

# COMPUTER SCIENCE SPECIALIZATIONS

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UNIVERSITY OF  
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FACULTY OF  
MATHEMATICS



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# ABOUT ME: Jeff Avery

- Cheriton School of Computer Science (2016+)
  - Associate Professor & Academic Advisor
  - Teach HCI, SE, Programming (CS 346)
  - CS Admissions, WiCS, UAPC
- Previously
  - Developer > Architect > Manager > Director
  - BI, gaming, telecom, healthcare, logistics, ...
- Education
  - BA, MA, BAsC, PhD



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Slides are  
posted here

# WHAT WE'LL COVER

- CS major programs
  - BCS vs BMath CS
  - Requirements, elective breadth & depth
- Specializations
  - Review of the list
  - Highlights of a few popular ones
  - Q&A



# CS MAJOR PROGRAMS

Program details and course comparison.

# CS MAJOR PROGRAMS: Requirements

Bachelor of Mathematics in Computer Science (BMath CS) – “OG CS”

- Requires *slightly more math* than the BCS degree.
- Can be combined with other math majors and/or minors! e.g., BMath CS + CO.

Bachelor of Computer Science (BCS) – “new program” (circa 2005?)

- Standalone degree; can only combine with minors.

Both require:

- 20.0 units of courses, including 5.0 units of non-math courses
- Slight course differences between programs (i.e., more math in one of them)
- 8 FT terms (coop) or 7 FT terms (regular)

# BACHELOR OF COMPUTER SCIENCE 2023-2024 ([link](#))

## Required Courses

### 7.75 CS Units

- CS 1[134]5
- CS 1[34]6
- CS 136L (0.25 unit)
- CS 240
- CS 241
- CS 245
- CS 246
- CS 251
- CS 341
- CS 350
- CS 340-398; 440-489 \_\_\_\_\_
- CS 340-398; 440-489 \_\_\_\_\_
- CS 340-398; 440-489 \_\_\_\_\_
- CS 440-489 \_\_\_\_\_
- CS 440-489 \_\_\_\_\_
- One of CS 440-498, CS 499T, CS 6XX, CS 7XX, CO 487, or STAT 440 \_\_\_\_\_

### 3.5 Math Units

- MATH 1[34]5
- MATH 1[34]6
- MATH 1[234]7
- MATH 1[234]8
- MATH 2[34]9
- STAT 2[34]0
- STAT 2[34]1

## Electives

### 5.0 Non-Math Elective Units, including [Breadth and Depth](#)

- Social Science: \_\_\_\_\_
- Social Science: \_\_\_\_\_
- Pure Science: \_\_\_\_\_
- Pure/Applied Science: \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

Choose either:

- Comm. list I<sup>1</sup>: \_\_\_\_\_
- Comm. list I or II<sup>2</sup>: \_\_\_\_\_
- Humanities: \_\_\_\_\_
- Humanities: \_\_\_\_\_

OR

- Comm. list I<sup>1</sup>: \_\_\_\_\_
- COMMST or ENGL from Comm. list II<sup>2</sup>: \_\_\_\_\_
- Humanities: \_\_\_\_\_
- Non-Math: \_\_\_\_\_

### 3.75 Additional Math or Non-Math Elective Units

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

## CS/Math courses

- 17 courses are required
- Choose another 6 courses from CS.

## Electives

- Choose 9-10 courses towards B&D.
- Choose ~8 other electives from any <sup>1</sup>

<sup>1</sup> 10 courses in total must be non-math (5.0 units).

# BMATH COMPUTER SCIENCE 2023-2024 ([link](#))

## Required Courses

### 7.75 CS Units

- CS 1[134]5
- CS 1[34]6
- CS 136L (0.25 unit)
- CS 240
- CS 241
- CS 245
- CS 246
- CS 251
- CS 341
- CS 350
- CS 360 or CS 365 \_\_\_\_\_
- CS 370 or CS 371 \_\_\_\_\_
- CS 340-398; 440-489 \_\_\_\_\_
- CS 440-489 \_\_\_\_\_
- CS 440-489 \_\_\_\_\_
- CS 440-498, CS 499T, CS 6XX, CS 7XX, CO 487, or STAT 440 \_\_\_\_\_

### 4.5 Math Units

- MATH 1[34]5
- MATH 1[34]6
- MATH 1[234]7
- MATH 1[234]8
- MATH 2[34]5
- MATH 2[34]7
- MATH 2[34]9
- STAT 2[34]0
- STAT 2[34]1

## Electives

### 5.0 Non-Math Elective Units, including [Breadth and Depth](#)

- Social Science: \_\_\_\_\_
- Social Science: \_\_\_\_\_
- Pure Science: \_\_\_\_\_
- Pure/Applied Science: \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

Choose either:

