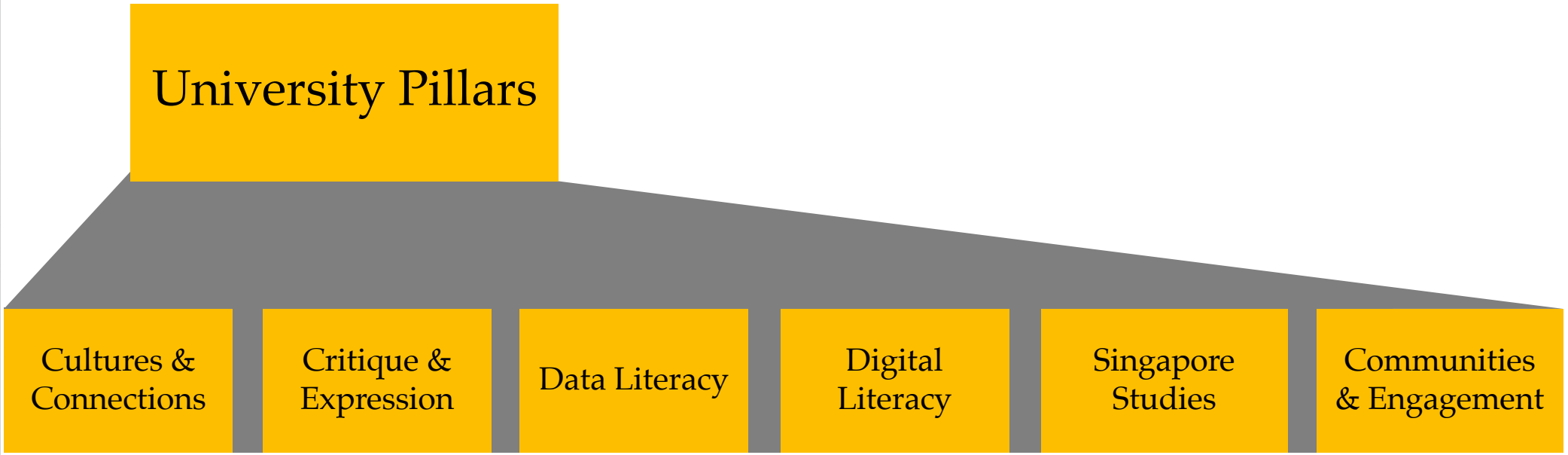

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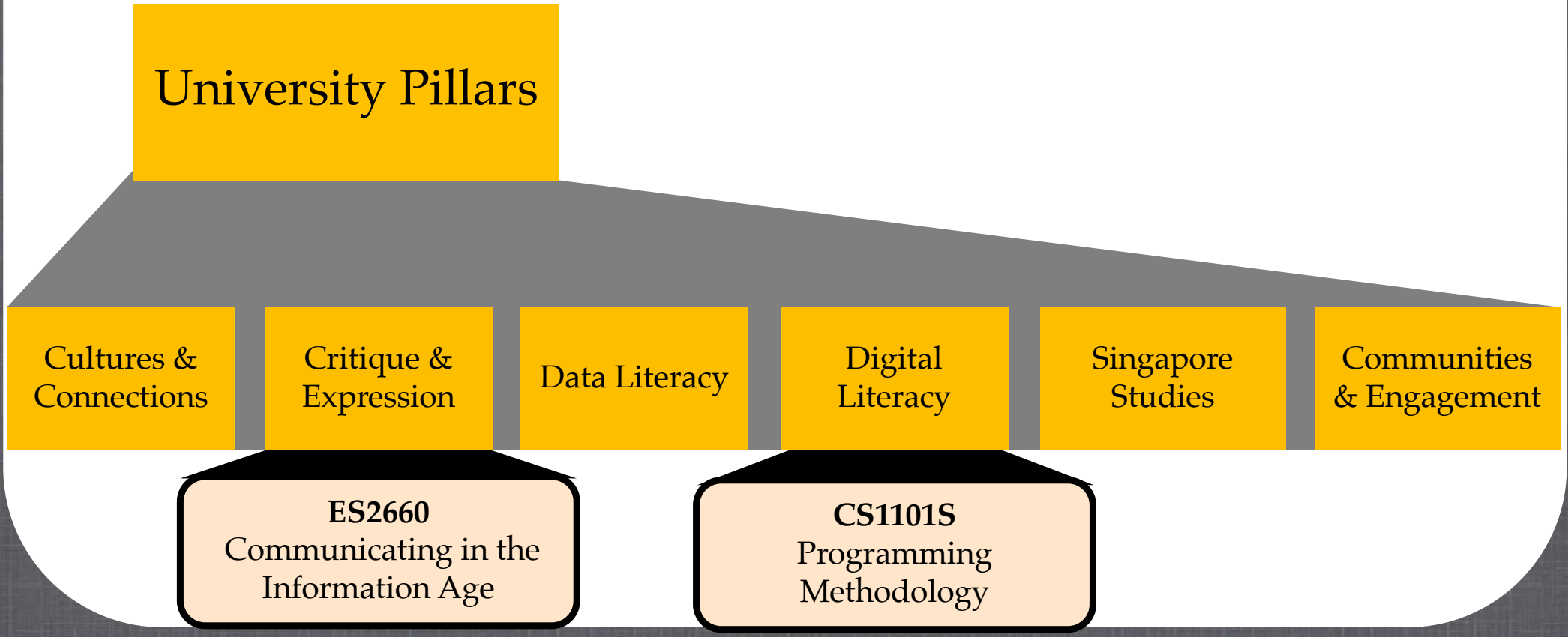

