**DigiPen**
INSTITUTE OF TECHNOLOGY
SINGAPORE

# Course Syllabus (Spring 2020)

[CS 170] High-level Programming II: The C++ Programming Language

## 1. Course Information

### 1.1. General Information

**Course full title:** [CS 170] High-level Programming II: The C++ Programming Language

**Pre-requisite(s):** [CS 120] High-level Programming I: The C Programming Language

**Co-requisite(s):** Nil

**Result type:** Grade, 4 credits

**Web page:** Singapore Campus\Spring 2020\cs170s20-a.sg
Singapore Campus\Spring 2020\cs170s20-b.sg

https://distance.sg.digipen.edu/
*The website is accessible via student's DIT login credential.*

### 1.2. Description

This course introduces the C++ language with particular emphasis on its object-oriented features. Topics include stylistic and usage differences between C and C++, namespaces, function and operator overloading, classes, inheritance, templates, and fundamental STL components.

### 1.3. Objectives and Learning Outcomes

After successfully completing this course, students should:

- ✓ Understand differences between imperative programming as practiced in [CS 120] and object-oriented programming practiced in [CS 170].
- ✓ Understand concepts of abstraction, encapsulation, inheritance, and polymorphism.
- ✓ Understand the practice of separating the interface from the implementation.
- ✓ Understand the challenges of building large-scale programs and know how object-oriented programming facilitates it.
- ✓ Understand different features of the standard library and know how to use them effectively in solving programming problems.
- ✓ Apply course concepts to implement data structures and programs to solve programming problems.

The successful students will be prepared to take the next programming course in the sequence *"[CS 225] Advanced C/C++"*. They will be able to use C++ in the second year game courses as well.

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## 2. Course Organization

### 2.1. Lecture Schedule

**Section A:**      Mondays         11:00am – 12:40pm
                    Wednesdays      11:00am – 12:40pm
                    SIT@SP          LT4A

**Section B:**      Mondays         9:00am – 10:40am
                    Wednesdays      9:00am – 10:40am
                    SIT@SP          LT4A

### 2.2. Laboratory Schedule

**Section A:**      Fridays         9:00am – 11:10am
                    SIT@SP          SR2F *(Tesla)*

**Section B:**      Tuesdays        3:30pm – 5:40pm
                    SIT@SP          SR3E *(Pascal)*

### 2.3. Instructors

**Lecturer:**          Slawomir "Swavek" Wlodkowski, *M.Sc.*

**Consultation hours:**   (by appointment only, typically within the hours shown below)
                          Mondays       2:00pm – 4:00pm
                          Wednesdays    2:00pm – 4:00pm

**Contact:**           swavek.wlodkowski@digipen.edu
                       (include "*[cs170s20-a]*" or "*[cs170s20-b]*" in the subject)

## 3. Learning Resources

### 3.1. Required Textbook

- Stanley B. Lippman, Josee Lajoie, Barbara E. Moo, "*C++Primer*", 5th Edition, Addison-Wesley. ISBN: 978-0321714114

### 3.2. Recommended Reading

- Bjarne Stroustrup, "*The C++ Programming Language*", 4th Edition. Addison-Wesley; ISBN: 978-0321563842.
- Bjarne Stroustrup, "*Programming: Principles and Practice Using C++",* 2nd Edition. Addison-Wesley; ISBN: 978-0321992789.
- Nicolai M. Josuttis, The C++ Standard Library: A Tutorial and Reference, 2nd Edition. Addison-Wesley; ISBN: 978-0321623218.

# 4. Course Outline

## 4.1. Schedule

| Week | Week start/Date | Topic |
|---|---|---|
| 1 | *6th January 2020* | *Spring trimester classes begin* |
|  | 6th January 2020 | Introduction to the course<br>Differences between C and C++ with emphasis on references, dynamic memory allocation and formatted I/O |
| 2 | 13th January 2020 | Object-oriented programming (OOP)<br>Classes, objects, interface vs. implementation, member access specifiers, constructors, destructors. |
| 3 | *20th January 2020* | *Deadline for course withdrawal without academic penalty* |
|  | 20th January 2020 | Overloaded functions, default parameters |
| 4 | *27th January 2020* | *Chinese Lunar New Year's Day Observed* |
|  | 27th January 2020 | Operator overloading |
| 5 | *3rd February 2020* | *Founder's Day Observed* |
|  | 3rd February 2020 | Composition and aggregation (*Has-a* idiom) |
| 6 | 10th February 2020 | Function and class templates |
| 7 | **17th February 2020** | **Trimester break (no classes)** |
| 8 | **24th February 2020** | **Mid-term exam** |
|  | 24th February 2020 | Standard Template Library (STL): containers, iterators, algorithms |
| 9 | *2nd March 2020* | *Mid-term grades due* |
|  | *4th March 2020* | *Deadline for course withdrawal with grade "W"* |
|  | 2nd March 2020 | STL containers: string, vector, deque, list, forward_list, set, map |
| 10 | 9th March 2020 | File I/O; exceptions |
| 11 | 16th March 2020 | Inheritance (*Is-a* idiom); base and derived classes |
| 12 | 23rd March 2020 | Polymorphism; virtual member functions |
| 13 | 30th March 2020 | Advanced OOP and copy control |
| 14 | **6th April 2020** | **Trimester review (no classes)** |
| 15 | **(TBA)** | **Final exam** |
| 16 | *20th April 2020* | *Final grades due* |

Above is a list of topics that will be covered this trimester. Depending on time, some minor topics may be added or skipped. Please note that this is a tentative organization of the course and it may change.

