THE UNIVERSITY OF WINNIPEG

ACS/PHYS-2102-050 Scientific Computing | Winter 2026

Course Information

Instructor:	Michelle Boyce
Email:	m.boyce@uwinnipeg.ca[1]
Lectures:	Thur 6:00-9:00 PM
Classroom:	2L14
Office	2C27
Office Hours:	By Appointment

Important Dates

Jan 8	Our First Class
Feb 15-21	Winter Term/Reading Week
Feb 26	Midterm
Mar 13	Withdraw Data
Apr 2	Our Last Class
Apr 3 (Fri)	*Good Friday Holiday*
Apr 9-22	Final Exams

Course Description:

Many problems arising in science are too difficult to solve analytically, and thus require analysis of some form by a computer. Using the language of C/C++, this course introduces the most common programming constructs used in scientific computing. The critical importance of data structures to represent information is emphasized, which naturally leads to an object-oriented approach to problem solving. The use of external libraries, such as those for numerical analysis, to solve more advanced problems are explored, with attention paid to checks that can be made on the reliability of the results.

Overview

This course provides an introduction to the C++ programming language, bootstrapped via the C programming language. Some of the underlying core principles of non-object-oriented programming are learned through C, and are carried forth to object-oriented programming through C++. Students will become familiar with the foundations of object-oriented programming, along with some software design concepts through the Unified Modeling Language (UML). Some basic applications used in scientific computing will also be covered. In many ways, C++ is the most fundamental object-oriented programming language, as other languages, such as, Java, JavaScript, Python, Visual Basic, etc., are hobbled in their abilities. Thus, learning C/C++, with a dash of UML, will provide a solid foundation in object-oriented application design and implementation for years to come!

Learning Modules

The following table outlines the learning modules within this course. The UML, Plotting, and Applications modules will be taught in concert with C/C++.

Objective	Topics	Resources
C	"Hello Word!", data types, operations, control structures, loops, I/O, functions, pointers, arrays, strings, structures, memory allocation.	W3Schools C Tutorial
C++	Basic class structure, data types, inheritance, polymorphism, I/O, constructors/destructors.	W3Schools C++ Tutorial
UML	Basic class notation, class diagrams, object hierarchy diagrams.	TutorialsPoint

[1] Do not use the Nexus email portal. It is not checked.

Objective	Topics	Resources
Plotting	Scatter plots, line plots.	GNUPlot
Applications	Area, slopes, statistics, root finding …	Numerical Recipes

NB: The aforementioned table is a general overview of the subject matter to be covered, and the breadth and depth of coverage is on a time-permitted basis – not all topics will necessarily be covered.

Course Material

Reference Texts:

- The ANSI C Programming Language, Brian W. Kernighan and Dennis M. Ritchie, 2nd ed., Prentice Hall, 1988. ISBN 0-13-110362-8
- C++ for C Programmers, Ira Pohl, 2nd ed., Benjamin/Cummings, 1994. ISBN 0-8053-3159-X
- UML Distilled, Martin Fowler, 3rd ed., Addison-Wesley, 2003. ISBN 0-321-19368-7
- Numerical Recipes, The Art of Scientific Computing (FORTRAN Version), William H. Press, Brian P. Flannery, Saul A. Teukolsky, and William T. Vetterling, 1st ed., Cambridge, 1989. ISBN 0-521-38330-7

Online Resources:

- W3Schools
  - C Tutorial: https://www.w3schools.com/c/
  - C++ Tutorial: https://www.w3schools.com/cpp/
- TutorialsPoint
  - UML Tutorial: https://www.tutorialspoint.com/uml/index.htm
- GNUPlot
  - http://www.gnuplot.info
- Online Help
  - Add the word “stackoverflow” to your Google searches when stuck on assignment problems and/or have compiler issues. Do not rely on AI.[2]

Evaluation Criterion

The general class format consists of live programming lectures, to which students can follow along, followed by a short break, after which students do hands on programming (tutorial). (Students can use their own personal computer and/or the ones provided in the classroom.) Typically the live and hands-on programming work become part of the assignments. The exams are heavily base on in-class experience and assignments, wherein some questions will be taken directly from this work. So to be successful in this course, attending classes and doing homework is important.