BComp(CS) Degree Requirements

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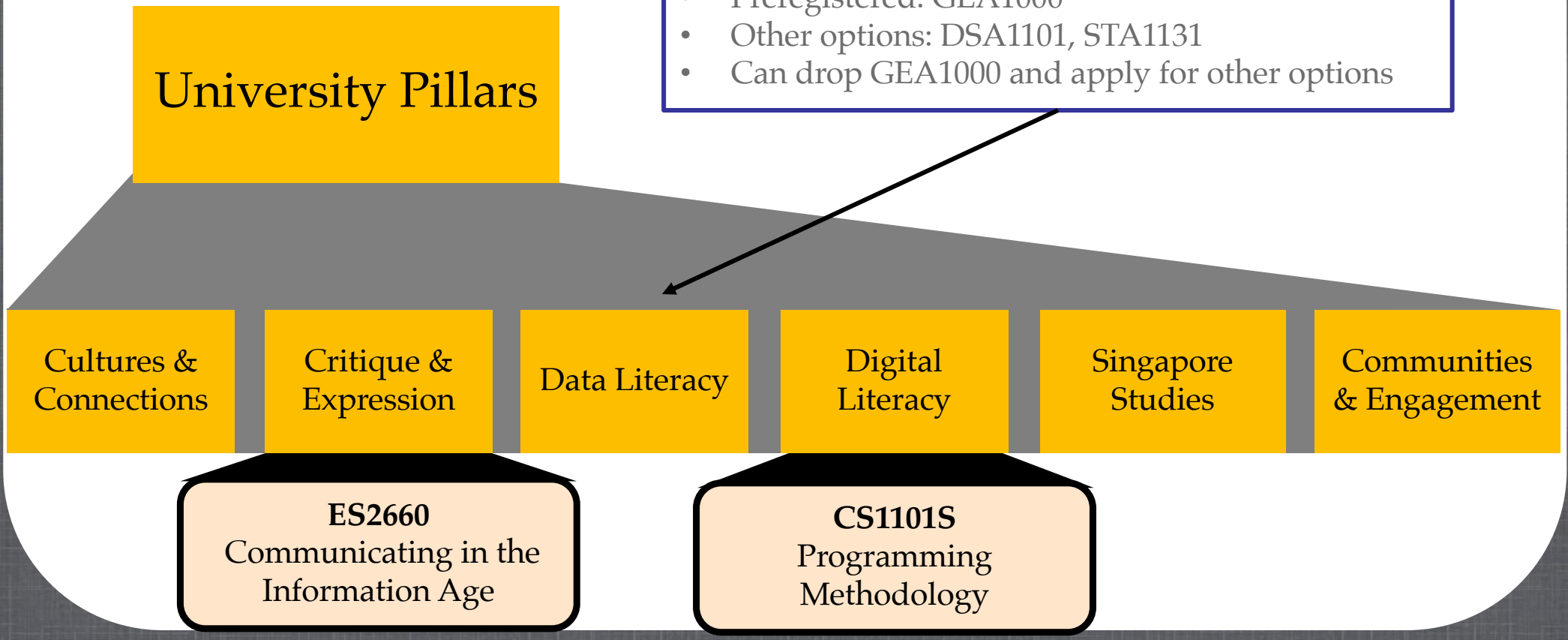
Data Literacy:

