

COS1511

May/June 2016

INTRODUCTION TO PROGRAMMING I

Duration : 2 Hours

75 Marks

EXAMINERS :

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Closed book examination.

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This examination question paper consists of 9 pages.

INSTRUCTIONS:

Do all rough work in the answer book.

Number your answers and label your rough work clearly.

Marks are awarded for part of an answer, so do whatever you are able to in each question.

ALL THE BEST!

[TURN OVER]

QUESTION 1**6 MARKS**

- 1.1 Consider the C++ code segment below. What value will `newval` have after this code has been executed? (2)

```
int var1 = 4;
int var2 = 10;
int newval = 0;
if (var1 * 2 >= var2)
    newval = 5 + 2 * var2;
else if (var1 < var2)
    newval = var2 - var1 * 2;
else
    newval = var1;
```

- 1.2 Suppose the input value for `a` is 5. What is the value of `a` after the following C++ code has been executed? (2)

```
int a;
cin >> a;
switch (a)
{
    case 1: a += 3;
    case 3: a = a * 3; break;
    case 5: a = ++a + 10;
    case 6: a /= 2;
    default: a = a + 1;
}
```

- 1.3 Consider the following C++ code segment: (2)

```
int findValue(int numberP)
{
    int count = 0;
    int value = 20;
    while (count < numberP)
    {
        value += count;
        count ++;
    }
    return value;
}
```

What will be the output of the following statement executed in the `main` function?

```
cout << findValue(3);
```

QUESTION 2**4 MARKS**

In Questions 2.1 and 2.2 you have to write down what the purpose of the segment of code is. Look at the following example before answering the questions:

```
int a,b,c;  
cin >> a >> b >> c;  
cout << c + b + a;
```

The purpose of the above code segment is to input three integer values and display their sum.

Now answer questions 2.1 and 2.2 below:

- 2.1 Assume that `s` and `n` have been declared as integers. Explain in words what the purpose of the following segment of code is: (2)

```
int s = 0;  
int n = 0;  
while (n <= 5)  
{  
    s = s + n;  
    n++;  
}
```

- 2.2 Explain the purpose of the following segment of code: (2)

```
int numbers[ ] = {11, 0, 15, 0, 16, 23};  
int c = 0;  
for (int i = 0; i <= 5; i++)  
    if (numbers[i] != 0)  
        c += 1;
```

QUESTION 3**8 MARKS**

Consider the following C++ code segment below.

```
1 int result(int valueP)  
2 {  
3     int a = 2;  
4     int count = 0;  
5     while (count < valueP)  
6     {  
7         a += count + a / 2;  
8         count += 2;  
9     }  
10    return a;  
11 }
```

Demonstrate the execution and output of the program by drawing a variable diagram that traces each line of code if the value of `valueP` is 6. You are required to draw a variable diagram to illustrate what the code does.

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QUESTION 4**8 MARKS**

Karlton Learning wants a program that displays the amount of money a company owes for a seminar. The fee per person is based on the number of people the company registers. For example, if the company registers 7 people then the amount owed is R 560.00. If the user enters a number that is less than or equal to 0, the program should display an appropriate error message.

Number of registrants	Fee per person
1 through 4	R100.00
5 through 10	R 80.00
11 or more	R 60.00

Complete the program below.

```
#include <iostream>
using namespace std;
int main()
{
    // Question 4.1 (2)
    // Declare a variable to hold the number of registrants and a
    // variable to hold the amount a company owes for a seminar.

    // Question 4.2 (2)
    // Write statements to input the number of registrants. If the
    // user enters a number that is less than or equal to 0, the
    // program should display an appropriate error message.

    // Question 4.3 (4)
    // Write statements to calculate and display the amount of money
    // a company owes for a seminar.

    return 0;
}
```

QUESTION 5**5 MARKS**

In order to plan road maintenance, the department of Road Works request that road usage must be determined. This is done by counting the number of vehicles using the road with two wheels, four wheels and more than four wheels respectively. Write down **ONLY** the necessary `switch` statement to count the number of vehicles with two wheels, four wheels and more than four wheels. Do **NOT** write a complete program.

Use the following variables:

```
int nrWheels;           // number of wheels of a vehicle using the road

int countTwo, countFour, countMore; // the counters for the
                                     // number of vehicles with
                                     // two, four and more than
                                     // four wheels respectively
```

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Assume that `countTwo`, `countFour` and `countMore` have been initialised already and that a value has been input and validated for `nrWheels`.

QUESTION 6**9 MARKS**

- 6.1 Write a `for`-statement to display the numbers 1 through 10 on the screen. (2)
- 6.2 Write a `while`-statement to display the numbers 1 through 10 on the screen. (3)
- 6.3 The code below should display the numbers 1, 2, 3 and 4 on the screen. However, the code is not working correctly. Correct the errors in the code. (2)

```
1  int num = 1;
2  while (num < 4)
3      cout << num << endl;
4  // endwhile
```

- 6.4 The code below should display each salesperson's commission. The commission is calculated by multiplying the salesperson's sales by 10%. The code is not working correctly. Correct the errors in the code. (2)

```
1  float sales = 0.0;
2  float commission = 0.0;
3  cout << "Enter a sales amount: ";
4  cin >> sales;
5  while (sales > 0.0)
6  {
7      Commission = sales * 0.1;
8      cout << commission << endl;
9  }
10 // endwhile
```

QUESTION 7**6 MARKS**

In this question you have to write a complete function.

