

## Programming Fundamentals (CS1002)

Course Instructor(s):

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Section(s): A,B,C,D,E,F,G

## Sessional-II Exam

Total Time (Hrs): 1  
Total Marks: 90  
Total Questions: 7

Date: Nov 4, 2024

Roll No

Course Section

Student Signature

Do not write below this line.

Attempt all the questions.

### Instructions:

1. Attempt all Questions in allocated space on the question paper, any answer not provided in designated space will not be considered.
2. Rough work space is provided with each question. Use last page for extra rough work.
3. Calculators are strictly prohibited.
4. Use permanent ink pens only. Any part done using a soft pencil will not be marked and cannot be claimed for rechecking.
5. Use proper indentation while writing code and ensure that your code is legible. You will lose your marks if your code is not clear.
6. Please read the question thoroughly and use your time properly; an uneven time distribution can lead to incomplete answers.

Question 1	Question 2	Question 3	Question 4	Question 5	Question 6	Question 7	Total
30	13	12	10	10	5	10	90

[CLO 2: Q1 - Q7]

Question 1:..... [10 x 3= 30 marks]

**NOTE:** Only full correct output can give you marks. Partially correct output will be considered wrong and will lead to zero marks in the part. If loop doesn't run or there is an infinite loop – identify it clearly in output.

i. What will be the output of the following code?

<pre>int i; for (i = 0, ++i, i++; i &lt;= 5; i += 2)     cout &lt;&lt; i;</pre>	<p>Rough Work:</p>         <p>Output: 24</p>
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ii. What is the output of the following code?

```
int i = 6, counter = 9;
while ((i - 1))
{
    if (counter++ % i == 0)
    { counter +=3 ; i--;
      continue; }
    ++counter;
    i--;
}
cout<<counter;
```

Rough Work:

Output:  
21

iii. What will be the output of the following code?

```
int main() {
    int i, j, m, answer;
    m = 0;
    j = 3;
    while (m < 4) {
        for (i = 0; i < j; i++) {
            answer = i * m;
            cout << answer;
        }
        m = m + 1;
        cout << endl;
    }
    return 0;
}
```

Rough Work:

Output:  
000  
012  
024  
036

iv. What will be the output of the following code?

```
int y = 0;

switch (y){

case 0:  y = y + 11;

case 1:  y = y / 2;
case 2:  y = y * 5;
case 3:  y = y + 1;

default: y = y%3;

}

cout << y << endl;
```

Rough Work:

Output:  
2

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v. What will be the output of the following code?

<pre>int main() {     int i, j;     int counter = 0;     int Arr[2][3];     for (i = 0; i &lt; 3; i++)         for (j = 0; j &lt; 2; j++)             {                 Arr[j][i] = counter;                 ++counter;             }     cout &lt;&lt; Arr[1][2];     return 0; }</pre>	Rough Work:  Output: 5
--	---------------------------------

vi. What will be the output of the following code?

[illegible]

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vii. What will be the output of the following code?

<pre>int n=50; int x = 0, i = 1;  while (i &lt;= n) {     x = x + (i * i);     i = i&lt;&lt;1; }  cout &lt;&lt; x &lt;&lt;endl;</pre>	<p><b>Rough Work:</b></p>          <p><b>Output:</b> 1365</p>
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viii. What will be the output of the following code?

<pre>int n=0; while(++n / 6 &lt; 3) {     if(n / 6 == 1)     {         n = n%6;     }     cout &lt;&lt; "Hello !! ";     n++; }</pre>	<p><b>Rough Work:</b></p>          <p><b>Output:</b> Hello !! (Infinite loop)</p>
---	---

ix. What will be the output of the following code?

<pre>int n=0; while(++n / 6 &lt; 3) {     if(n % 6 == 0)     {         n = n/6;     }     cout &lt;&lt; "Hello !! ";     n++; }</pre>	<p><b>Rough Work:</b></p>          <p><b>Output:</b> Hello !! Hello !! Hello !! Hello !! Hello !! Hello !! !! Hello !! Hello !! (9 times)</p>
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x. What will be the output of the following code?

```
#include <iostream>
int array[] = {1, 2, 3, 4};
int size = sizeof(array) /
sizeof(array[0]);
using namespace std;
void modifyArray() {
    for (int i = 0; i < size; i++)
    {
        if (array[i] % 2 == 0) {
            array[i] *= 2;
        }
    }
}

int main() {
    modifyArray();
    for (int i = 0; i < size; i++)
    {
        cout << array[i] << " ";
    }
    return 0;
}
```

Rough Work:

Output:  
1 4 3 8

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Question 2:..... [13 marks]

- i. Given the following if-else statement, write its equivalent statement using ternary operator. [5 marks]

```
if (x >= 5)
    if(y==1)
        z = x * 25;
    else
        z = x * 15;
else
    if(y==1)
        z = 5 * 25;
    else
        z = 5 * 15;
```

`z = (x >= 5) ? ((y == 1) ? x * 25 : x * 15) : ((y == 1) ? 5 * 25 : 5 * 15);`

OR

`z = x >= 5 ? y == 1 ? x * 25 : x * 15 : y == 1 ? 5 * 25 : 5 * 15;`

- ii. Consider the following code (assume that U, V, W, X, Y and Z are blocks of statements) and answer the questions below: [8 Marks]

```
int main()
{
    Z;
    do
    {
        U;
        if (if_condition)
        {
            V;
            if
            (break_condition)
                break;
        }
        else
            W;
        X;
    } while (loop_condition);
    Y;
    return 0;
}
```

Rough Work

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What is the minimum number of times, the “if\_condition”, the “break\_condition” and the “loop\_condition” will be executed (tested). [1]

```
if_condition = 1  
break_condition = 0  
loop_condition = 1
```