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



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

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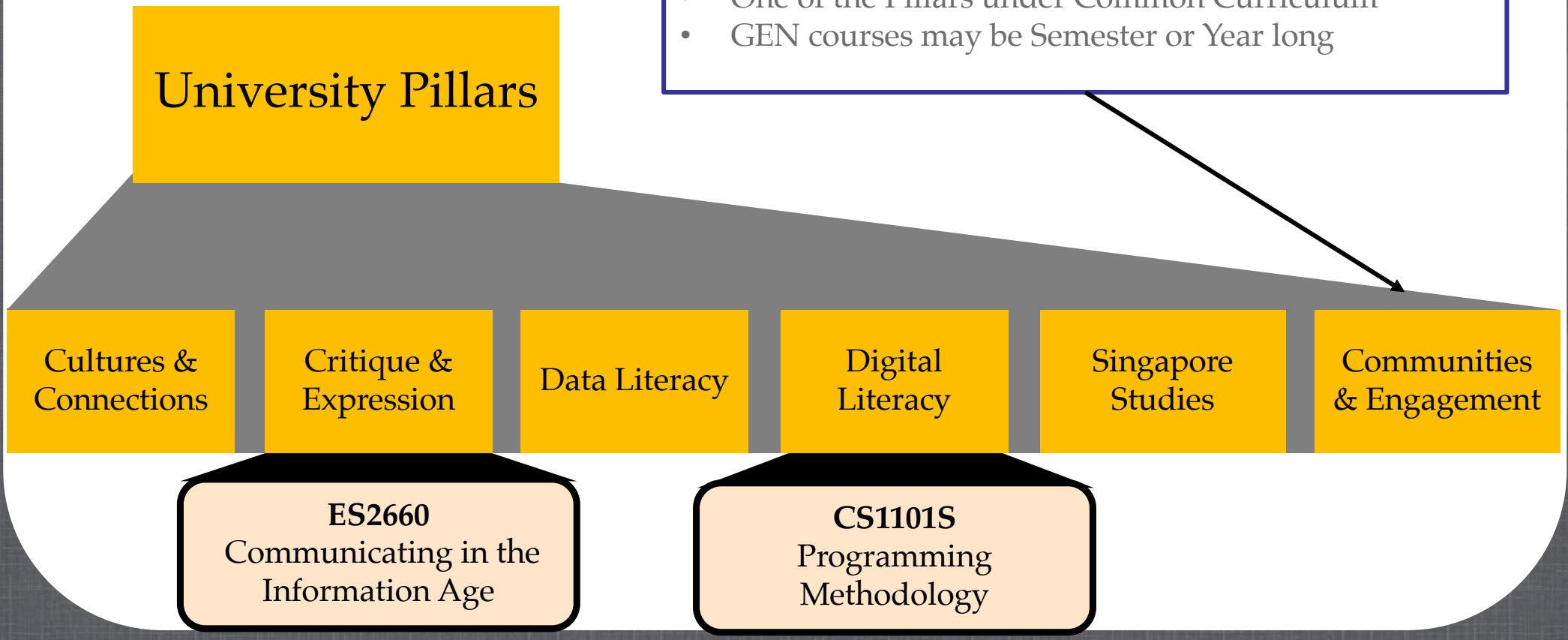
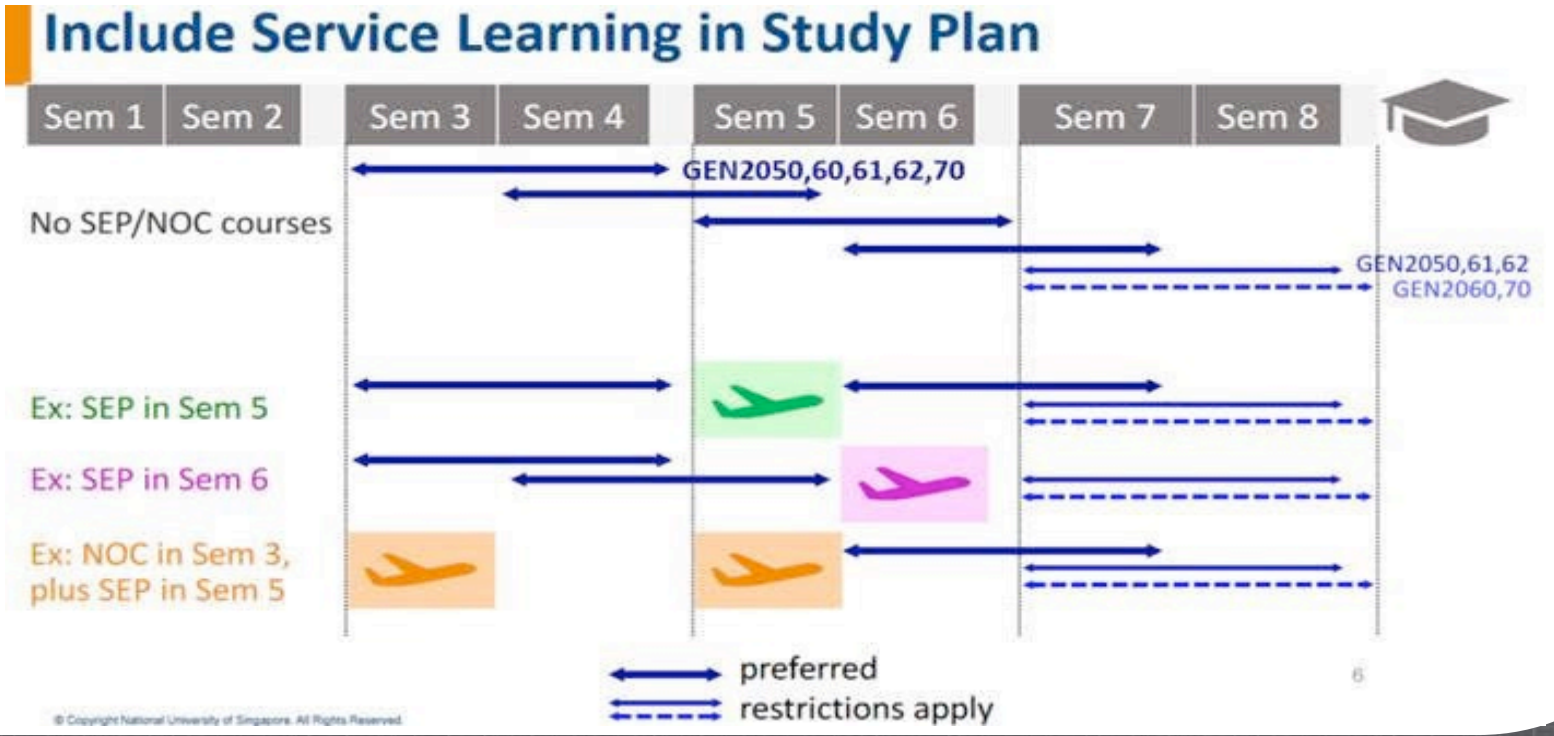
Communities & Engagement
- One of the Pillars under Common Curriculum
- GEN courses may be Semester or Year long



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.