- Comm. list I<sup>1</sup>: \_\_\_\_\_
- Comm. list I or II<sup>2</sup>: \_\_\_\_\_
- Humanities: \_\_\_\_\_
- Humanities: \_\_\_\_\_

OR

- Comm. list I<sup>1</sup>: \_\_\_\_\_
- COMMST or ENGL from Comm. list II<sup>2</sup>: \_\_\_\_\_
- Humanities: \_\_\_\_\_
- Non-Math: \_\_\_\_\_

### 1.5 Additional [Math<sup>3</sup>](#) Elective Units

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

### 1.25 Additional [Math or Non-Math](#) Elective Units

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

## CS/Math courses

- 21 courses are required.
- [Choose another 4 courses from CS.](#)

## Electives

- [Choose 9-10 courses towards B&D.](#)
- [Choose 1.5 math courses.](#)
- [Choose 3-4 electives<sup>1</sup>](#)

<sup>1</sup> 10 courses in total must be non-math (5.0 units).

# SPECIALIZATIONS

Customizing your degree.

## SPECIALIZATIONS ([link](#))

Specialization	What is it?	Extra courses	B&D?
Artificial Intelligence (AI)	Simulation of human intelligence.	ECE, SYDE, STATS	x
Bioinformatics (BIO)	Processing of biological data (e.g., genes, proteins).	BIOL, CHEM	Waive Breadth & Depth
Business (BUS)	Finance, accounting, marketing.	ACTSC, BUS, ECON	x
Computational Fine Arts (CFA)	Digital expression.	FINE	x
Digital Hardware (DH)	Physical computing, engineering.	ECE, MTE	Waive Depth
Game Design ( <i>Proposed</i> )	How to create compelling digital games.	ENGL? FINE?	x
Human Computer Interaction (HCI)	The ways that humans and machines interact e.g., input devices, speech.	STV, FINE, INTEG, PSYCH	x
Software Engineering (SE)	Building quality software to a specification.	BET, STV, GEOG, SOC, STV, ECE	x

## HOW DO THEY WORK?

- Specializations are meant to be *extra to a core degree (BCS or BMath CS)*.
- We think of it as augmenting a core CS degree with courses from another area.
  - In MOST cases, adding a specialization means that you commit to extra courses, but still need to take core requirements and meet B&D elective requirements.
  - This means that course count is important. It can be challenging to “fit” everything into a regular schedule.
- **MOST STUDENT DO NOT TAKE A SPECIALIZATION!** They’re optional.
- How do you add a specialization? Fill out a [plan modification form](#) in 2A or later.

# AI Specialization

- AI specialization
- Why study this?
  - Make computers perform human-like tasks e.g., managing written information, responding to spoken or written language, making recommendations and so on.
- Requirements:
  - BCS or BMath CS requirements
  - CS 486, CS 492, CS 480|485
  - 4 other courses from Math/ENG

## Required Courses

- Complete all of the following
  - Complete all the following:
    - CS486 - Introduction to Artificial Intelligence (0.50)
    - CS492 - The Social Implications of Computing (0.50)
  - Complete 1 of the following:
    - CS480 - Introduction to Machine Learning (0.50)
    - CS485 - Statistical and Computational Foundations of Machine Learning (0.50)
  - Complete 4 of the following:
    - BIOL487 - Computational Neuroscience (0.50)
    - CO367 - Nonlinear Optimization (0.50)
    - CO456 - Introduction to Game Theory (0.50)
    - CO463 - Convex Optimization and Analysis (0.50)
    - CO466 - Continuous Optimization (0.50)
    - CS452 - Real-Time Programming (0.50)
    - CS479 - Neural Networks (0.50)
    - CS480 - Introduction to Machine Learning (0.50)
    - CS484 - Computational Vision (0.50)
    - CS485 - Statistical and Computational Foundations of Machine Learning (0.50)
    - ECE380 - Analog Control Systems (0.50)
    - ECE423 - Embedded Computer Systems (0.50)
    - ECE457C - Reinforcement Learning (0.50)

CS courses

Non-math electives

# Business Specialization

- Business specialization
- Why study this?
  - Interest in using computers in business/IT/finance.
- Requirements:
  - BCS or BMath CS requirements
  - 2 from CS 348, CS 454, CS 490
  - 6 other courses from BUS/COMM

Everything about CS

## Required Courses

- Complete all of the following
  - Complete 2 of the following:
    - CS348 - Introduction to Database Management (0.50)
    - CS454 - Distributed Systems (0.50)
    - CS490 - Information Systems Management (0.50) **CS courses**
  - Complete 3.0 units from the list of approved courses.