## 4.2. Format

Students are clustered into three sections: A, B, and C. Sections A and B are taught by Swavek Wlodkowski, and they are covered in this syllabus. Students of the section C should refer to a separate syllabus document published by Dr Vadim Surov.

This trimester follows the structure "6+1+6+2". This means it is divided into halves, each lasting 6 weeks. After the initial 6 weeks of the trimester, there is 1 week of a scheduled break followed immediately by the mid-term exam. Then the trimester continues for 6 more weeks. There may be a few days of break at the end of the second half, followed by the final exam in a week 14 or 15.

There will be 23 lectures plus a mid-term exam instead of one lecture in the week 8. A three-hour long final exam will conclude the trimester. There will be 12 laboratory classes accompanying the lectures.

# 5. Grading Policy

## 5.1. Grade Components

The composition of grades is as follows:

- Reading quizzes, quizzes, MCQ:      18%
- Lab exercises (x12):      18%
- Programming assignments      14%
- Mid-term exam:      25%
- Final exam:      25%

## 5.2. Letter Grades

The following table presents the final letter grades in relation to the grade percentage.

| Grade | Description | Percentage |
|-------|-------------|------------|
| A | Excellent | 93 – 100% |
| A − | Excellent | 90 – 92.99% |
| B + | Good | 87 – 89.99% |
| B | Good | 83 – 86.99% |
| B − | Good | 80 – 82.99% |
| C + | Fair | 77 – 79.99% |
| C | Fair | 73 – 76.99% |
| C − | Fair | 70 – 72.99% |
| D | Poor | 60 – 69.99% |
| F | Failure | Below 60% |

Fair (C-) is the minimum grade required for undergraduate students to earn credit in core courses.

Poor (D) is the minimum grade required for undergraduate students to earn credit in non-core courses.

## 5.3. Class Participation

Class participation can boost your grade if you are on the border. It is possible to get an A with an overall grade of 89.8% if you have actively participated in the classes throughout the trimester.

## 5.4. Rubrics and Assessment

During the trimester there will be two major exams – mid-term and final, several short quizzes and/or short in-class programming assignments during the labs. The subject matter for these exams will be specified to you well in advance of the examination date.

In addition, there will be about six (6) programming assignments to work on outside the class. Programming assignments will use the C++ programming language; more specifically, all programs must adhere to Standard C++17 (or newer), which is what this course is about. Every assignment will consist of a program specification that describes the functionality that needs to be implemented, and it may include a list of C++ classes or functions that you must implement to complete the assignment. You must strive to follow all the directions exactly as specified in the specification.

Your assignment submissions will be evaluated and graded using two compilers:

- Microsoft Visual C++ compiler (Visual Studio 2019, or higher), and
- GNU g++ compiler (version 7.4.0, or higher).

These compilers are installed on DigiPen Singapore computers. You must strive to follow all of the directions exactly as specified in the specification. The detailed submission guidelines will be published alongside the first assignment specification.

## 5.5.  Late Submission

Each assignment provided will be accompanied with a due date and time, which will be clearly stated on the assignment submission page. A **100% penalty** will be imposed on any submission deemed late by the DigiPen Distance Learning course management system (*Moodle*). Submissions after the due date, or submissions using other means of communications (i.e. via email) will not be permitted.

Students may request for extensions should they provide valid reasons with documented proof to justify their case. This will be handled on a case-by-case basis by the instructor. Request for extensions after the deadline will not be accepted except in extraordinary cases.

## 5.6.  Grade Appeal

If a student is dissatisfied with the grades, they should firstly raise up the matter to the instructor. If the student is still not satisfied, they can do a formal grade appeal through the Registrar's Office. A formal committee will be assembled to resolve the appeal. In such cases, students must fill-in the Grade Appeal Form available at Front Desk and submit it to the Registrar's Office, along with supporting documents.

## 5.7.  Re-Sit Examination

Students who fail to acquire a minimal grade required to pass the course may be eligible to re-sit the final exam. The re-sit will be offered to the students with the final grade from the course within 5% of the course's minimal required grade.

The instructor will provide a list of eligible students to the Registrar's Office within two days after the grade report deadline. The Registrar's Office will notify the students, who should reply within three days after the email notification. The Registrar's Office will conduct the re-sit examination on the Friday prior to the start of the trimester. Until receiving the results, the students will be excused from the prerequisite requirements in the new trimester. The re-sit exam will be graded by Friday of the first week of the new trimester. The re-sit exam grade will replace the original grade from the final exam. If the new total score lets the students acquire the minimal passing grade, the minimal grade will be recognised as the official grade from the course.