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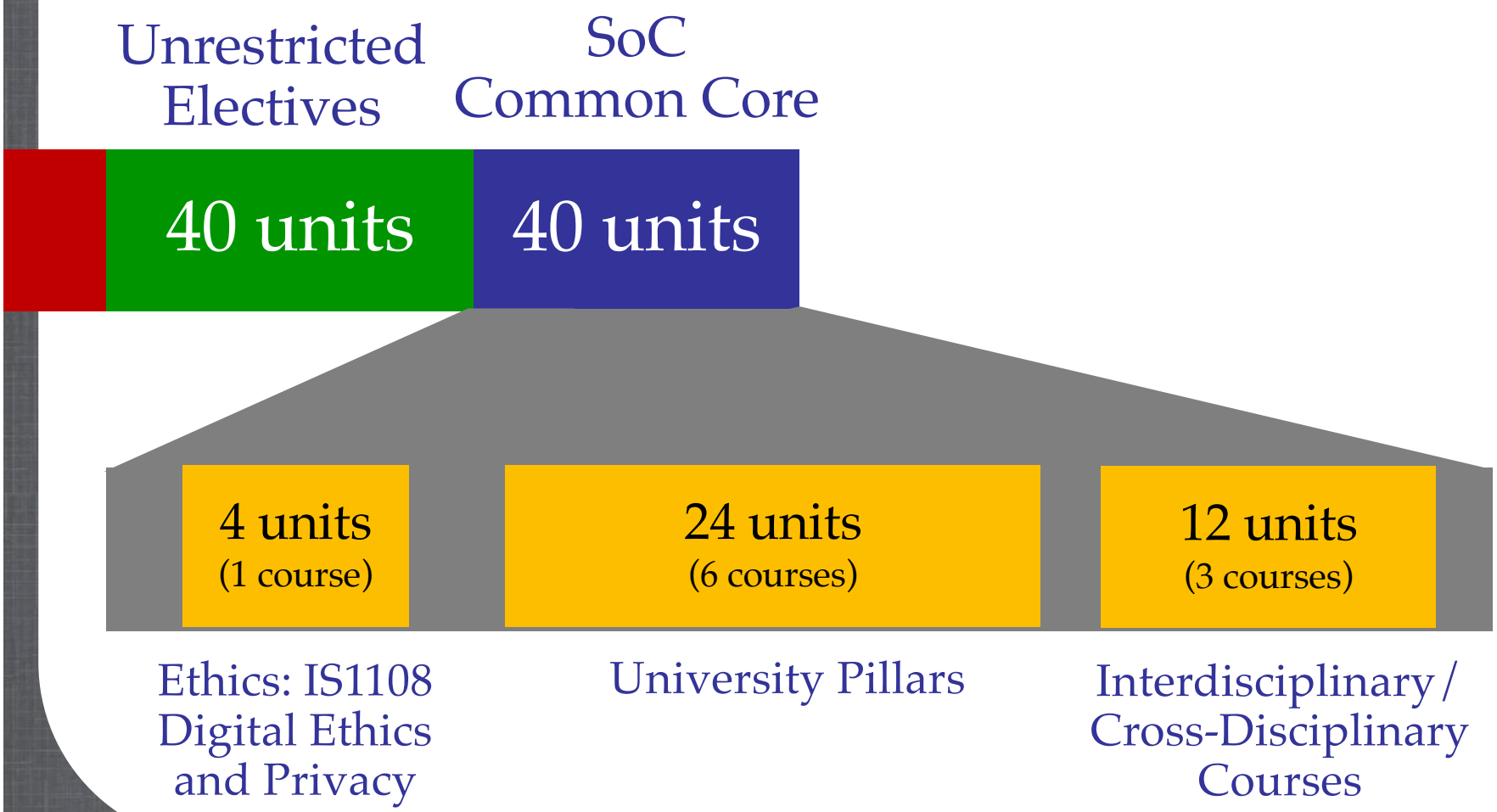


BComp(CS) Degree Requirements

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

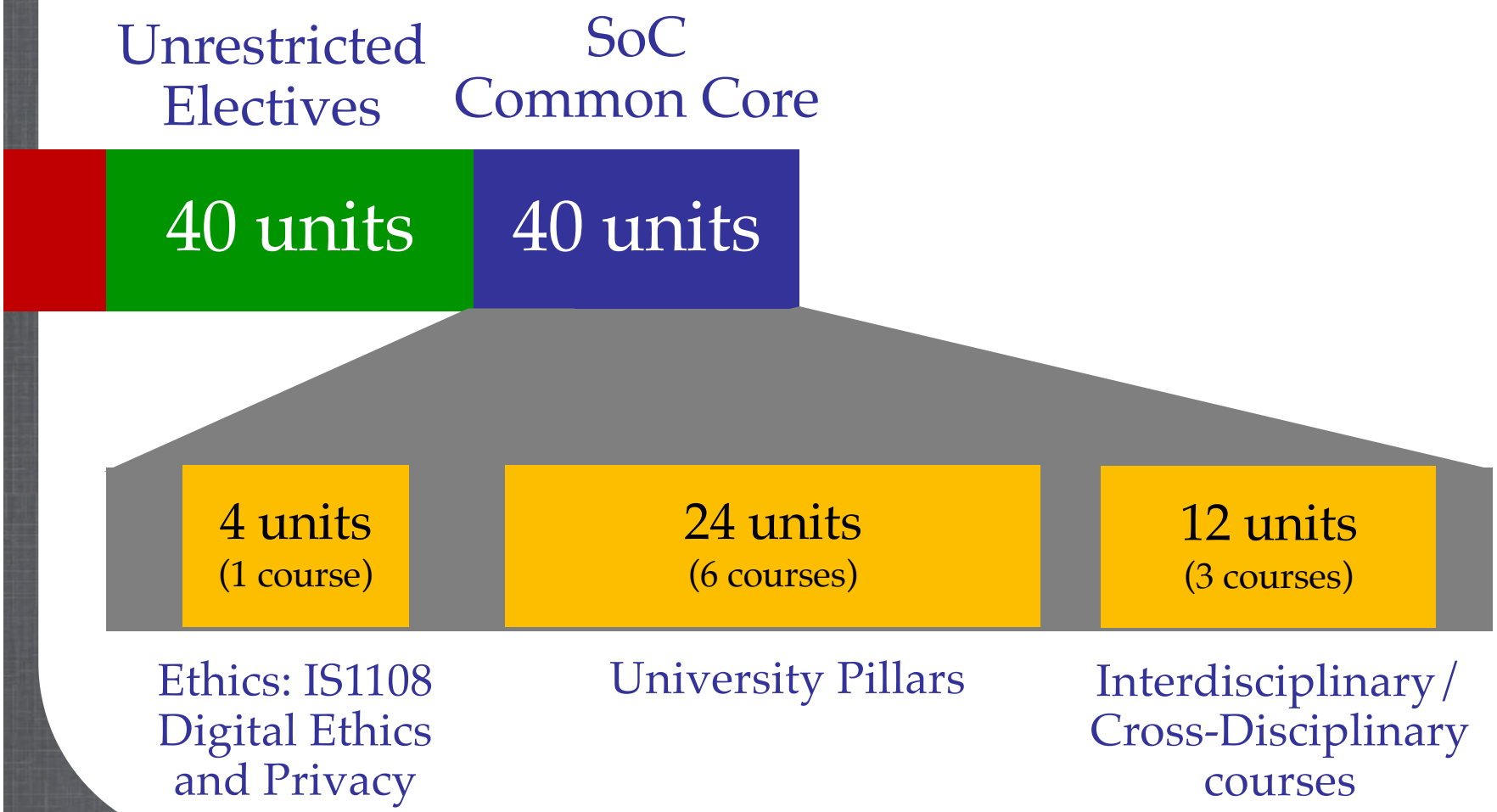
- IS1128 IT, Management and Organisation
- IS2238 Economics of IT and AI
- HSH1000 The Human Condition
- HSI2001 Scientific Inquiry & Health: Good Science, Bad Science
- HSI2011 The World of Quantum
- DTK1234 Design Thinking
- EG2501 Liveable Cities
- IE2141 Systems Thinking and Dynamics
- PF1101 Fundamentals 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