## Approved Courses List

- Complete all of the following
  - Choose any of the following:
    - ACTSC231 - Introductory Financial Mathematics (0.50)
    - ACTSC372 - Investment Science and Corporate Finance (0.50)
    - AFM102 - Introduction to Managerial Accounting (0.50)
    - BUS121W - Critical Thinking and Communication Skills (WLU) (0.50)
    - BUS362W - Applied Marketing (WLU) (0.50)
    - BUS381W - Strategic Management I (WLU) (0.50) **All non-math electives**
    - BUS491W - Strategic Management II (WLU) (0.50)
    - COMM400 - Entrepreneurship, Technology and the Emerging Information Economy (0.50)
    - ECON101 - Introduction to Microeconomics (0.50)
    - ECON102 - Introduction to Macroeconomics (0.50)
    - HRM200 - Basic Human Resources Management (0.50)
    - MGMT220 - Entrepreneurship and the Creative Workplace (0.50)

# Digital Hardware

- DH specialization
- Why study this?
  - Interest in EE, hardware.
- Must apply for entry during 1A and complete the term with 75.0%.
- Requirements:
  - BCS or BMath CS requirements
  - 9 course from CS/ENG.
  - *We waive elective depth.*

## Required Courses

- Complete all of the following
  - Complete all the following:
    - ECE124 - Digital Circuits and Systems (0.50)
    - ECE222 - Digital Computers (0.50) Mix of CS/non-ma
    - ECE327 - Digital Hardware Systems (0.50)
    - ECE423 - Embedded Computer Systems (0.50)
  - Complete 1 of the following:
    - CS450 - Computer Architecture (0.50)
    - ECE320 - Computer Architecture (0.50)
  - Complete 2 of the following:
    - CS452 - Real-Time Programming (0.50)
    - CS454 - Distributed Systems (0.50) CS courses
    - CS456 - Computer Networks (0.50)
    - CS457 - System Performance Evaluation (0.50)

# Software Engineering

- SE specialization

- Why study this?

- Interest in designing/building software (engineering methods).

- NOT the same as SE program, not a professional designation.

- Requirements:

- BCS or BMath CS requirements
- 8 courses from CS.

- Complete 1 of the following:
  - CS445 - Software Requirements Specification and Analysis (0.50)
  - ECE451 - Software Requirements Specification and Analysis (0.50)
- Complete 1 of the following:
  - CS446 - Software Design and Architectures (0.50)
  - ECE452 - Software Design and Architectures (0.50)
- Complete 1 of the following:
  - CS447 - Software Testing, Quality Assurance, and Maintenance (0.50)
  - ECE453 - Software Testing, Quality Assurance, and Maintenance (0.50)
- Complete 2 of the following:
  - CS442 - Principles of Programming Languages (0.50)
  - CS444 - Compiler Construction (0.50)
  - CS448 - Database Systems Implementation (0.50)
  - CS449 - Human-Computer Interaction (0.50)
  - CS450 - Computer Architecture (0.50)
  - CS451 - Data-Intensive Distributed Computing (0.50)

CS courses

# CHECKLISTS ([link](#))

## BACHELOR OF COMPUTER SCIENCE (BCS) ^

Year	BCS	BCS with Specializations						
23/24	<a href="#">BCS</a>	<a href="#">AI</a>	<a href="#">Bio</a>	<a href="#">Bus</a>	<a href="#">CFA</a>	<a href="#">DH</a>	<a href="#">HCI</a>	<a href="#">SE</a>
22/23	<a href="#">BCS</a>	<a href="#">AI</a>	<a href="#">Bio</a>	<a href="#">Bus</a>	<a href="#">CFA</a>	<a href="#">DH</a>	<a href="#">HCI</a>	<a href="#">SE</a>
21/22	<a href="#">BCS</a>	<a href="#">AI</a>	<a href="#">Bio</a>	<a href="#">Bus</a>	<a href="#">CFA</a>	<a href="#">DH</a>	<a href="#">HCI</a>	<a href="#">SE</a>
20/21	<a href="#">BCS</a>	<a href="#">AI</a>	<a href="#">Bio</a>	<a href="#">Bus</a>	<a href="#">CFA</a>	<a href="#">DH</a>	<a href="#">HCI</a>	<a href="#">SE</a>

## BMATH COMPUTER SCIENCE (BMATH CS) ^

Year	BMath(CS)	BMath(CS) with Specializations						
23/24	<a href="#">BMath(CS)</a>	<a href="#">AI</a>	<a href="#">Bio</a>	<a href="#">Bus</a>	<a href="#">CFA</a>	<a href="#">DH</a>	<a href="#">HCI</a>	<a href="#">SE</a>
22/23	<a href="#">BMath(CS)</a>	<a href="#">AI</a>	<a href="#">Bio</a>	<a href="#">Bus</a>	<a href="#">CFA</a>	<a href="#">DH</a>	<a href="#">HCI</a>	<a href="#">SE</a>
21/22	<a href="#">BMath(CS)</a>	<a href="#">AI</a>	<a href="#">Bio</a>	<a href="#">Bus</a>	<a href="#">CFA</a>	<a href="#">DH</a>	<a href="#">HCI</a>	<a href="#">SE</a>

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