03-60-340-30
2014 Winter, Mon. Feb. 10, 2014 in DH 355
University of Windsor, School of Computer Science

Midterm 1 Examination

Mr. Paul Preney

Student ID:	
FIRST Name:	
LAST Name:	

"I have neither given nor received unauthorized help with this examination. Any suspicion of cheating will automatically void my mark on this examination."

_____
Signature
Unsigned examination booklets will not be graded.
Signature implies agreement with the above statement in quotes.

INSTRUCTIONS

1. You have **50 minutes** maximum to complete this examination. Pace yourself accordingly.
2. Write your answers in the space provided. No additional space will be provided.
3. Do **not** remove any papers from this booklet or add new ones.
4. You may **not** use any reference material(s) **except** what has been provided within this examination booklet and the book *The C++ Programming Language, 4th Edition*.
5. **You may not use the C Standard Library unless given explicit permission to do so.** This is a course on C++ --not C. C++ coding techniques and the C++ Standard Library without the C Standard Library subset must always be used. If you have any questions concerning this, then ask for clarification.
6. **Document your code where appropriate.** Unclear code may not receive partial marks without documentation. Ensure any written English uses proper spelling, grammar, and can be understood. Answers must be neat and legible to receive marks.
7. **Be sure** that you have printed your name and student number on all pages of this examination.
8. Ensure that you have all **6 pages** of this examination (including this page) before starting to write this exam. If you don't, bring this to the attention of the instructor immediately.
9. Ensure the proper case, spelling, syntax, grammar, and punctuation marks are correctly used in all answers involving code.

EXAMINATION MARK: _____

MAXIMUM MARK: 43

Part I: Multiple Choice and Short Answer Questions (33 marks)

For each question in this section, neatly and plainly **circle or underline** the **single** response which most correctly completes/answers the statement/question given for multiple choice or True/False questions, otherwise, write in the appropriate answer(s) in the space provided. Read carefully! Unintelligible or ambiguous responses will receive a mark of zero (0) for that question, so ensure that your answer is clear.

Q1) The C++ programming language was created by _____ (full name).

Answer: _____Bjarne Stroustrup_____ **[1 mark]**

Q2) C++ was originally called _____.

Answer: _____C with classes_____ **[1 mark]**

Q3) C++ was first standardized in 1998 . **[1 marks]**

    (a) 1989   (b) 1998   (c) 1999   (d) 2003   (e) 2007   (f) 2011

Q4) The current C++ standard in effect was standardized in what year?

Answer: _____2023_____ **[1 mark]**

Q5) True or False: A general aim of the C++'s language design is that it is more important to provide a useful feature than to prevent every misuse. **[1 mark]**

    (a) True   (b) False

Q6) True or False: C++ allows implicit violations of the type system. **[1 mark]**

    (a) True   (b) False

Q7) Briefly describe the zero overhead language design rule in C++. **[2 marks]**

    You dont pay for what you dont use

Q8) The imperative programming paradigm defines computation in terms of _____state_____. **[2 marks]**

    programming statements that desribe changes in state

Q9) The modular programming paradigm allows _____: the ability to expose/hide functions/types defined in different modules.

Answer: _____encapsulation_____ **[1 mark]**

Q10) The difference between the object-based and the object-oriented paradigms is that the object-based paradigm does not use/support _____.

Answer: _____inheritance_____ **[1 mark]**

Q11) Match the following descriptions with the programming paradigm that best applies.

Letter	Description
A	"Decide which classes you want; provide a full set of operations for each class; make commonality explicit using inheritance."
B	"Decide which procedures you want; use the best algorithms you can find."
C	"Decide which algorithms you want; parameterize them so that they work for a variety suitable types and data structures.
D	"Decide which modules you want; partition the program so that data is hidden within modules."
E	"Decide which types you want; provide a full set of operations for each type."

Write the letter of the most appropriate description corresponding to the programming paradigm below:

_____E_____ Object-Based Paradigm **[1 mark]**

_____C_____ Generic Paradigm **[1 mark]**

_____D_____ Modular Paradigm **[1 mark]**

_____A_____ Object-Oriented Paradigm **[1 mark]**

_____B_____ Procedural Paradigm **[1 mark]**

Q12) True or False: C++'s template mechanism is Turing-complete. **[1 mark]**

  (a) True (b) False

Q13) C++ is a multi-_____ programming language.