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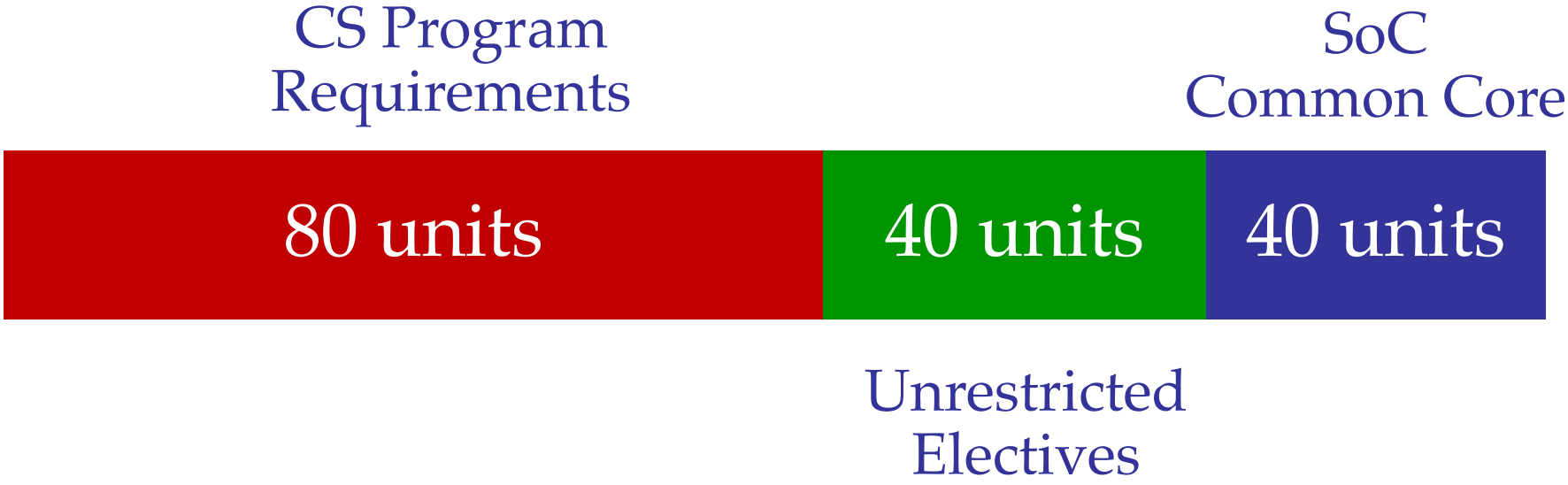

