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University of Swaziland
Department Of Computer Science
Main ,Examination
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Title of paper: *C under Unix*

Course number: *CS344*

Time Allowed: *Three (3) hours*

Instructions:

- *Each question is worth 20 marks*
- *Answer any five (5) questions from questions 1 to 7*

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Question 1-20 marks

(i) State whether each of the following is true or false. If false explain why?

[10 Marks]

(a) Declarations can appear almost anywhere in the body of a C++ program.
(b) Data members or member functions declared with access specifier protected are not accessible to member functions of the class in which they are declared.
(c) The default case is required in the switch selection statement.
(d) A function prototype is the same as the function signature.
(e) All arguments to function calls in C++ are passed by value.
(f) It is an error if an initializer list contains more initializers than there are elements in the array.
(g) A class may have only one constructor functions.
(h) A subclass inherits only the protected members of its super-class.
(i) A constructor function cannot be virtual.
(j) C++ array indexes always start from 0.

(ii) Write a C++ statement(s) to accomplish each of the following

(a) Display the sum of odd integers between 1 and 99 using a for statement.

[2 marks]

(b) Using a while loop, display the values in a array B in reverse order starting from the last value in the array. Assume array B contains N values.

[2 marks]

(c) Declare an array of 5 integers called **scores** and use an initilizer list to initialize the first three values in the array to 34, 100, 56.

[2 marks]

(d) Read characters from an input file, **data.txt** and count the number of characters in the file.

[4 marks]

Question 2- 20 marks

i. Write the C++ syntax and draw the activity diagram for the following statements.

a. **if-else** statement *3 marks*

b. **while** statement *3 marks*

c. **for** statement. *4 marks*

i. Distinguish between the following

a. class template and template class. *2 marks*

b. Protected and Private data members *2 marks*

c. Call-by-value and call-by-reference *2 marks*

d. A compiler and an interpreter. *2 marks*

e. An object and a class *2 marks*

Question 3 – 20 marks

(i) Write a C++ program that asks the user to enter three integers from the keyboard and displays, on standard output, the sum, average, product, smallest and largest of these numbers in the following format:

```
Input three different integers: 13 27 14
Sum is 54
Average is 18
Product is 4914
Smallest is 13
Largest is 27
```

[*5 marks*]

(ii) An integer is said to be a perfect number if the sum of its divisors, including 1 (but not the number itself), is equal to the number. For example 6 is a perfect number because 6 = 1 + 2+ 3. Write a function perfect that determines whether parameter number is a perfect number.

[*15 marks*]

Question 4 – 20 marks

The factorial of a non-negative integer number n is written n! and defined as follows:

$$n! = \begin{cases} 1 & \text{if } n = 1 \\ n\,x\,(n-1)! & \text{if } n > 1 \end{cases}$$

(i) Write a non-recursive function that takes an integer value n as an argument and computes and returns the factorial of n.

[*5 marks*]

(ii) Write a recursive function that takes an integer value n as an argument and computes and returns the factorial of n.

[*5 marks*]

(iii) Write a program that uses the factorial function defined in (i) above to estimate the value of e by using the following formula:

$$e = 1 + \frac{1}{1!} + \frac{1}{2!} + \frac{1}{3!} + \ldots$$

The program must prompt the user the number of terms in the summation.

[*10 marks*]

Question 5– 20 marks

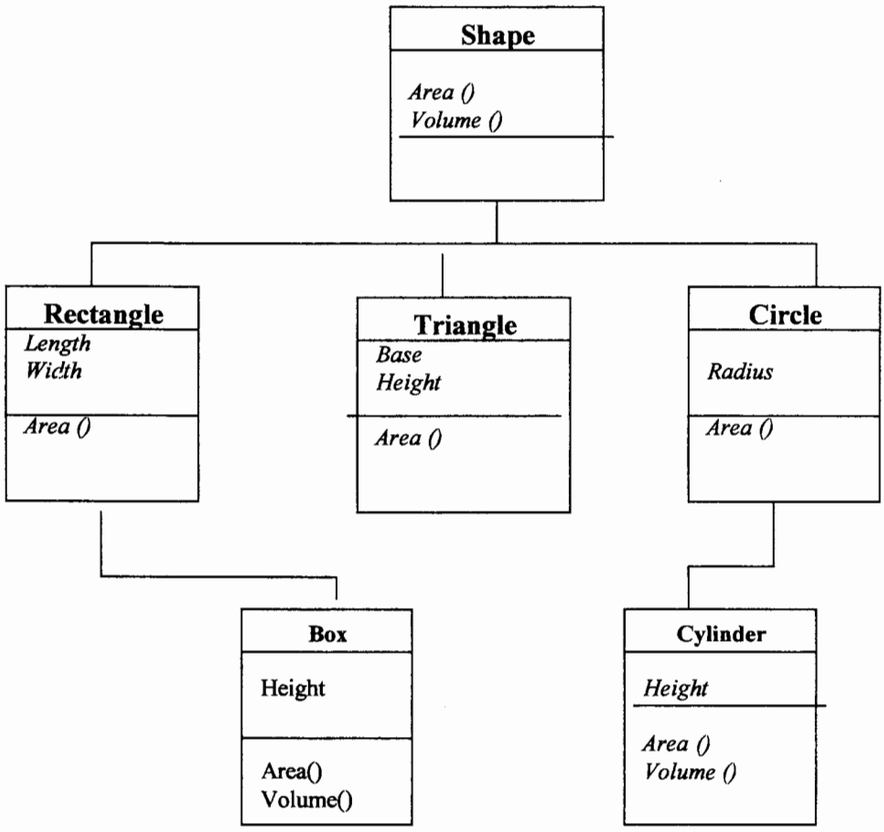
Write a C++ function **Count** *(ifstream InFile)* that takes an input stream, *InFile*, as input and produces the following statistical values:

Number of Vowels =
Number of blank characters =
Number of non-blank charactes =
Number of Lines =

[*20 marks*]

Question 6-20 marks

Consider the following class hierarchy for shapes



Using C++ notation implement the above class hierarchy. Your implementation must be as close as possible to the above design. You may add necessary operations, but all the attributes have been specified. [*20 marks*]

The following formulas are useful.

VolumeOfCylinder = BaseCircleArea * Height;
AreaOfCylinder = 2*BaseCircleArea + 2*Pi*RadiusofBaseCircleArea*Height.

VolumeOfBox = BaseRectangleArea * Height;
AreaOfBox = 2*BaseRectangleArea + 2*Height*Length + 2 * Height *Width;

Question 7-20 marks

Create a class called **IntegerSet**. Each object of class **IntegerSet** can hold integers in the range 0 through 100. A set is represented internally as an array of ones and zeros. Array element **a [i]** is 1 if **i** is in the set. Array element **a[j]** is 0 if j is not in the set. The default constructor initializes a set to an empty set. A set is empty if all its array elements are initialized to 0.

Implement the following operations on a set:

- **Insert (e)** – adds a new element **e** into the set.
- **Remove (e)** – remove element **e** from the set.
- **IsMember (e)** – returns true if element **e** is in the set and false otherwise.
- **Print ()** – display all elements of the set on standard output.

[*20 marks*]

<END OF QUESTION PAPER>