# COMPUTING – MAJOR (COMPUTING) – BACHELOR OF COMPUTING (HONOURS)

**COMP-M-BCH** (Computing)
**COMP-I-BCH** (Computing with Professional Internship)

**Subject:** Administered by the School of Computing.
**Plan:** Consists of 72.00 units as described below.
**Program:** The Plan, alone, or in combination with a Minor in another subject, and with sufficient electives to total 120.00 units, will lead to a Bachelor of Computing (Honours) Degree.

**Note:** Requirements for this program have been modified. Please consult the 2022-2023 (https://www.queensu.ca/academic-calendar/archive/2022-2023/arts-science/)*Calendar* for the previous requirements.

| Code | Title | Units |
|---|---|---|
| **1. Core** | | |
| **A. Complete the following:** | | |
| CISC 121 | Introduction to Computing Science I | 3.00 |
| CISC 124 | Introduction to Computing Science II | 3.00 |
| **B. Complete 3.00 units from the following:** | | **3.00** |
| STAT 263 | Introduction to Statistics | |
| STAT 268 | Statistics and Probability I | |
| STAT 351 | Probability I | |
| STAT_Options | | |
| **C. Complete the following:** | | |
| CISC 203 | Discrete Mathematics for Computing II | 3.00 |
| CISC 204 | Logic for Computing Science | 3.00 |
| CISC 221 | Computer Architecture | 3.00 |
| CISC 223 | Software Specifications | 3.00 |
| CISC 235 | Data Structures | 3.00 |
| **D. Complete 3.00 units from the following:** | | **3.00** |
| CISC 322 | Software Architecture | |
| CISC 326 | Game Architecture | |
| **E. Complete the following:** | | |
| CISC 324 | Operating Systems | 3.00 |
| CISC 360 | Programming Paradigms | 3.00 |
| CISC 365 | Algorithms I | 3.00 |
| **F. Complete the following:** | | |
| CISC 497 | Social, Ethical and Legal Issues in Computing | 3.00 |
| **G. Complete 3.00 units from the following:** | | **3.00** |
| CISC 495 | Software Evolution | |
| CISC 496 | Game Development Project | |
| CISC 499 | Advanced Undergraduate Project | |
| CISC 500 | Undergraduate Thesis | |
| **2. Option** | | |
| **A. Complete 15.00 units from one of the following options:** | | **15.00** |
| i. Fundamental Computation | | |
| ii. Biomedical Computation | | |
| iii. Data Analytics | | |
| iv. Artificial Intelligence | | |
| v. Game Development | | |
| vi. Security | | |
| **B. Complete 3.00 units from the following:** | | **3.00** |
| CISC, COCA, COGS, or SOFT at the 200-level or above | | |
| **3. Supporting** | | |
| **A. Complete 6.00 units from the following:** | | **6.00** |
| CISC 102 & MATH 111 | Discrete Mathematics for Computing I and Linear Algebra | |
| CISC 102 & MATH 112 | Discrete Mathematics for Computing I and Introduction to Linear Algebra | |
| MATH 110 | Linear Algebra | |
| **B. Complete 6.00 units from the following:** | | **6.00** |
| MATH 120 | Differential and Integral Calculus | |
| MATH 121 | Differential and Integral Calculus | |
| MATH 123 & MATH 124 | Differential and Integral Calculus I and Differential and Integral Calculus II | |
| **Electives** | | |
| Elective Courses | | 48.00 |
| **Total Units** | | **120.00** |

## Option List

### i. Fundamental Computation

| Code | Title | Units |
|---|---|---|
| **a. Complete 3.00 units from the following:** | | **3.00** |
| CISC 422 | Formal Methods in Software Engineering | |
| CISC 455 | Evolutionary Optimization and Learning | |
| CISC 462 | Computability and Complexity | |
| CISC 465 | Semantics of Programming Languages | |
| CISC 467 | Fuzzy Logic | |
| **b. Complete 3.00 units from the following:** | | **3.00** |
| CISC | | |
| CISC_Subs | | |
| SOFT at the 400-level or above | | |
| **c. Complete 6.00 units from the following:** | | **6.00** |

| | | |
|---|---|---|
| CISC at the 300-level or above | | |
| CISC_Subs at the 300-level or above | | |
| SOFT at the 300-level or above | | |
| **d. Complete 3.00 units from the following:** | | **3.00** |
| CISC at the 200-level or above | | |
| CISC_Subs at the 200-level or above | | |
| SOFT at the 200-level or above | | |
| **Total Units** | | **15.00** |

### ii. Biomedical Computation

| Code | Title | Units |
|---|---|---|
| **a. Complete the following:** | | |
| CISC 271 | Linear Data Analysis | 3.00 |
| CISC 330 | Computer-Integrated Surgery | 3.00 |
| CISC 352 | Artificial Intelligence | 3.00 |
| CISC 472 | Medical Informatics | 3.00 |
| **b. Complete 3.00 units from the following:** | | **3.00** |
| CISC 320 | Fundamentals of Software Development | |
| CISC 471 | Computational Biology | |
| **Total Units** | | **15.00** |

### iii. Data Analytics

| Code | Title | Units |
|---|---|---|
| **a. Complete the following:** | | |
| CISC 271 | Linear Data Analysis | 3.00 |
| CISC 371 | Nonlinear Data Analysis | 3.00 |
| CISC 372 | Advanced Data Analytics | 3.00 |
| CISC 451 | Topics in Data Analytics | 3.00 |
| CISC 452 | Neural and Genetic Computing | 3.00 |
| **Total Units** | | **15.00** |