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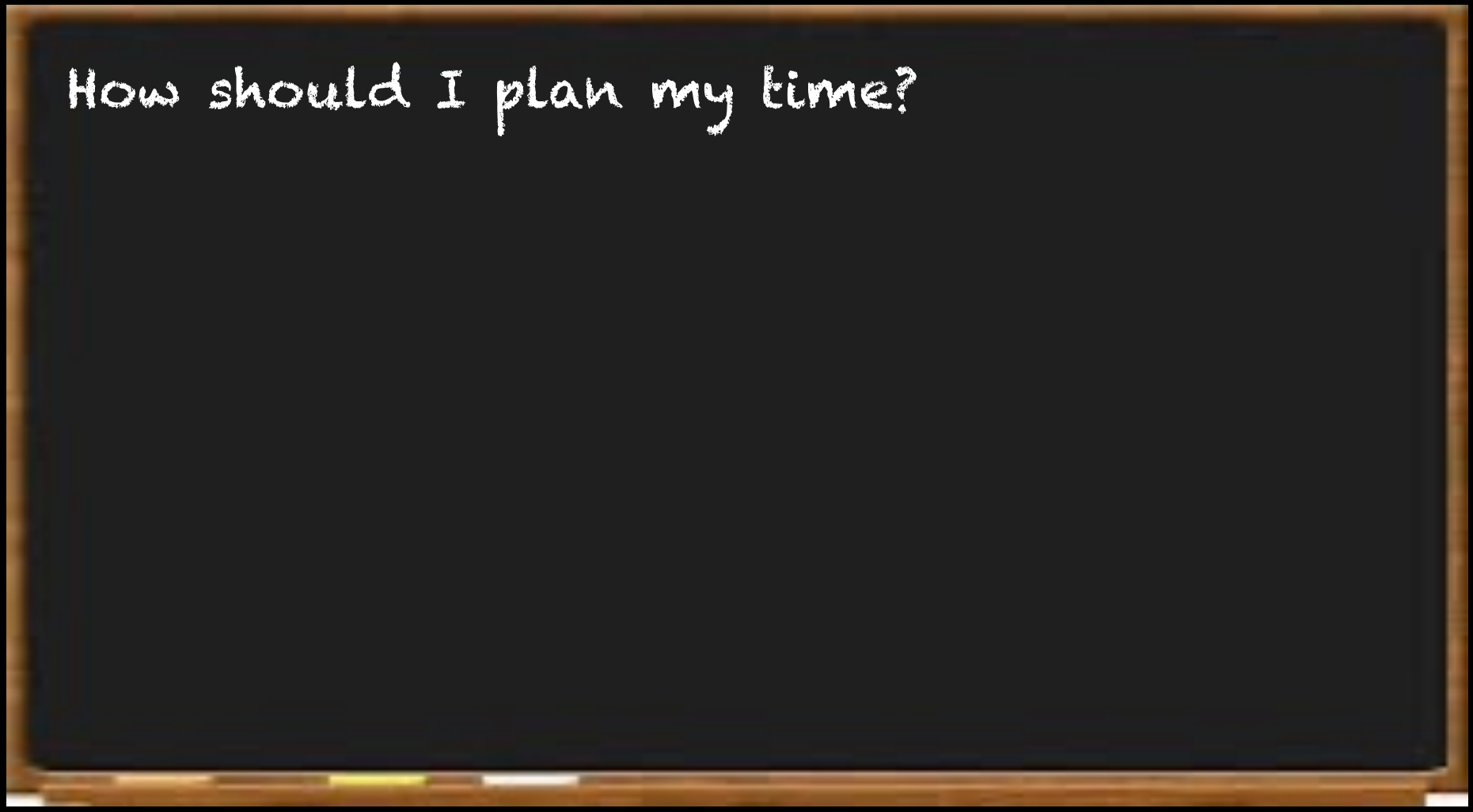
Some options:

- 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

Sample

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

Sample

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

Sample

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

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

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

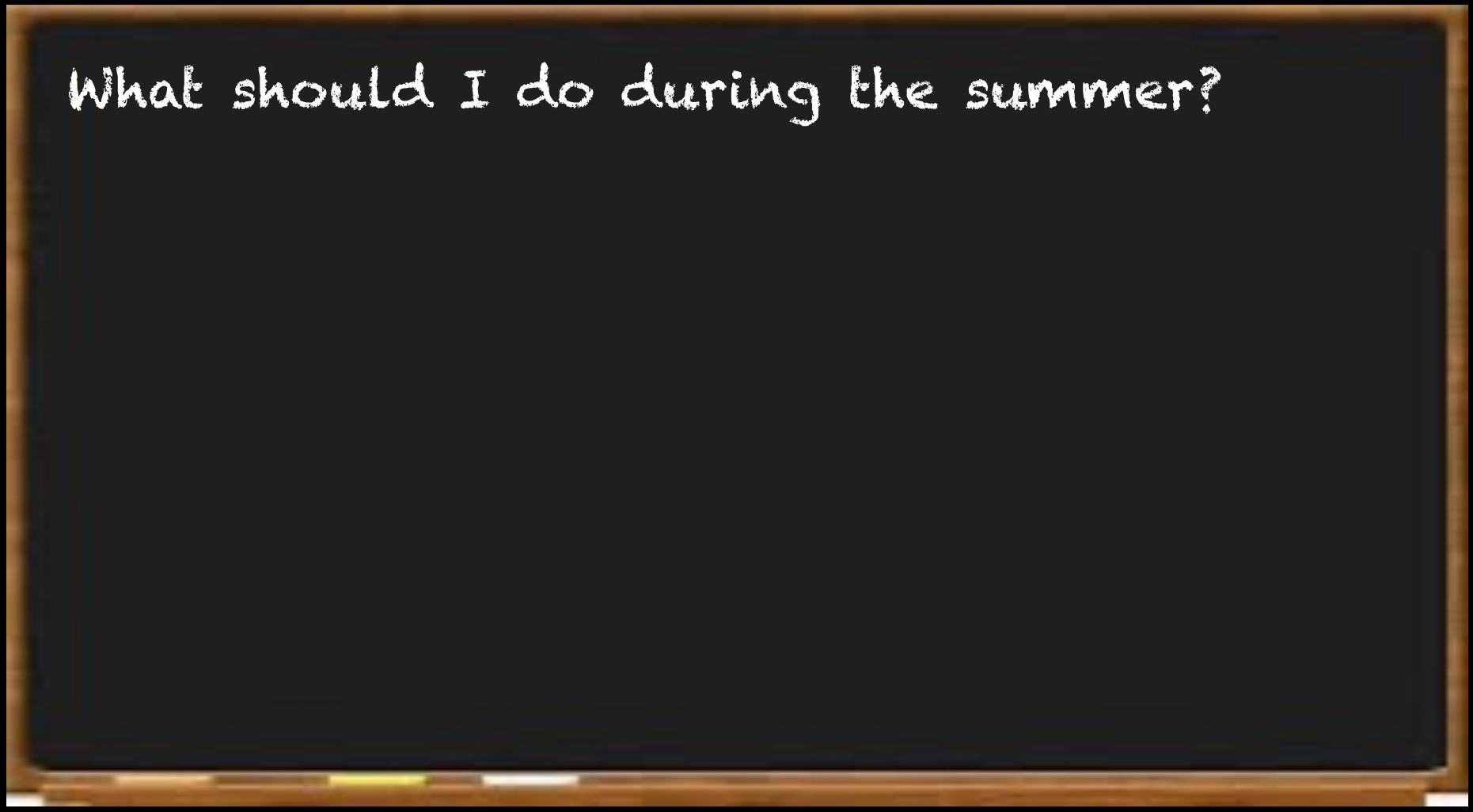
What if I can't take XXX in Year 1?

