EVERYTHING YOU WANTED TO KNOW ABOUT CS

BUT DIDN'T KNOW WHO TO ASK.

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ABOUT ME: Jeff Avery

- Industry ~ 18 years
  - Developer > Architect > Manager > Director
  - BI, gaming, telecom, healthcare, logistics, …
- PhD 2012-2016
- UW 2016-present
  - Undergraduate advisor
  - CS admissions, WiCS, UAPC, (S&P)
  - Lecturer in Computer Science
    - Teach software engineering + programming courses



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Teaching: 50%
Advising: 50%
Other : 50%

WHAT WE'LL COVER

- Review of CS major programs
  - Regular programs: BCS vs BMath CS
  - Specialized programs: BCS DS vs Math DS, CS vs SE
  - Elective breadth & depth, Specializations
- Navigating our minors
  - Difference between CS minor and Computing minor
  - Sample course plan for each of these
  - Benefits for Math students
- Admission to CS plans
  - Adding minors
  - Applying for majors

CS MAJOR PROGRAMS

Program details and course comparison.

CS MAJOR PROGRAMS

Name	Degree	Admission	#Admitted 2024	Managed By…
Bachelor of Computer Science	BCS	High school	325	Math/CS
Bachelor of Computer Science / Business Administration DD	BCS/BBA	High school	36 UW 50 WLU	Math/CS & WLU
Bachelor of Mathematics in Computer Science	BMath CS	Year 2+	n/a	Math/CS
Bachelor of Computer Science in Data Science	BCS DS	Year 2+	n/a	Math/CS
Software Engineering	BEng	High school	110	Eng/ECE & Math/CS
Computing and Financial Management	BCFM	High school	37	Arts/AFM & Math/CS

CS MAJOR PROGRAMS: Why two?!

Bachelor of Mathematics in Computer Science (BMath CS) – 4-year Honors, "OG CS"

- Originally designed as a year-2 admission program – aligned with other math programs.

Bachelor of Computer Science (BCS) – 4-year Honors, "new program"

- BCS was added mid-2000s.
- Direct admission from HS into BCS.
- This is the "default plan" for new students and transfers into CS.
- Designed to be "more flexible", "less rigorous" than the BMath CS.

Comparison

- Both are suitable for careers in Computer Science; small differences in required courses.
- BCS is a standalone degree; BMath CS can be combined with other math majors. e.g., BMath CS + CO.
- Students can freely transfer between BCS and BMath CS (by filling in a plan-mod form).

CS MAJOR: CS COURSES

Term	Course	(Math H)	BCS	BMath CS
1A	CS 135 Designing Functional Programs	X	X	X
1B	CS 136 Elementary Algorithm Design & Data Abstraction	X	X	X
	CS 136L Tools and Techniques for Software Development	X	X	X
2A	CS 245 Logic and Computation	opt	X	X
	CS 246 Object-Oriented Software Development	opt	X	X
2B	CS 240 Data Structures and Data Management		X	X
	CS 241 Foundations of Sequential Programs		X	X
	CS 251 Computer Organization and Design		X	X
3A	CS 341 Algorithms		X	X
	CS 350 Operating Systems		X	X
	CS 360 Introduction to Theory of Computing			X
3B	CS 370 Numerical Computation	opt		X

CS MAJOR: REQUIRED MATH COURSES

Term	Course	(Math H)	BCS	BMath CS
1A	MATH 135 Algebra for Honors Math	X	X	X
	MATH 137 Calculus 1 for Honors Math	X	X	X
1B	MATH 136 Linear Algebra 1 for Honors Math	X	X	X
	MATH 138 Calculus 2 for Honors Math	X	X	X
2A	MATH 235 Linear Algebra 2 for Honors Math	X		X
	MATH 237 Calculus 3 for Honors Math	opt		X
	STAT 230 Probability	X	X	X
2B	MATH 239 Introduction to Combinatorics	opt	X	X
	STAT 231 Statistics	X	X	X
3A+	MATH XXX Math Elective			X
	MATH XXX Math Elective			X
	MATH XXX Math Elective			X

ELECTIVE BREADTH & DEPTH

Applies to BCS, BMath CS and BCS DS (but NOT SE or CFM).

In addition to 10 non-math courses, we *also* require:

Breadth

- 1.0 units humanities (can count List II towards this)
- 1.0 units social science
- 0.5 units science
- 0.5 units applied science

Is ECE Applied Science? What if a course isn't offered in 4B?

Depth

- 3 courses in a prerequisite chain (i.e., 3 in-a-row, or 3 with one at 3XX or higher).

SPECIALIZATIONS

Can add these to BCS or BMath CS.