### iv. Artificial Intelligence

| Code | Title | Units |
|---|---|---|
| **a. Complete the following:** | | |
| COGS 100 | Introduction to Cognitive Science | 3.00 |
| COGS 201 | Cognition and Computation | 3.00 |
| CISC 352 | Artificial Intelligence | 3.00 |
| **b. Complete 6.00 units from the following course list:** | | **6.00** |
| CISC_Artificial_Intelligence | | |
| **Total Units** | | **15.00** |

### v. Game Development

| Code | Title | Units |
|---|---|---|
| **a. Complete the following:** | | |
| CISC 226 | Game Design | 3.00 |
| CISC 320 | Fundamentals of Software Development | 3.00 |
| CISC 352 | Artificial Intelligence | 3.00 |
| CISC 454 | Graphics (A) | 3.00 |
| CISC 486 | Game Development | 3.00 |
| **Total Units** | | **15.00** |

### vi. Security

| Code | Title | Units |
|---|---|---|
| **a. Complete the following:** | | |
| CISC 220 | System Level Programming | 3.00 |
| CISC 327 | Software Quality Assurance | 3.00 |
| CISC 335 | Computer Networks | 3.00 |
| CISC 447 | Introduction to Cybersecurity | 3.00 |
| **b. Complete 3.00 units from the following:** | | **3.00** |
| CISC 434 | Distributed Systems | |
| CISC 448 | Software Reliability and Security | |
| CISC 468 | Cryptography | |
| **Total Units** | | **15.00** |

## 4. Substitutions

A. Students in the internship version of this Plan will substitute 3.00 units from COMP at the 300-level for requirement **1.G.** (CISC 496 (https://www.queensu.ca/academic-calendar/search/?P=CISC%20496) or CISC 499 (https://www.queensu.ca/academic-calendar/search/?P=CISC%20499) or CISC 500 (https://www.queensu.ca/academic-calendar/search/?P=CISC%20500)). In addition, the B.Cmp. (Hons.) Program requirements will be increased by 6.00 units from COMP at the 300-level, for a total of 126.00 units if the student is taking a 12-month internship, or by 9.00 units from COMP at the 300-level, for a total of 129.00 units if the student is taking a 16-month internship.

## 5. Notes

A. Students with no programming experience should review the Introductory Courses (https://www.queensu.ca/academic-calendar/arts-science/schools-departments-programs/computing/) paragraph included on the School of Computing overview page in the *Calendar.*

B. ELEC courses are offered by the Faculty of Engineering and Applied Science. Special permission may be required to register. All such courses will count as 3.00 units towards degree requirements in Arts and Science.

C. Students should consider the following courses to complement their option courses. Data Analytics: Students interested in machine learning or artificial intelligence can take CISC 473. Game Development: Students with interests the arts can take COCA 201. Students with interests in analytics or machine learning can take CISC 271. Students

with interests in human-computer interaction can take CISC 325.

D. A maximum of 6.00 units from courses offered by other Faculties and Schools may be counted toward the program and/or Plan requirements. This includes courses in BMED, COMM, GLPH, HSCI, LAW, NURS, and courses in the Faculty of Engineering and Applied Science.

## Computing Course List

The following list contains courses offered through other Departments. In accordance with Academic Regulation **2.6** (Access to Classes), students do not have enrolment priority in all of these courses. Access to these courses may only be made available during the Open Enrolment period, and then only if space permits.

### CISC_Artificial _Intelligence

| Code | Title | Units |
|---|---|---|
| **Artificial Intelligence Option Courses** | | |
| CISC 351 | Advanced Data Analytics | 3.00 |
| CISC 371 | Nonlinear Data Analysis | 3.00 |
| CISC 372 | Advanced Data Analytics | 3.00 |
| CISC 451 | Topics in Data Analytics | 3.00 |
| CISC 452 | Neural and Genetic Computing | 3.00 |
| CISC 453 | Topics in Artificial Intelligence | 3.00 |
| CISC 455 | Evolutionary Optimization and Learning | 3.00 |
| CISC 467 | Fuzzy Logic | 3.00 |
| CISC 473 | Deep Learning | 3.00 |
| CISC 474 | Reinforcement Learning | 3.00 |

### CISC_Subs

| Code | Title | Units |
|---|---|---|
| **Courses in other departments usable as CISC Options** | | |
| COMM 365 | Advanced Business Decision Modeling | 3.00 |
| ELEC 470 | Computer System Architecture | 3.00 |
| MATH 272 | Applications of Numerical Methods | 3.00 |
| MATH 337 | Stochastic Models in Operations Research | 3.00 |
| MATH 401 | Graph Theory | 3.00 |
| MATH 402 | Enumerative Combinatorics | 3.00 |
| MATH 434 | Optimization Theory with Applications to Machine Learning | 3.00 |
| MATH 474 | Information Theory | 3.00 |

### STAT_Options

| Code | Title | Units |
|---|---|---|
| **Statistic Course Options** | | |
| BIOL 243 | Introduction to Statistics | 3.00 |
| CHEE 209 | Analysis Of Process Data | 3.00 |
| COMM 162 | Managerial Statistics | 3.00 |
| ECON 250 | Introduction to Statistics | 3.00 |
| GPHY 247 | Introduction to Statistics | 3.00 |
| KNPE 251 | Introduction to Statistics | 3.00 |
| NURS 323 | Introduction to Statistics | 3.00 |
| POLS 285 | Introduction to Statistics | 3.00 |
| PSYC 202 | Statistics in Psychology | 3.00 |
| SOCY 211 | Introduction to Statistics | 3.00 |
| STAM 200 | Introduction to Statistics | 3.00 |
| STAT 263 | Introduction to Statistics | 3.00 |