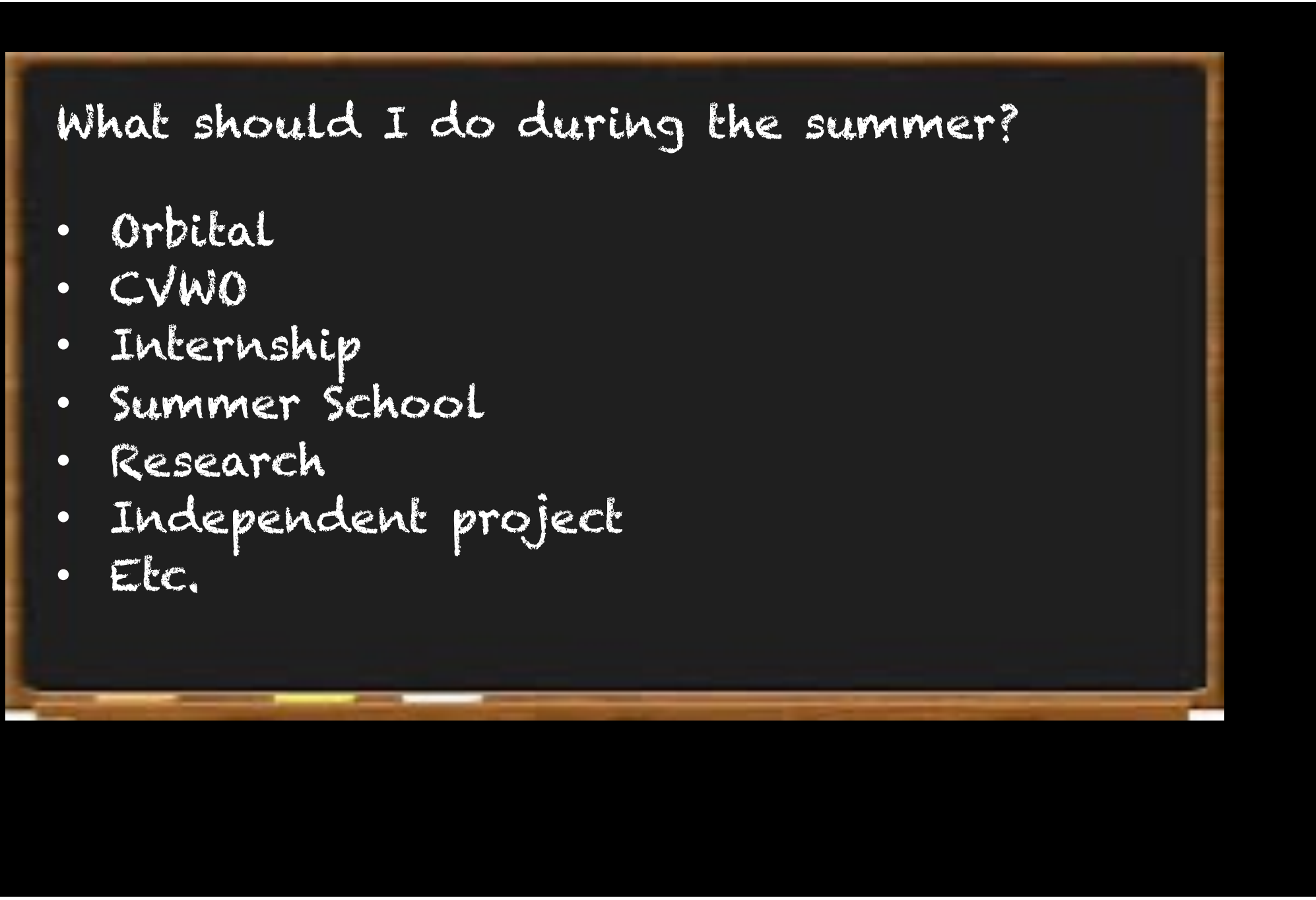
Example: Student cannot take CS1231S in Semester 1

