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University Examinations 2023/2024

FIRST YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE OF MASTER OF SCIENCE IN APPLIED MATHEMATICS

SMA 5190: STRUCTURED AND SPECIAL PROGRAMMING

DATE: APRIL 2024 **TIME: 3 HOURS**

INSTRUCTIONS: *Answer **Any** three questions*

QUESTION ONE (30 MARKS)

a) As a Master's student, you are expected to give a talk in a conference highlighting the various programming paradigms that have been in practice over the years. Briefly, present at least four such paradigms that you would include in your presentation (4 Marks)

b) In your first lesson of programming to your students, students are yearning to know the various ways in which they can be able to declare and initialize variables in C++. Having studied programming, you are required to explain the concept of variables to them, demonstrate at least four primitive data types and guide them on the rules governing variables declaration. Present what you would include in your class (6 Marks)

c) Consider the following program.

```
#include <stdio.h>
```

```
using mainspace std;
int main (Void)
(
INT sum;
/* COMPUTE RESULT
sum =25+37- 19
 /* DISPLAY RESULTS //
cout<<"The answer is sum;
return 0;
}
```

i. Identify the syntactic errors in the following program (4 Marks)

ii. Rewrite the corrected program (4 Marks)

d) Distinguish between syntax and semantic errors as used in programming (2 Marks)

QUESTION TWO (20 MARKS)

a) With appropriate examples, describe any two decision making and two looping structures (6 marks)

b) i. Write the algorithm pseudo code to be followed by a program that reverses an integer number entered by the user (e.g. if the user enters 10591, the program outputs 19501) (6 Marks)

ii. Write a C+ program to implement the above algorithm (8 Marks)

QUESTION THREE (20 MARKS)

a) Using appropriate examples, explain two ways to insert comments in C++ (2 Marks)

b) Write a C++ program that prints out all the prime numbers between 1 and 50. Use appropriate comments to explain your program (8 Marks)

c) Suppose we want an array to satisfy the condition,

a[0]<=a[1]<=a[2]<=…..

And suppose this code is written to implement a test of this condition

```
#include  <iostream>
using namespace std;
int main(void)
  int array[10] = { 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 };
  // assume the array is filled somehow.
 for(int i=0; i < 10; i++)
 if (array[i] > array[i+l])
    cout<< "Array elements " <<i<< " and "<<i+l<<are out of order<<endl;
  return 0;
 }
```

When this is run, we sometimes get the following puzzling output:

Array elements 9 and 10 are out of order.

Even more puzzling, sometimes we don't get this output.

i) Explain what causes this anomaly (4 Marks)

ii) Write a code that fixes this anomaly (4 Marks)

QUESTION FOUR (20 MARKS)

a) As a Mathematics teacher, you are required to prepare an introductory lesson to your students. One of the lesson objectives is to describe each of the following terms as used in programming; write what you would include in your plan

i. Function and Function Syntax (4 Marks)

ii. Function prototype (2 Marks)

iii. Local and Global variable (2 Marks)

b) Further, to the above definitions you are required to demonstrate the use of functions in programming by;

i. Writing a C++ function that returns the maximum integer value when an array often integers is passed to it (7 Marks)

ii. Writing the main function that tests the above function when a user enters a set of 10 scores (5 Marks)

QUESTION FIVE (20 MARKS)

a. Consider the following program to answer the questions that follow;

```
// Program to determine tomorrow's date
#include <iostream>
using namespace std;

int main (void)

{

        struct date

        {

                int month;
                int     day;
                int year;
        };
        struct date today, tomorrow;

        const int = {31, 28, 31, 30, 31, 30, 31, 31, 30, 31, 30, 31 ;
```

```
cout<< "Enter today's date (dd):";
 cin>>today.day;

cout<< "Enter today's month (mm): ";
cin>>today.month;

cout<< "Enter today's year (yyyy): ";
cin>>today.year;

if (today.day!= daysPer Month[today.month - l]) {
                tomorrow.day today.day + l;
                tomorrow.month = today.month;
                tomorrow.year = today.year;

}
else if (today.month == 12) { // end of year
                  tomorrow.day = 1;
                  tomorrow.month = 1;
                  tomorrow.year = today.year + l;
}

else  // end of month
                tomorrow.day = l;
                tomorrow.month = today.month + l;
                tomorrow.year = today.year;
}
cout<< "Tomorrow's date is " <<tomorrow.month<<tomorrow.day,<<tomorrow.year;
 return 0;
}
```

i. What is the name of the structure data type in this program? (2 marks)

ii. Enumerate the two structure variables that have been declared in the program (2 Marks)

iii. Unlike primitive data type variables, a special syntax is needed when dealing with structure variables. Explain using an example from the program (4 Marks)

iv. Write the expected output when each of the following dates is passed as per the program request;

i. 2 28 2000 (2 Marks)

ii. 12 17 2014 (1 Mark)

iii. 12 31 2016 (1 Mark)

v. When the date entered is 2 28 2004 the program outputs

tomorrow's date is 3/1/04

Explain why this happens (3 Marks)

vi. Write a function to fix the above problem (5 Marks)