[2] See, “How to Succeed in this Course,” below.

Grading Scheme:

- Participation 5%:
  - Attendance taken
  - Must attend full class to get full attendance marks
  - Students must focus on work pertaining to the class
  - Two exemptions allowed
- Assignments 25%:
  - Roughly one per week
  - Posted/Submitted *via* Nexus[3]
  - Zero if late
- Midterm 30%:
  - In class
  - No cheat sheets
  - A Simple Calculator (incapable of storing information)
  - No personal electronic devices (e.g., phones, smart watches)[4]
  - Photo ID Required
- Final 40%:
  - Same criterion as Midterm.

NB: If the Midterm is missed for valid reasons, the final shall count as 70%.[5]

Grading System:

The percentage to letter grade conversion guidelines are as follows.

Letter	Percentage
A+	90.00 - 100.00
A	84.00 - 89.99
A-	80.00 - 83.99
B+	74.00 - 79.99
B	67.00 - 73.99
C+	61.00 - 66.99
C	55.00 - 60.99
D	50.00 - 54.99
F	0.00 - 49.99

Note: These are guidelines, wherein the final grades shall be approved by the Department Review Committee (DRC), and so are subject to change.

How to Succeed in this Course

It is important to attend classes and participate in all activities. Learning programming is an experiential process. The process of typing in code (not copy-pasting), compiling, running, and debugging (trouble shooting) is what leads to success.

[3] Should technical difficulties arise with Nexus, email shall be used.
[4] They must be turned off and stowed away.
[5] The midterm date is Feb 26th, which does not conflict with Observed Religious Holidays.

The use of AI tools is highly discouraged.[6] Instead of struggling to understand a problem, its usage affects memory retention, as it is not an effective experiential learning tool. It is also prone to errors. In addition, it is not good at human interaction, as it provides a false sense of positive reinforcement – it tells you what you want to hear. Given that you will be evaluated based on closed book exams, this is a recipe for disaster.

Copying from fellow classmates is highly discouraged.[7] However, collaborating with a classmate, after struggling with a problem, is an effective method of reinforced learning. Also, with human interaction, you are not always told what you want to hear. This punctuates the learning process by making you re-evaluate your thoughts. This will lead to critical thinking skills, which lends well to programming and problem solving – in general!

Programming requires logical thinking and paying attention to detail. These guidelines are here to help you with that process. When it comes to exams, memorizing syntax becomes less of an effort, as it will be reinforced through experiential learning.

Academic Integrity

You are expected to take academic integrity very seriously and be mindful of your own activities and the requests/offers you may receive from others.

In addition to the guidelines in the Academic Calendar (Regulations and Policies, Subsection 8a), for all assessment items in this course, the following are considered cheating, plagiarism, or academic misconduct:

- Copying from another student's work and submitting it as your own (group or collaborative work approved by the instructor is not considered cheating).
- Uploading the assignment questions on file-sharing websites (such as Chegg.com, quizlet, ChatGPT, or any other 'Help' sites) in order to receive help or solutions.
- Copying from any sources, including, but not limited to: the Internet; any AI tools, online calculators and graphing tools; assignments or tests/exams from previous years or from other courses; solutions provided by a third party (purchased or otherwise).
- Asking questions from another student or any unauthorized person during the exams and tests, including, but not limited to: the in-person exams, take-home exams, or remote exams.
- Talking or communicating with other student(s), during the exams/tests (in-person or on Zoom), in any language, for any reason or purpose.
- Using or having in one's possession any unauthorized sources and devices during the tests and exams.
- Soliciting and obtaining solutions to the assignments, tests, and exams via any means of communication (*e.g.*, e-mail, text, phone call, social media chats, *etc*.).
- Providing test or exam questions and/or solutions to another student, uploading them to a filesharing website, or otherwise sharing them outside the course.