- 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

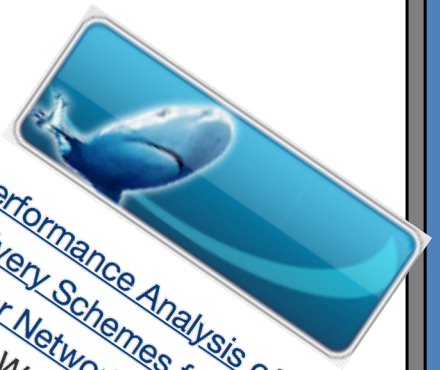
Undergraduate Research at SOC

You can be part of it…

Error Correction of Reads in DNA Fragment Assembly
By Zheng Jia

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

Modeling from Photographs
By Tan Min Rui

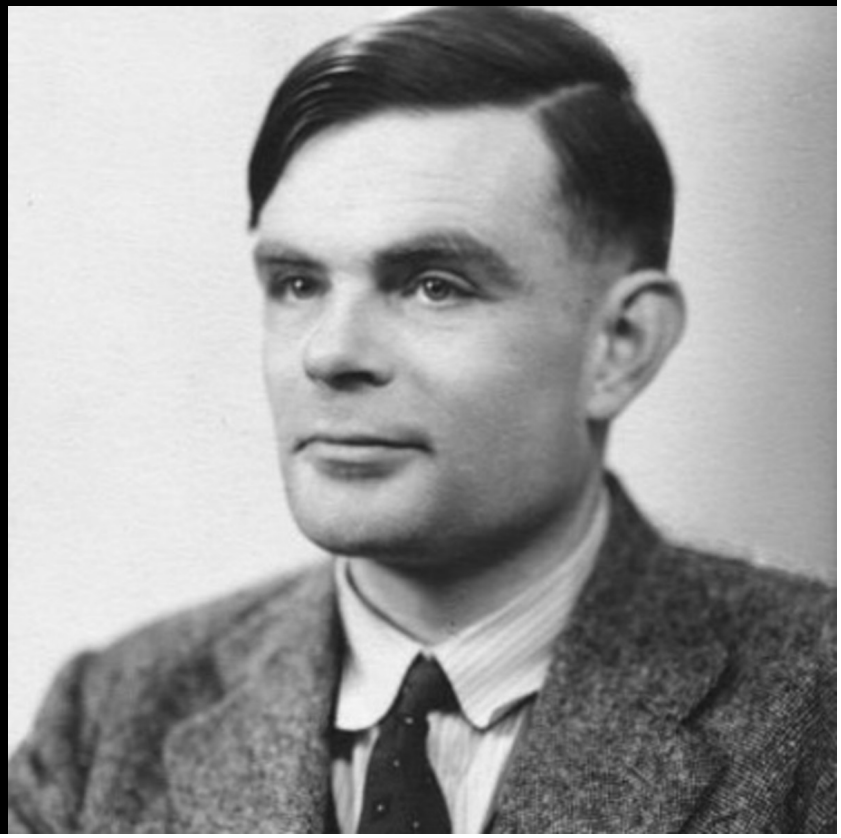
Directed Novelty and Redundancy in Information Retrieval
By Joseph Tan Kai Huang

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

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?

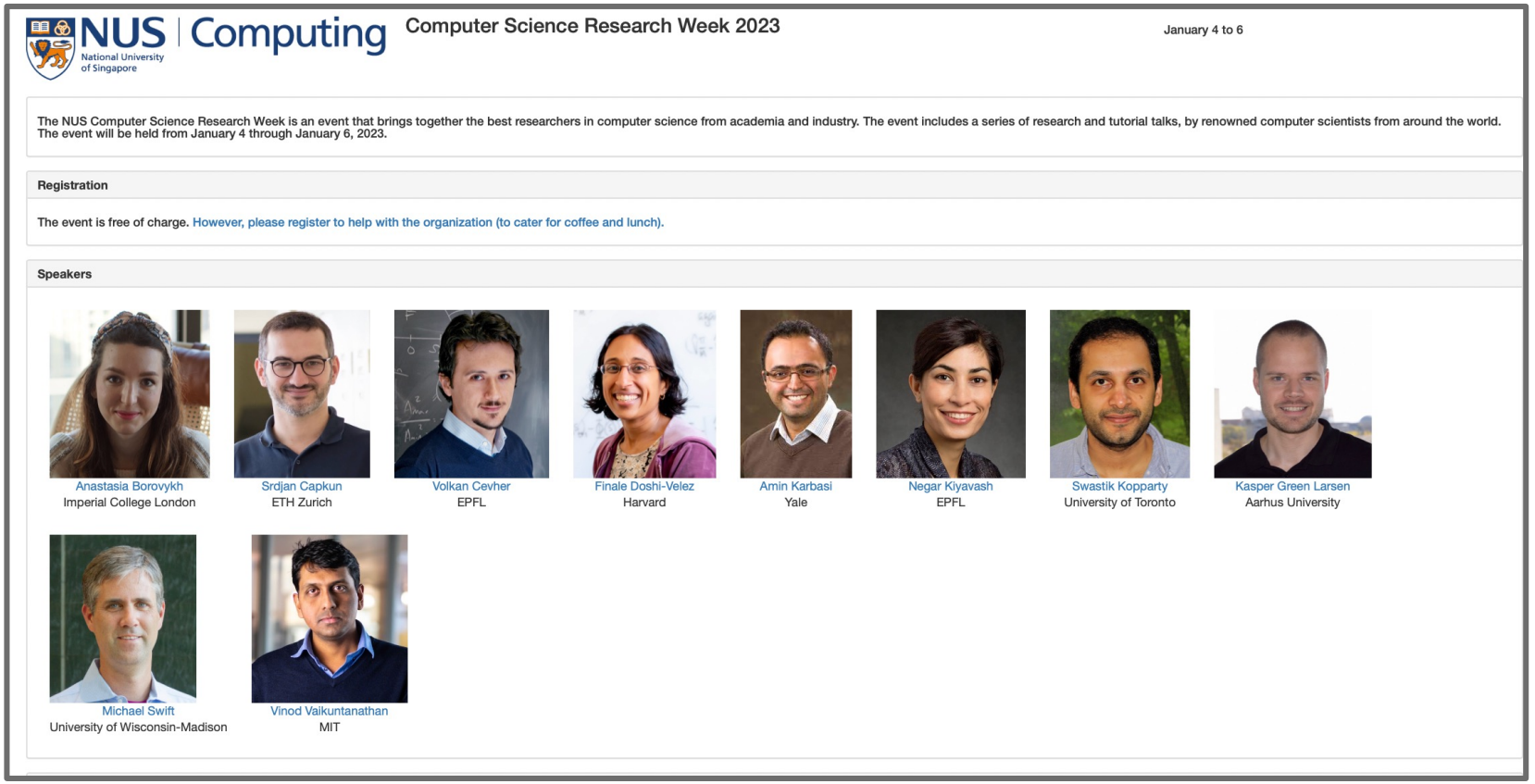
- You are interested in research!
- You may want to pursue a career in research (either industrial or academic).
- "Honors" program for our most successful students.
- Networking opportunities.
- Mentor in research.

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!