UNIVERSITY OF NEW ENGLAND

UNIT NAME: COMP 132

PAPER TITLE: Computer Science II

PAPER NUMBER: First and Only

DATE: **Wednesday 17 June 2009** **TIME:** **2:00 PM TO 4:00 PM**

TIME ALLOWED: Two (2) hours plus fifteen minutes reading time

NUMBER OF PAGES IN PAPER: TEN (10)

NUMBER OF QUESTIONS ON PAPER: SIXTEEN (16)

NUMBER OF QUESTIONS TO BE ANSWERED: SIXTEEN (16)

STATIONERY PER CANDIDATE:

0	6 LEAF A4 BOOKS	**0**	ROUGH WORK BOOK
1	12 LEAF A4 BOOKS	**0**	GRAPH PAPER SHEETS

OTHER AIDS REQUIRED: **NIL**

POCKET CALCULATORS PERMITTED: **YES** **(SILENT TYPE)**

TEXTBOOKS OR NOTES PERMITTED: **NIL**

INSTRUCTIONS FOR CANDIDATES:

- Candidates **MAY** make notes on this examination question paper during the fifteen minutes reading time
- Questions are not of equal value
- Answer all questions in the answer booklet provided. Any answers written on this examination question paper **will not be marked**
- Candidates may retain their copy of this examination question paper

Question 1 *[10 marks]*

Fill in the blank spaces with appropriate words:

a) A pattern from which the compiler can create a function is known as a _____

b) The `#ifdef` directive is an example of a _____ compilation directive.

c) The call-by-name (or macro-substitution) mechanism is provided in C++ by the _____ specifier.

d) The part of the program where an identifier refers to a particular object or function is called the _____ of that identifier.

e) A function's _____ is a list of the types of its parameters.

f) A _____ parameter contains a copy of the corresponding argument.

g) _____ is the phenomenon of a function calling itself.

h) In order for a program to write output to a file, a(n) _____ object must connect the program to that file.

i) All lines of C++ code that begin with a(n) _____ character are preprocessor directives.

j) Placing a(n) _____ between a parameter's type and its name indicates that the parameter is a reference parameter.

Question 2 *[4 marks]*

Given the following function:

```
void f(int val1, int & val2, int & val3)
{
  val3 = val2 = val1 * val1 + 1;
}
```

Rewrite the definition of f() so that *val*1 is a const reference parameter and *val*2 is a value parameter.

Question 3 *[4 marks]*

What is the output of the following code:

```
#include <iostream>
using namespace std;

//function prototype
void func(int& r, int& p, int q);

int main()
{
    int x = 3, y = 1, z = 4;

    cout << x << " " << y << " " << z << endl;
    func(x, y, z);
    cout << x << " " << y << " " << z << endl;
    z = 0;
    func(x, y, z);
    cout << x << " " << y << " " << z << endl;
} // main

// function implementation
void func(int& r, int& p, int q)
{
    cout << q++ << " " << --r << " " << ++p << endl;
} // func
```

Question 4 is on page 4

Question 4 *[2 marks]*

What output will the following program produce?

```
#include<iostream>

using namespace std;

int main()
{
  int n = 3;

  for(int n = 1; n < 2; n++)
  cout <<  n * n + n + 6 << endl;
  cout << "n has a value of: " << n << endl;
}
```

Question 5 *[10 marks]*

a) Describe what "inlining" a function suggests to the compiler.

b) For the function definition;

```
inline int div(int x, int y)
{
   return ( x * (y + 1)/4 ) ;
}
```

i) What is the output of the following statement?

```
cout << div(5, 9) << endl;
```

ii) How will the compiler modify the following statement?

```
cout << div(8, 5) << endl;
```

c) What is **code bloat**?
How do we avoid code bloat?

Question 6 *[10 marks]*

A text file has been read and stored in a C++ string object named **myString**.

a) Implement an algorithm of how you would use the C++ string method(s) and cctype library methods to output the total number of **Upper-case** letters (i.e., characters in the range 'A' to 'Z') that are stored in myString.
NOTE: Your algorithm should NOT assume the file was not empty.

b) From your algorithm implement the program using C++ code.