Students from the Systems Engineering (ElectroMechanical Systems) [SEEMS] program are not eligible for a re-sit exam following the policy described above. As the SEEMS program is jointly offered by DigiPen (Singapore) and SIT, the grades are approved by the SIT Board of Examination. Changes to grades are not allowed thereafter, unless due to approved appeal cases.

# 6. Attendance Policy

Attendance in the lectures and laboratory classes is mandatory. There are no makeup quizzes or exams. You will be penalized for unexcused absences from class according to the following scale:

- Four (4) or more absences will result in a 10% reduction of your overall course grade.
- Eight (8) or more absences will result in a 20% reduction of your overall course grade.
- Eleven (11) or more absences will result in a 30% reduction of your overall course grade.
- Fifteen (15) or more absences will result in your automatic failure in the course irrespective of your performance on assignments, quizzes, and exams.

## 6.1. Medical Leave and Family Emergencies

Medical leave and family emergencies accompanied by appropriate documents will be the only exceptions to the mandatory attendance policy. Sleeping, studying for another class or exam, working on your game, etc., are not valid reasons for an absence.

## 6.2. Classroom Conduct

Students are expected to behave professionally at all times with regards to classroom conduct. To maintain a conducive learning environment during class, it is expected for students to:

- Be quiet during class while the instructor is talking and to keep a low noise level at all times. This is to ensure that everyone is able to listen to the lecture and discussion. Do not disturb others while doing class activities.
- Turn off your mobile phones and devices or put them on silent mode. This is to prevent unwanted interruptions due to phones ringing or vibrating. In emergency situations, get the instructor's approval to use the phone before the class.
- Reduce use of mobile phones during class where possible. Also, playing games on any device is strictly prohibited during class time. This is to reduce distractions for everyone around including the student him/herself. Penalties may be imposed if students are caught doing so.
- Keep the classrooms clean. Eating or drinking in class is strictly prohibited with the exception of bottled water. Do dispose of all wastes (such as used paper, eraser crumbs, empty bottles etc.) in the garbage bins located outside classrooms.
- Do not mistreat school equipment (such as computers, keyboards, mice, monitors etc.). There will be penalties given for such abuse cases and having broken equipment will cause inconvenience for everyone in school.

## 6.3. External Preparation

It is expected that the students in this class spend 6 hours on average per week for outside classroom activities through the trimester, including, but not limited to, homework, reading assignments, project implementation, group discussions, preparation of examinations, etc.

## 6.4. Last Withdrawal Date

In this trimester, the last date to withdraw without an academic penalty is 20th January 2020. The latest course withdrawal date is 4th March 2020.

In order to withdraw from a course it is not sufficient simply to stop attending class or to inform the instructor. In accordance with the policy, contact your advisor or the Registrar to begin the withdrawal process. The last day for withdrawal from this course is cited in the official catalog.

# 7. Other Policies

## 7.1. Academic Integrity

DigiPen Institute of Technology Singapore stands for academic honesty, and professional integrity. As this course requires students to submit work for assessment, through this policy DigiPen would like to highlight the importance of the proper moral conduct and ethics.

Academic dishonesty in any form will not be tolerated in this course. Cheating, copying, plagiarizing, or any other form of academic dishonesty (including doing someone else's individual assignments) will result in, at the extreme minimum, a zero on the assignment in question, and could result in a failing grade in the course or even expulsion from DigiPen. Take note that both sharing your code and using someone else's code may constitute a breach of the academic integrity policy.

It is permissible to discuss exercises and assignments (not solutions) with other students in the class, but the solutions must be recognizably your own. With the internet as a readily accessible source of information and help, students may feel that plagiarism is ambiguous, and thus be unable to determine what it constitutes. Here are some general guidelines to help make the distinction:

- Do **NOT** copy-paste any works online. Using works that are not yours is plagiarism.
- Do **NOT** ask online communities (such as stack overflow, unity forums etc.) to solve your bugs and code issues by providing your code segments. Asking others to solve your issues is work not done by you, and thus it is plagiarism.
- You may learn from sources online, understand the workings and concepts, and implementing them again via **your own efforts**. A good habit is to assume that you will be tested on the things you learn online, and if you are unable to answer the questions then you should not use said works.
- You may ask online communities about general problems, and use their insights **to work on your problem**.
- These applies to all sources on any medium, be it the internet, textbooks, friends or social media. It is the content that is important, not the medium they are on.
- The bottom line test is to ask yourself "**Did I work on this?**" If you did not, then you should not use it. Learn from it and work it out yourself.
- Do **NOT** share any code that you submit for assessment and evaluation by the instructor.

## 7.2. Disability Support Services

Students who have special needs or medical conditions and require formal accommodations in order to fully participate or effectively demonstrate learning in this class should contact the Student Life & Advising Office (studentlife.sg@digipen.edu) at the beginning of each trimester. A Student Life & Advising Officer will meet with the student privately to discuss how the accommodations will be implemented.