The Fruit Packers keep record of the number of crates of fruit that are packed for each day for a whole year (365 days). These 365 values are stored in an `int` array called `crates`. You have to write a function, called `calcAverage` to determine the average number of crates packed per day for the year.

Assume the following:

- a declaration of a global constant:
- `const int NUM_DAYS = 365; // number of days per year`
- two declaration statements in the main function:

```
int crates[NUM_DAYS]; // array of days
int average;           // the average number of crates
```

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- values have been assigned already to all the elements of the array
- the function is called in the main function as follows:

```
average = calcAverage(crates);
```

Write down ONLY the complete function `calcAverage`.

QUESTION 8**8 MARKS**

- 8.1 Write a function header for the function `check` that has two parameters. The first parameter should be an integer value and the second parameter a floating point value. The function returns no value. (1)
- 8.2 Write a function header for the function `mult` that has two floating point numbers as parameters and returns the result of multiplying them. (1)
- 8.3 Write a function header for the function `time` that inputs seconds, minutes and hours and returns them as parameters to its calling function. (1)
- 8.4 Write a function header for the function `countLets` that returns the number of occurrences of a character in a string, both provided as parameters. (1)
- 8.5 Suppose the following declarations appear in the `main` function of a C++ program:

```
int number;  
float cost, markup, discount;
```

Also, suppose the following calling statement appears in the `main` function:

```
amount = calcFinal(67.50, markup, discount, 5);
```

Write the correct function header of the function `calcFinal`? (2)

- 8.6 Suppose the following declarations appear in the `main` function of a C++ program:

```
string dayOfWeek;  
int productCode, number;  
float discount;
```

If the following function header is given:

```
void calcDiscount(float & discountP , int productCodeP,  
                 int numberP, string dayOfWeekP);
```

give the correct calling statement of the function `calcDiscount` in the `main` function. (2)

QUESTION 9**8 MARKS**

Bookworm bookstores announced a competition running over four weeks for their three branches. The branch with the highest sales per week will receive a surprise for that week. You as a programmer are requested to write a program to keep record of the number of books sold per week in each of the three branches over this period of four weeks. The (incomplete) program below inputs the respective number of books sold and stores it in a two-dimensional array called `sales`, with four rows and three columns. The program then displays for each week, the highest number of book sold.

Here is an example of the input data for the program:

	Bookworm South	Bookworm West	Bookworm North
Week 1	100	120	103
Week 2	96	122	111
Week 3	110	101	119
Week 4	106	99	102

And the corresponding output:

```
The highest sales in week 1 were 120 books.
The highest sales in week 2 were 122 books.
The highest sales in week 3 were 119 books.
The highest sales in week 4 were 106 books.
```

Use the declarations in the (incomplete) program below and do the following:

9.1 Declare the two- dimensional array `sales`. (2)

9.2 Assume array `sales` have been initialised. Write a program fragment to determine and display the highest sales per week. (6)

```
#include <iostream>
using namespace std;
const int NUM_WEEKS = 4;
const int NAME = 3;
int main()
{
    int highest;

    // array sales should be declared here (part 9.1)

    // Assume statements to input the array here
    // Do not write these statements

    // Your statements to determine and display the highest
    // number of sales per week (part 9.2 of the question)

    return 0;
}
```

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QUESTION 10**6 MARKS**

Consider the following struct definition:

```
struct Product
{
    String name;
    float weight;
    float price;
}
```

- 10.1 Given this structure type definition above, suppose the following declaration appear in the main function of a C++ program

```
Product p1;
```

Write a `cout` statement that will display all the fields of the `Product p1`. (2)

- 10.2 Write a function `read_Product_Record` which accepts a reference parameter `new_Product` of type `Product`. `read_Product_Record` fills `new_Product` with values entered from the keyboard. (4)

QUESTION 11**7 MARKS**

In this question you have to write a function that receives as input a person's first names and surname, and then display just the initials. For example, if the input is `John Peter Doe`, the initials `JPD` must be displayed.

Member functions of the `string` class to manipulate the values of `string` objects are provided on the next page.

Function signature	Description
<code>int size()</code>	Returns the size (i.e. length) of a string object.
<code>string substr(int, int)</code>	Returns a substring of a string object. The first parameter specifies the starting position (i.e. the position from which the substring should be copied) and the second parameter specifies how long the substring should be (i.e. how many characters should be copied). The second parameter may be omitted, in which case the sub-string consisting of all the characters from the starting position (specified by the first and only parameter) to the end of the string are returned.
<code>int find(string, int)</code>	Returns the position of a string (specified as the first parameter) within a string object. The second parameter is optional, and can be used to specify where the search has to be commenced. If omitted, the search commences at the beginning of the string object. If the string being sought is not found, -1 is returned.
<code>void insert(int, string)</code>	Inserts a string (specified as the second parameter) into a string object at a particular position (specified as the first parameter)
<code>void erase(int, int)</code>	Erases a substring from a string object. The substring that is to be erased is determined by the two parameters: from the position specified by the first parameter, as many characters as specified by the second parameter
<code>void replace(int, int, string)</code>	Replaces specified characters of a string object with another string. The characters to be replaced are determined by the first two parameters: from the position specified by the first parameter, as many characters as specified by the second parameter. The string to be inserted in their place is specified by the third parameter.