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

SPECIALIZED PROGRAMS: DATA SCIENCE

Bachelor of Data Science in Computer Science (BCS DS)

- Suitable for students that want to do large-scale data analysis (Specialized CS + STATS).
  - It's basically a Joint STATS + CS degree, with 1-2 new courses that were recently developed.
  - Messaging: we're building on existing strengths. i.e., "we've been doing data science for a very long time".
- Cannot be combined with other majors! For a double-major, switch to BMath CS.
  - BCS and BMath CS can still take all the BCS DS courses! (*Why go into BCS DS then?*)
- Comparable to BMath DS (managed by Stats/ActSci).
  - The programs mirror one-another, and are very similar, but lead to different degrees.
  - We normally direct students interested in DS to apply to both programs.
  - Practical difference: BCS DS can take ANY CS courses; BMath DS cannot access other CS courses.

DATA SCIENCE - CS COURSES

Term	Course	BCS	BCS DS	BMath DS
1A	CS 135 Designing Functional Programs	X	X	X
1B	CS 136 Elementary Algorithm Design	X	X	X
	CS 136L Tools and Techniques	X	X	X
2A	CS 245 Logic and Computation	X	X	X
	CS 246 Object-Oriented Software Development	X	X	X
2B	CS 240 Data Structures and Data Management	X	X	X
	CS 241 Foundations of Sequential Programs	X	X	X
	CS 251 Computer Organization and Design	X	X	X
3A	CS 341 Algorithms	X	X	X
	CS 350 Operating Systems	X	X	
	CS 348 Databases		X	X
3B+	CS 451 Data Intensive Distributed Computing		X	X
	CS 480 ML or CS 485 Statistical ML or CS 486 AI		X	X
	Specialized courses (1-2 CS, 4-5 STATS)		X	X

SPECIALIZED PROGRAMS: SOFTWARE ENGINEERING

Software Engineering (BEng SE)

- Designed to (a) teach students how to be professional engineers (practices, process) and (b) also how to apply this software development. The program produces software developers.
- Core courses are very similar to the BCS program, with the addition of required Engineering courses e.g., CHE, PHYS, SE curriculum.
- They have a heavier courseload, more prescribed courses, fewer electives means fewer opportunities to take advanced CS courses.
- Can also take most CS specializations (not SE).
- Ability to obtain P.Eng certification post-graduation.

TRANSFERS INTO CS MAJOR PROGRAMS

BCS

- We have a very small number that we can admit each term (<25 out of 75+ applications).
- Minimum requirement: completed CS 136 + CS 136L.
  - Practical requirement: grade of at least 90% in CS 136 and later CS courses.
- This is a competitive process for *everyone*.
  - Students apply online in the term when they are taking these courses (or comparable courses).
  - We used to allow transfers from CFM directly into BCS. As of Fall 2022, they need to remain in CFM for at least 2 terms and then apply to CS.
  - Similarly, we used to allow SE transfers. As of Fall 2024 (next term!), they need to remain in SE for at least 2 terms and then apply to CS.
- We admit directly into BCS, but students can then easily switch to BMath CS.

TRANSFERS INTO SPECIALIZED PROGRAMS

BCS/BBA Double Degree

- No. You cannot transfer into this program.

BCS Data Science

- Apply online (as a BCS student). We admit up to 25 per term, but rarely hit that limit.

CFM

- Talk to the CFM Program Manager. IIRC it has happened, but I believe it rare.

SE

- Talk to the SE Director. Incredibly rare. A unicorn. IIRC has happened at least once.

TRANSFER Q&A

Can I reapply after being rejected?

- Yes! However, unless your grades are already *really high*, you probably need to do something to increase your chances of being competitive e.g., take a CS major course like CS 245 or CS 246 (and score high in it). Unless your application was right on the edge of being accepted, the result probably won't be any different just by reapplying.

How many times can I apply?

- You can apply every term once you have met the requirements (CS 136/L).

Should HS students who wants CS but were offered a different program accept that offer, and then try to transfer into CS?

- No. Please no. You should only accept an offer if you want to graduate from that program. Many math programs combine well with CS *minor* courses, which may be an option for you.

CS MINOR PLANS

Plan details and courses. Advice on which courses to take.

CS MINOR PLANS

Name	Courses	Suitable for
CS Minor	8 CS, 1 MATH	Math students (incl. former CS students)
Computing Minor	8 CS	Everyone (except SE, CFM)

MINOR PLANS: CS MINOR

CS Minor (2016-present)

- Has gone through many iterations. It's intended to be "CS intensive".
- Current iteration requires CS major courses i.e., courses with middle digit 4-9.

  "The Computer Science minor is generally not available to students outside the Faculty of Mathematics because it includes several restricted courses. Students inside the Faculty of Mathematics may need to register as a Computer Science major for one or more terms to complete the Computer Science minor."

