Concordia University
Department of Computer Science
And Software Engineering

Home Examination

Course: COMP 6411   **Issued:** Wednesday, March 5th, 2014
Instructor: Dr. Joey Paquet   **Due:** Wednesday, April 2nd, 2014

General instructions and information

- The value of all questions is provided, as well as an approximation of the expected length of the answer to be provided.
- This is an open-book examination.
- For all answers, strong and numerous references must be provided.
- This is an *individual* examination, plagiarism will result in strong mark deductions and even failure.
- Answer *question 1 and 2 and a total of 50% among questions 3-7*.
- The report will be graded on factors including the quality of your answers, quality of language used, quality of presentation, and quality of references.
- A bibliography must be included separately with the answer for **each** answered question. References should be used within the text of your report, using a standard referencing style such as [Paquet 2010], [Paq10], or [1]. If you quote verbatim from a source, make it clear by using quote marks, italics font, or for longer quotes, putting the quote in an indented paragraph on its own. References that are not explicitly referred to in the text will not be counted. Text that is copied from a source and not properly quoted will not be counted as part of the answer. The references used for each question should include at least five high-quality references that have either a Digital Object Identifier (DOI) or International Standard Book Number (ISBN).
- Your report should be submitted electronically as a *pdf* file to the EAS as *theory_assignment-1* before midnight on Wednesday, April 2nd, 2014. Late submissions will not be accepted.

A. Mandatory questions (50%):

1. **[30%: 3-4 pages]** Explain what is multiple inheritance, what problems are associated with it, and how it is implemented in various programming languages. Explain what is C++ virtual inheritance, and explain how it helps to solve some of the problems associated with multiple inheritance in C++. Explain how Java is trying to overcome some of the problems of multiple inheritance by using interface classes. Another solution to the multiple inheritance problem is the notion of mixin. Explain what is a mixin, and what is the difference between using mixins and multiple inheritance such as used in C++, and interface classes such as used in Java. Highlight advantages and drawbacks of each mechanism (multiple inheritance, interface classes, mixins) to provide multiple inheritance.

2. **[20%: 2-3 pages]** The C++ programming language is very powerful but complex. C# has been developed from C++ and is fully integrated into new Microsoft developments such as .NET which is central to the new versions of the Windows operating system. Assess the importance of C#, state what were the goals in mind when this language was created, how it satisfies these goals and to what extent it is superior to C++ and some of its other derivatives such as Java.

B. Choose for a total of 50% among the following questions:

3. **[20%: 2-3 pages]** Describe what are *static* (i.e. compile-time) and *dynamic* (i.e. run-time) type checking. Compare their advantages and disadvantages from the point of view of both the language implementation and the programmer using the language. Discuss reasons why using dynamic typing in a language's implementation may limit the language's use in some specific application areas.

4. **[20%: 2-3 pages]** In the history of programming languages, there has been a variety of procedure call parameter passing mechanisms. ALGOL 60 provided *call by value* and *call by name*. Pascal provided *call by value* and *call by reference*. ALGOL-W used, among others, *call by result* and *call by value-result*. Using concrete and simple program examples, describe the calling mechanisms just mentioned. Finally discuss why most modern programming languages provide only *call by value*.

5. **[20%: 2-3 pages]** The use of a virtual machine such as JVM to execute programs leads to overhead that slows down the execution of the executed programs. Explain in technical terms the various reasons for this overhead. Explain in technical terms various solutions that are implemented to reduce such overhead. Give examples of different virtual machines (JVM or other) that *do* or *do not* implement such solutions.

6. **[10%: 1-2 pages]** Explain the differences in the concepts and compilation and run-time behavior implementation between C++ templates and Java generics.

7. **[10%: 1-2 pages]** The CLU programming language has been cited as influential for the design of many object-oriented programming languages. Explain what language features of CLU have influenced other languages, and how CLU is different from what we nowadays understand as object-oriented programming.