The following C++ string methods should be of use:

1. size()
2. empty()

The following operations from the **C**-char-**type library** *cctype* should be of use:

1. isalpha(ch)
2. isupper(ch)

Question 7 *[10 marks]*

Answer the following questions true or false (T / F)

a) When using "separate compilation" an inline library function must be defined in the header file.

b) If an array *myArray* has 10 elements, the last element will be *myArray*[10].

c) The following code fragment contains compilation errors.

```
double doubleValue;
int *iPtr = &doubleValue;
```

d) When using "separate compilation" the implementation of a template function must be placed in the application file.

e) Elements of an array can be of different data types.

Question 7 f) is on page 6

f) If A is the name of an array, then $A + 2$ is the address of the second element of A.

g) A vector of vectors is a two dimensional object.

h) One of the strengths of a linked list is that an item can be inserted at any point without moving any list elements.

i) Function calls increase the execution time of a program.

j) Values can be inserted at the end of a vector$< T >$ more efficiently than at its front.

Question 8 *[5 marks]*

Given the following function prototype:

```
template<typename T>
void Output(const vector<T>& theVector);
```

Implement a generic *Output()* function that uses a *forever* loop and the subscript operator to display, via *cout*, the contents stored in the `vector <T>`.

Question 9 *[4 marks]*

Given the following recursive function:

```
void f(int i)
{
  if ((1 <= i) && (i <=8))
  {
    f(i - 1);
    cout << i;
  }
  else
    cout << endl;
}
```

What is the output of the following statement:
$f(7)$;

Question 10 *[7 marks]*

Given the following function prototype:

```
void printArray(int& myArray, int size);
```

a) Overload the printArray function so that it accepts an array of type **char**

b) Implement both versions of the "PrintArray" function.

Question 11 *[6 marks]*

Write a function named *average* that will return the average value of the numbers stored in an array of doubles.
Assume the return type is of type **double**, and the parameter list for the function average consists of

- a parameter for the array, and
- a parameter for the size of the array.

Question 12 *[6 marks]*

Write the C++ code needed to read some numbers (of type double) which are stored in a file (named *data.txt*). The numbers are to be read via an *ifstream*, and then outputted to the screen via *cout*.

Include any library you would need in your response.

Question 13 is on page 8

Question 13 *[5 marks]*

What is the output of the following program?

```
#include <iostream>
using namespace std;

int main(){
 int array[10] = {9, 4, 0, 6, 3, 5, 8, 2, 7, 1};
 int *ptr = array+4;
 cout << *array
      << *ptr
      << ptr[2]
      << *(ptr - 3)
      << *(array + 2)
      << endl;


}
```

Question 14 *[5 marks]*

Briefly describe some of the advantages and disadvantages of C-style arrays compared to vector<T>'s.

Question 15 is on page 9

Question 15 *[6 marks]*

For the class *Complex* that is implemented as follows:

```
#include<iostream>
using namespace std;

class Complex
{

  public:
    Complex(double r = 1, double i = 1)
    {
      real = r;
      imag = i;
    }

  double Real() const
  {
    return real;
  }

  double Imag() const
  {
    return imag;
  }

  private:
    double real;
    double imag;
};
```

Question 15 a) is on page 10

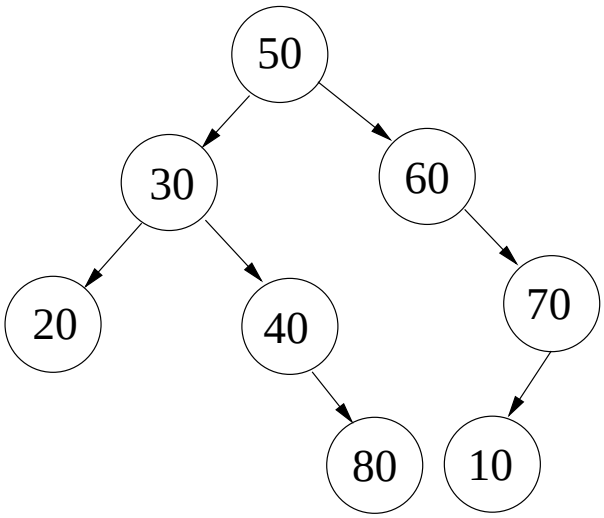
a) How would you implement the *Copy Constructor* for the Complex Class?

b) How would you implement the *Assignment Operation* for the Complex Class?

Question 16 *[6 marks]*

The operation of "tree traversal" can be simply stated as the movement through a binary tree in such a way that each node of the tree is visited exactly once.

Given the following binary tree:



Write the order of the nodes visited in:

a) preorder

b) postorder

c) inorder