- However, we restricted CS admission in 2017. We don't let students do this ^ anymore.
- Practically, this means there's a *very* short list of courses that a math student can take to satisfy these requirements. This minor is most appealing to former CS students.
- We cannot admit anyone into the CS minor – can only grant at graduation.

MINOR PLANS: CS MINOR REQUIREMENTS



CS Minor (2016-present)

- One of MATH 239, 249 (Combinatorics)
- One of CS 115, 135, 145 (CS 1)
- One of CS 136/136L, 146/146L (CS 2)
- One additional course from CS 340-398, CS 440-498.
- Five additional courses from CS 240-299, CS 340-398, CS 440-498.

Constraint: the average of all CS courses needs to be at least 60%.

CS MINOR: SUGGESTED COURSES

Course
MATH 239 Introduction to Combinatorics
CS 135 Designing Functional Programs
CS 136 Elementary Algorithm Design & Data Abstraction
CS 136L Tools and Techniques for Software Development
CS 245 Logic and Computation
CS 246 Object-Oriented Software Development
CS 370 Numerical Computation *or* CS 371 Computational Mathematics
CS 467 Introduction to Quantum Information Processing
CS 475 Computational Linear Algebra
CS 479 Neural Networks
CS 487 Introduction to Symbolic Computation

Requirements

- MATH 239
- CS 135
- CS 136 + 136L
- 7 more CS courses

Theses courses are available to anyone in Math H.

This list includes 8 CS courses from 2XX on; they would only need 7 from that list.

MINOR PLANS: COMPUTING MINOR

Computing Minor (2020-present)

- Has also gone through iterations (Computing Technology, Computing Option).
- Current iteration allows *any* CS courses to be used (woohoo!)
- Anyone can easily meet the requirements.
- We can easily admit *anyone* with a plan-mod form.

We recommend the Computer Minor > CS Minor for most students!

- *Much more flexibility* in the courses that they can take.

MINOR PLANS: COMPUTING MINOR REQUIREMENTS



Computing Minor (2023-2024)

- One of CS 115, 135, 145
- One of CS 114, 116, 136/136L, 146/146L
- One course from CS 100-146, CS 200-299, CS 300-398, CS 400-498.
- Four additional courses from CS 200-299, CS 300-398, CS 400-498.
- One additional course from CS 300-398, CS 400-498.

Constraint: the average of all CS courses needs to be at least 60%.

COMPUTING MINOR: SUGGESTED COURSES

Course
CS 135 Designing Functional Programs
CS 136 Elementary Algorithm Design & Data Abstraction
CS 136L Tools and Techniques for Software Development
CS 245 Logic and Computation
CS 246 Object-Oriented Software Development
CS 230 Introduction to Computers and Computer Systems (sim CS 251)
CS 231 Algorithmic Problem Solving (sim CS 341)
CS 234 Data Types and Structures (sim CS 240)
CS 431 Data Intensive Distributed Analytics

Requirements

- ~~MATH 239~~
- CS 135
- CS 136 + 136L
- ~~7~~ 6 more CS courses

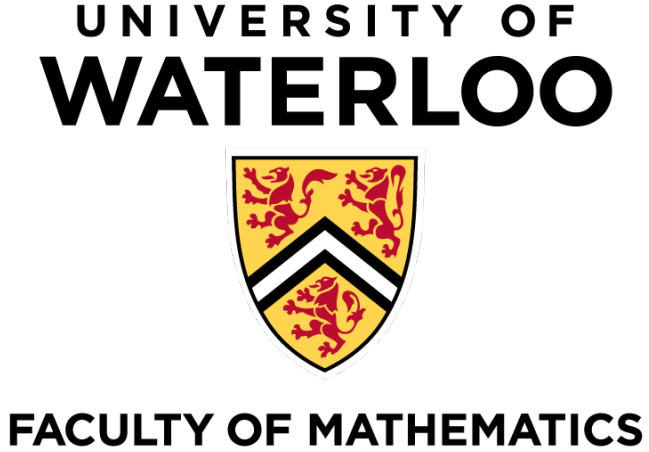
This list includes 6 CS courses to meet requirements.

Courses are available to anyone, even outside of Math.

They could also take any of the CS minor courses we listed and use them towards the Computing Minor.

WHY TAKE A CS/COMPUTING MINOR

- Computer science touches every field. There's a real chance that you will need some CS + programming skills in your career.
- You will learn practical skills to complement your main plan.
  - Problem solving, Working with data (CS 431)
  - Programming, Testing, Analysis (CS 115, 116, 135, 136, 136L)
  - Algorithms (CS 231)
- The Computing Minor is broad enough to let you choose from many different courses based on your interests e.g., business/analysis, ML, programming.
  - The CS Minor, ironically, doesn't do this as well since it's so restrictive.


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