It is your responsibility to know the policies and guidelines, and to be aware of the academic misconduct procedures. Anybody involved in the process could be charged with academic

[6] NB: Please see **AI Text-generating Tools** section below.
[7] NB: Please see **Academic Integrity** section below.

misconduct. For more information, please see the Academic Calendar, Regulations and Policies, Subsection 8a (https://uwinnipeg.ca/academics/calendar/docs/regulationsandpolicies.pdf).

AI Text-generating Tools

Students must follow principles of academic integrity (*e.g.*, honesty, respect, fairness, and responsibility) in their use of material obtained through AI text-generating tools (*e.g.*, ChatGPT, Bing, Notion AI). Suspected misuse of AI may result in a report to the Senate Academic Standards and Misconduct Committee. If AI tools are used, students must cite them. According to the MLA (https://style.mla.org/citing-generative-ai/), "you should

a. cite a generative AI tool whenever you paraphrase, quote, or incorporate into your own work any content (whether text, image, data, or other) that was created by it
b. acknowledge all functional uses of the tool (like editing your prose or translating words) in a note, your text, or another suitable location
c. take care to vet the secondary sources it cites"

If students are not sure whether or not they can use AI tools, they should ask their professors.

University of Winnipeg Regulations and Policies

- ***Course Outline changes***
  - A permitted or necessary change in mode of delivery may require adjustments to important aspects of course outlines, like class schedule and the number, nature, and weighting of assignments and/or exams.
- ***COVID-19***
  - Students can find answers to updates and frequently asked questions related to COVID-19 here: https://www.uwinnipeg.ca/covid-19/index.html
- Winter term 2026
  - Lectures begin on January 5.
  - Reading week is February 15 to 21.
  - Voluntary withdrawal is March 13.
  - Lectures end on April 3.
  - Evaluation period is April 9 to 22.
- ***Class Cancellation***
  - When it is necessary to cancel a class due to exceptional circumstances, every effort will be made to inform students *via* UWinnipeg email.
- ***Communication***
  - Students have the responsibility to regularly check their University of Winnipeg email addresses to ensure timely receipt of correspondence from the University and/or their course instructors.
  - Students are also responsible for regularly checking Nexus for announcements, notes/slides updates, assignments (downloads/uploads), *etc*. This will be the primary source for the dissemination of information pertaining to this course. Nexus has email alerts that can be set.
    - Should technical difficulties arise with Nexus, communication shall default to email.
    - Do not use the Nexus email tool, as it is not checked.

- ***Voluntary Withdrawal***
  - The Voluntary Withdrawal (VW) date, without academic penalty, is Wednesday, March 13, 2026.
  - Please note that withdrawing before the voluntary withdrawal date does not necessarily result in a fee refund.
  - A minimum of 20% of the work on which the final grade is based will be evaluated and available to the student prior to the voluntary withdrawal date.
  - Students are encouraged to contact their instructor prior to withdrawing in case they can help in any way.
- ***University Closures 2026***
  - The dates the University is closed for holidays:
    - ★ February 16, 2026 (Louis Riel Day)
    - ★ April 3, 2026 (Good Friday)
    - ★ April 5, 2026 (Easter Sunday)
- ***Religious Holy Days***
  - Students may choose not to attend classes or write examinations on holy days of their religion, but they must notify their instructors at least two weeks in advance. Instructors will then provide opportunity for students to make up work examinations without penalty. A list of religious holidays can be found in the Undergraduate Academic Calendar.[5]

    https://www.uwinnipeg.ca/academics/calendar/docs/important-notes.pdf
- ***Regulations, Policies, and Academic Integrity***
  - Students are encouraged to familiarize themselves with the Regulations and Policies found in the 2025-26 Academic Calendar. Particular attention should be given to subsections 8 (Student Discipline, including Academic Misconduct Policies and Procedures), 9 (Senate Appeals), and 10 (Grade Appeals).
  - Please be mindful of the importance of maintaining academic integrity and the potential consequences of engaging in plagiarism, cheating, and other forms of academic misconduct. Even unintentional plagiarism is a form of academic misconduct.
  - Similarly, uploading essays and other assignments to essay vendor or trader sites (filesharing sites that are known providers of essays for use by others who submit them to instructors as their own work) is a form of misconduct, as it involves aiding and abetting plagiarism.
  - An updated and expanded University of Winnipeg library site outlining principles of Academic Integrity can be found at https://library.uwinnipeg.ca/use-the-library/help-with-research/academic-integrity.html.
- ***Respectful Learning Environment***
  - Students are expected to conduct themselves in a respectful manner on campus and in the learning environment irrespective of platform being used. Behaviour, communications, or acts that are inconsistent with a number of UW policies, such as,
    - ★ Respectful Working and Learning Environment Policy and Procedures
    - ★ Acceptable Use of Information Technology Policy