  Answer: _____paradigm_____ **[1 mark]**

Q14) Clearly explain what the differences, if any, are between `T *const` and `T const*`. **[2 marks]**

_____T* const is a constant(read only) pointer to_____
  a non constant value of type T (read write instance of T)

_____T const* is a non-constant pointer(read/write) which points to a_____
  constant value of type T(read only)

Q15) Write a C++11 lambda function that accepts a `double` as an argument and returns its value multiplied by 3.14. **[2 marks]**

[ ](double x) {return x * 3.14}

Q16) The mathematician that designed key portions of the STL is _____ (full name).

Answer: _____ Alexander Stepanov _____ **[1 mark]**

Q17) Briefly describe what a C++ Standard Library container represents. **[1 mark]**

_____ represents a collection of objects/values _____

_____

_____

Q18) Briefly describe what a C++ Standard Library iterator represents. **[1 mark]**

_____ Represents a pointer/cursor to an object/value in a container, or represents one past
the end of the iterator position of the container. Iterators go through the elements stored
in a container (iterate through) _____

_____

Q19) C++ Standard Library's iterators were modeled upon which C language construct?

Answer: _____ pointers _____ **[1 mark]**

Q20) Briefly explain what is meant by a predicate in the C++ Standard Library. **[1 mark]**

_____ a function which returns a boolean _____

_____

Q21) True or false: In C++ a Standard Library function requiring a predicate allows the predicate to be stateful. **[1 mark]**

(a) True   (b) False

Q22) In the C++ Standard Library, all sorting operations rely on a _____ (3 words; Hint: SWO) to sort things. The default overloaded operator to perform such is _____.

3-word answer: _____ strict weak order _____ **[1 mark]**

Operator answer: _____ < (i.e less than) _____ **[1 mark]**

Part II: General Questions (10 Marks)

Answer all parts of each question in the space provided below each question. The number of marks assigned to each question is indicated at the end of each question. You are expected to answer questions using complete sentences and proper grammar. If the answer is program code, simply write the code fragment that answers the question **unless you are explicitly asked to write a full-and-complete program**.

NOTE: Unless you are asked to write a full-and-complete program, assume `using namespace std;` *is at the* **top** *of the code fragment you are writing. If you are writing a code fragment within a function, assuming the proper* `#include` *files have been included elsewhere.*

Q23) Your boss has just let go of an employee that wrote an insertion sort routine, called `insertion_sort()`, function using `std::vector` because he had asked for it to be written with `std::list`. Your boss thought he could just change the `typedef` from `vector<int>` to `list<int>` but got all kinds of compiler errors! He has **asked you** to **rewrite `insertion_sort()`** function to **use iterators** so that it **works properly for all bidirectional iterator inputs and random-access iterators**. He included a sample `main()` so you could see how it will be invoked. Pseudocode for the insertion sort is as follows, given an array A whose first index is zero:

```
for i from 1 to length(A) {
        j = i
        while (j != 0 and A[j-1] > A[j]) {
                swap(A[i], A[j-1])
                j = j – 1
        }
}
```

Your solution must <u>only use valid bidirectional iterator operations</u>. All <u>comparisons must be done using $\leq$</u> (i.e., less than). You must <u>only use the for loop construct</u> –not the while, do..while, or goto constructs.

NOTE: Write your answer on the next page. `insertion_sort()` will sort [first,last) in ascending order.

```cpp
#include <iostream>
#include <list>
#include <algorithm>

using namespace std;

template <typename Iter>
void insertion_sort(Iter first, Iter last)
{
  // YOUR ANSWER GOES HERE.
}

int main()
{
  typedef list<int> LIST;
  LIST stuff{ 32, 14, 45, -24, 6543, 7635, 2, -5, -23, -25, -242 };
  insertion_sort(begin(stuff), end(stuff));
  for (auto const& i : stuff)
    cout << i << ' ';
  cout << endl;
}
```

[10 marks]

Q23 Answer - Write **ONLY** the code **INSIDE** the provided **insertion_sort()** function above. (If you do otherwise then marks will be deducted.) You cannot change the function prototype.