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INTRODUCTION TO PROGRAMMING 1 - RPL

Duration 2 Hours

75 Marks

EXAMINERS

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Closed book examination

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This paper consists of 10 pages and 12 questions

Please ensure that you have 10 pages and 12 questions

INSTRUCTIONS:

- Answer all the questions
- Do all rough work in the answer book
- The mark for each question is given in brackets next to the question
- Please answer the questions in the correct order If you want to do a question later, leave enough space
- 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!

QUESTION 1 — 8 marks

1 1 Insert brackets to show the order of execution in the following C++ statement (2)

```
int n =  3 * 7 / 2 - 4 + 2 % 2,
```

1 2 Suppose the five C++ instructions below occur in a program What will be the output that will be displayed on the screen? (2)

```
int n,
int m = 113,
m--,
n = m++,
cout << m << " " << n << endl,
```

1 3 Write down the C++ code for the following algebraic expression (2)

$$x = 4(b + c) + \frac{a - 3b}{b + 7}$$

1 4 Write down the output after the execution of the following program fragment (2)

```
char ch = 'a',
cout << char(ch + 3) << endl,
```

QUESTION 2 — 8 marks

2 1 Suppose the declaration and nested `if` statements below occur in a C+ + program and values are assigned to the variables before the `if` statements are executed Suppose Thabo was born in SA in 1978 and is right-handed If these values are assigned to the relevant variables, what will the output be? (2)

```
string bornIn;      // country where person was born
int year,           // year when person was born
bool rightHanded,   // true if right-handed, false if left-handed

//values are assigned to bornIn, year and rightHanded here

if (rightHanded)
   if (year >= 1980)
       cout << "Group D",
   else
        if (bornIn != "SA")
           cout << "Group C",
        else
           cout << "Group A",
else
    if (bornIn == "SA")
       cout << "Group B" ,
```

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

```
int alpha,
cin >> alpha,
switch (alpha)
{
  case 1
  case 2   alpha = 2 + alpha,
           break,
  case 4   alpha++,
  case 5.  alpha = alpha * 2,
  case 6:  alpha = alpha + 5;
           break,
  default
           alpha--,
}
```

2 3 Write down the output of the following program fragment (2)

```
for (int i = 1, i < 4; i++)
{
    for (int j = 1, j <= i, j++)
       cout << '*',
    cout << endl,
}
```

2 4 We want to assign the value `true` to a boolean variable `safe` if

- either the value of `int` variable `dogs` is greater than 0 and the value of `char` variable `lock` is 'y', OR
- the value of the `char` variable `alarm` is 'A' or 'B'

Write the statement that will assign the correct value to `safe` (2)

QUESTION 3 **9 marks**

3 1 Consider the following C++ code fragment Convert the `switch` code to a nested `if` statement Note, it is not necessary to rewrite the declarations in your exam book You can only write down the code for the nested `if` statement (4)

```
float price, cost,
int number, days,
cout << "How many persons  ",
cin >> number,
cout << "How many days  ",
cin >> days,
```

```
//switch statement
switch (number)
{
   case 1  price = 150,
           break,
   case 2  price = 250,
           break,
   case 3
   case 4  price = 350,
           break,
   default  price = 1000;
}

cost = price * days;
```

3 2 Convert the following `for` loop to a `do while` loop (3)

```
int j = 2,
for (int i = 1, i <= 5, i++)
{
   cout << setw(4) << j,
   j = j + 5,
}
```

3 3 The following code should display each salesperson's commission The commission is calculated by multiplying the salesperson's sales by 10% However, there is a problem, the code is not working correctly Explain the problem and correct the code (2)

```
float sales = 0 0,
float commission = 0 0;
cout << "Enter a sales amount  ",
cin >> sales,
while (sales > 0 0)
{
   commission = sales * 0.1,
   cout << commission << endl,
}
```

QUESTION 4 **4 marks**

In the following program explain the difference between the functions `doubleNum1` and `doubleNum2` and show how each are being called

```
void doubleNum1 (int & value)
{
      value *=2,
}
```

```
int doubleNum2 (int value)
{
      return (value *= 2),
}
```

QUESTION 5 **4 marks**

Consider the following C++ code and complete it by filling in the required code

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

int larger(int x, int y)
{
    if (x >= y)
        return x;
    else
        return y;
}
int smaller(int x, int y)
{
    if (x <= y)
        return x;
    else
        return y;
}
void getMiniMax(int n, int & min, int & max)
{
    int num, // hold the current number
    cout << "Enter " << n << " numbers " <<endl;
    cin >> num;
    min = num;
    max = num;

    for (int i = 1; i < n; i++)
    {
        cin >> num;
        max = _____(1)_____ // Call the larger function here
        min = _____(2)_____ // Call the smaller function here
    }
}
void getInfo()
{
    cout << "This program computes the minimum and Maximum number" << endl;
    cout << "How many number do you want to enter? ";
}
int main()
{
    int minimum = 0;
    int maximum = 0;
    int n;
    _____(3)_____ // Call the getInfo function here
    cin >> n;

    _____(4)_____ // Call the getMiniMax function here

    cout << "The minimum is " << minimum << endl;
    cout << "The maximum is " << maximum << endl;
}
```

QUESTION 6 **2 marks**

In this question you have to write down what the purpose of the segment of code is Look at the following example before answering the question

```
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 them in reverse order Now answer the question below