could be considered “non-academic” misconduct.
  - More detailed information can be found here:
    - ★ Student Non-Academic Misconduct Policy
    - ★ Student Non-Academic Misconduct Procedures
- ***Scent Policy***
  - In order to ensure a safe and comfortable learning environment for everyone, we kindly ask that all students refrain from wearing or using scented products while attending class.
- ***Copyright and Intellectual Property***
  - Course materials are the property of the instructor who developed them. Examples of such materials are course outlines, assignment descriptions, lecture notes, test questions, and presentation slides — irrespective of format. Students who upload these materials to filesharing sites, or in any other way share these materials with others outside the class without prior permission of the instructor/presenter, are in violation of copyright law and University policy.
  - Students must also seek prior permission of the instructor/presenter before, for example, photographing, recording, or taking screenshots of slides, presentations, lectures, and notes on the board (or computer). Students found to be in violation of an instructor’s intellectual property rights could face serious consequences pursuant to the Academic Misconduct or Non-Academic Misconduct Policy; such consequences could possibly involve legal sanction under the Copyright policy
    https://www.uwinnipeg.ca/policies/docs/policies/copyright-policy.pdf
- ***Research Ethics***
  - Students conducting research interviews, focus groups, surveys, or any other method of collecting data from any person, including a family member, must obtain research ethics approval before commencing data collection. Exceptions are research activities done in class as a learning exercise. For submission requirements and deadlines, see
    https://www.uwinnipeg.ca/research/ethics/human-ethics.html
- ***Privacy***
  - A guide to the basic requirements for the collection, use, and disclosure of personal information may be found here. The Privacy and Policy Procedures may be found here.
  - Students should be reminded of their rights in relation to the collecting of personal data by the University, especially if Zoom is being used for remote learning and testing / proctoring:
    - ★ Student Privacy Notice
    - ★ Zoom Privacy Notice
    - ★ Zoom Test and Exam Proctoring

Sexual Violence and Human Rights Advisor (SVHRA)

Students who have experienced Sexual Violence can access support from the SVHRA. The SVHRA receives disclosures and can support students with on and off-campus reporting. In collaboration with the Sexual Violence Response Team (SVRT), the SVHRA also provides fast-track referrals to Student Wellness, academic accommodations, security support, and other on and off campus

supports. The SVHRA and SVRT operate within a confidential, survivor-centered, and trauma-informed framework.

Disclosures may be made in-person, email, by text, by phone, or Zoom/Teams.

5Ri55, 5th Floor (Rice Centre)

204.230.6660 – *call or text (confidential line)*

svrt@uwinnipeg.ca **uwinnipeg.ca/respect/sexual-violence**

Accessibility Services

Students with documented disabilities, temporary or chronic medical conditions, requiring academic accommodations for tests/exams (*e.g.*, private space) or during lectures/laboratories (*e.g.*, note-takers) are encouraged to contact Accessibility Services (AS) & Deaf and Hard of Hearing Services (DHHS) at 204.786.9771 or accessibilityservices@uwinnipeg.ca to discuss appropriate options. All information about a student's disability or medical condition remains confidential.

More information about these services can be found online at
http://www.uwinnipeg.ca/accessibility/

Land Acknowledgement

We acknowledge that we are gathered on ancestral lands, on Treaty One Territory. These lands are the heartland of the Métis people. We acknowledge that our water is sourced from Shoal Lake 40 First Nation.

https://www.uwinnipeg.ca/indigenous/land-acknowledgement.html