Explain the purpose of the following segment of code

```
const N = 5,
int n[N] = {11,2,23,14,5},
int a = n[0],
for (int i = 1, i < N, i++)
   if (a < n[i])
      a = n[i],
```

QUESTION 7 **10 marks**

Study the program below and answer the questions that follow

```
1  #include <iostream>
2  #include <string>
3  using namespace std,

4  const int CUT1 = 12,
5  const int CUT2 = 18,

6  string func1(int p1)
7  {
8     string p2,
9     if (p1 >= CUT2)
10       p2 = "evening",
11    else if (p1>= CUT1)
12       p2 = "afternoon",
13    else
14       p2 = "morning",
15    cout << p2 << endl,
16    return p2,
17 }
```

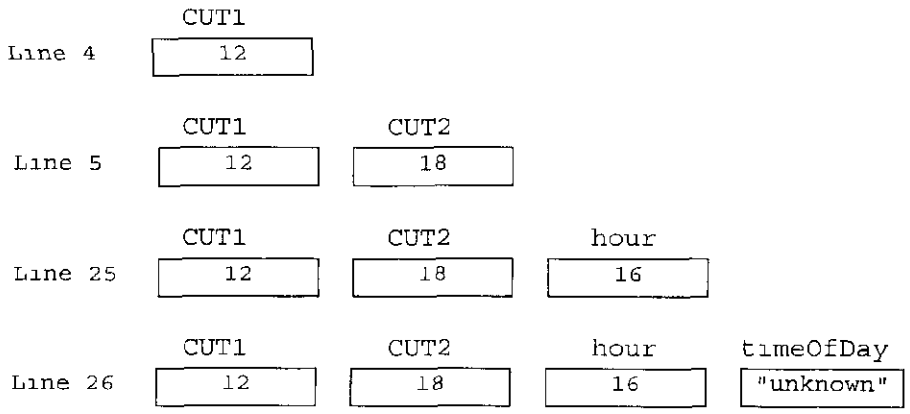
```
18 void func2 (int & a1)
19 {
20    a1 += 12,
21    a1 %= 24,
22 }


23 int main()
24 {
25    int hour = 16,
26    string timeOfDay = "unknown",
27    timeOfDay = func1(hour),
28    func2(hour),
29    timeOfDay = func1(hour),
30    cout << timeOfDay << endl,
31    return 0,
32 }
```

7 1 Draw variable diagrams for the next eight lines after line 26

Also, clearly indicate if the value of a variable is accessible using the conventions from the Study Guide as indicated below (9)

Remember the following conventions used for variable diagrams

- A question mark ? shows an uninitialised value for a variable
- The notation 25 → 5 means that execution jumps from line 25 to line 5
- Use square brackets [ ] around the name of a variable to show that it is inaccessible while the current function is being executed



7 2 What output will be produced by line 30? (1)

QUESTION 8 **7 marks**

The function `calcAverage` is a `void` function that inputs marks for a course and calculates the average mark The function receives as a parameter an integer value (the total number of students) and returns to the calling program two float values, the first value is the total of the students' marks obtained and the second value represents the average mark of the course These values are passed as parameters The mark for each student is entered and the total mark is calculated which is used to calculate the average Use as formal parameters an integer `numStudents` and two reference parameters `totalScore` and `courseAvg` Write the function

QUESTION 9 **4 marks**

Consider the following three lists

List 1	List 2	List 3
1	0	1
2	4	0
3	6	1
4	8	0
5	10	1

Write a C++ function `myLists` that adds the values in list 1 to the values in list 2 as shown above If the sum of the two is an even number, the corresponding value of list 3 is set to 0, otherwise it is set to

Use the following function header

```
void myLists(int list1[], int list2[], int list3[], int size),
```

QUESTION 10 **6 marks**

Consider the following output from the two-dimensional array

1	2	1	2
3	4	3	4
5	6	5	6
7	8	7	8

10 1 Write a C++ statement to declare and initialise the two-dimensional array `matrix` as shown above (2)

10 2 Write a function `printMatrix` to show the contents of `matrix` (4)

QUESTION 11 — 8 marks

Write C++ statement to do the following

11 1 Define a `struct SoccerTeam` with the following components (4)

- Team name
- Array of players

Assume that the following constant has been defined

```
const int TEAM_SIZE = 11;
```

11 2 Use the function header below and write a C++ function `isTeamMember` which checks if a given player is a member of the team (4)

```
bool isTeamMember (SoccerTeam teamP, string playerP);
```

QUESTION 12 — 5 marks

In this question you have to write the body of a function The function header is given Hint Below the question we list a number of `string` member functions that you may need

The function header looks as follows

```
string changedSentence(string senP)
```

The function receives a string of characters, indicated by `senP` in the function header The function has to

- mark all occurrences of `s` in the given string `senP` by inserting the character * in front of `s`, and
- return the changed string as the value of the function

Example If the string

```
She was so worried that she could not sleep
```

is given, the string

```
She wa*s *so worried that *she could not *sleep
```

should be returned You should write the body of the function ONLY

Member functions of the string class

The following member functions are provided with the `string` class to manipulate the values of `string` objects

Function signature	Description
`int size()`	Returns the size (i e length) of a string object
`string substr(int,int)`	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
`int find(string,int)`	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
`void insert(int,string)`	Inserts a string (specified as the second parameter) into a string object at a particular position (specified as the first parameter)
`void erase(int,int)`	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
`void replace(int,int,string)`	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