The block U and the block X will be executed same number of times.n {True/False} [1]  
\_\_\_\_\_False\_\_\_\_\_

If we know that the “break\_condition” is executed (tested) N times, can we claim anything about the “loop\_condition” and the “if\_condition”. Give exact answer with respect to N. [2]

**Minimum N times**

In the above code, either the Block V will be executed or the Block Y will be executed. {True/False}  
\_False\_\_\_\_\_ [1]

In the above code, if the loop is completely executed N times and the Block V is executed M (where  $M \leq N$ ) times, then how many times the Block W will be executed. Give exact answer with respect to M & N [1]

**N-M times**

In the above code, if the “loop\_condition” is executed (tested) N times, how many times at most the Block V can be executed. Give exact answer with respect to N [2]

N times

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**Question 3:**..... [12 marks]

Consider the following c++ code snippets and the expected outcome/output by the programmer. Identify if there is any **logical error** in the code that may lead to wrong output - give brief explanation and how to correct the error if any. Note: There is no syntax error in the code. [3+3+3+3]

1.	<pre> 1      #include &lt;iostream&gt; 2      int matrix[2][3]; 3      void initializeMatrix() { 4          for (int i = 0; i &lt;= 2; i++) { 5              for (int j = 0; j &lt;= 3; j++) { 6                  matrix[i][j] = i * j; 7              } 8          } 9      } 10     using namespace std; 11     int main() { 12         initializeMatrix(); 13         for (int i = 0; i &lt;= 2; i++) { 14             for (int j = 0; j &lt;= 3; j++) { 15                 cout &lt;&lt; matrix[i][j] &lt;&lt; " "; 16             } 17             cout &lt;&lt; "\n"; 18         } 19         return 0; 20     } </pre>	<p><b>Expected Outcome:</b></p> <p>0 0 0 0 1 2</p>
<p><b>Explanation</b></p> <p>Array out of bound logical error</p>		
2.	<pre> 1      #include &lt;iostream&gt; 2      int matrix[2][3] = {{5, 7, 9}, {3, 6, 10}}; 3      using namespace std; 4      void modifyMatrix() { 5          for (int i = 0; i &lt; 2; i++) { 6              for (int j = 0; j &lt; 3; j++) { 7                  if ((i &amp; 1) == 0) { 8                      matrix[i][j] &lt;&lt;= 1; 9                  } else { 10                     matrix[i][j] = matrix[i][j] &amp; ~(1 &lt;&lt; j); 11                 } } 12         } } 13     int main() { 14         modifyMatrix(); 15         for (int i = 0; i &lt; 2; i++) { 16             for (int j = 0; j &lt; 3; j++) { 17                 cout &lt;&lt; matrix[i][j] &lt;&lt; " "; 18             } 19             cout &lt;&lt; "\n"; 20         } 21         return 0; 22     } </pre>	<p><b>Expected Outcome:</b></p> <p>10 14 18 2 4 10</p>



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<b>Explanation</b>  <b>No problem in code / output</b>		
3.	<pre> 1  #include &lt;iostream&gt; 2  using namespace std; 3 4  int main() { 5 6      char chararray[5][5]; 7 8      for (int i = 0; i &lt; 5; i++) { 9          char ch = 'A'; 10         for (int j = 0; j &lt; 4; j++) { 11             chararray[i][j] = ch++; 12         } 13         cout&lt;&lt;chararray[i]&lt;&lt;endl; 14     } 15     return 0; 16 }</pre>	<b>Expected Outcome:</b>  ABCD  ABCD  ABCD  ABCD  ABCD
<b>Explanation:</b>  <b>Forgot to add NULL character, will result in printing garbage</b>		
4.	<pre> 1  #include &lt;iostream&gt; 2  using namespace std; 3 4  int main() { 5      int resetCount = 0; 6 7      for (int x = 0, y = 2; x &lt; 10 &amp;&amp; resetCount &lt; 2; 8          x++, y--) { 9 10         cout &lt;&lt; "x = " &lt;&lt; x &lt;&lt; ", y = " &lt;&lt; y &lt;&lt; endl; 11         if (y == 0) { 12             x = 0; 13             y = 2; 14             resetCount++; 15         } 16     } 17     return 0; 18 } 19 }</pre>	<b>Expected Outcome:</b>  x = 0, y = 2  x = 1, y = 1  x = 2, y = 0  x = 0, y = 2  x = 1, y = 1  x = 2, y = 0
<b>Explanation:</b>  <b>For loop, step 4 is autoincrement at the end of the loop , "x = 0, y = 2" will never get printed in this code. Need to do x=-1, y=3</b>		

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Question 4:..... [10 marks]

Complete the following C++ program that asks user to enter between a four digit, six or eight digit value (use input as long long int). Your program should print true if sum of each first  $n/2$  digits is greater than the last  $n/2$  sum of the digits. (e.g. 12345678 ... will result false as  $1+2+3+4$  is less than  $5+6+7+8$ .)

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

int main() {
    long long inputNumber;

    // Prompt user for input
    cout << "Enter a number with 4, 6, or 8 digits: ";
    cin >> inputNumber;

    // Check if the number is 4, 6, or 8 digits
    if ((inputNumber < 1000 || inputNumber > 99999999) ||
        (inputNumber >= 10000 && inputNumber < 100000) || // Exclude 5 digits
        (inputNumber >= 1000000 && inputNumber < 10000000)) { // Exclude 7
digits
        cout << "Invalid input! Please enter a number with 4, 6, or 8
digits." << endl;
        return 1; // Exit the program if the input is invalid
    }
    // Array to hold the digits
    int digits[8]; // Max size for 8 digits
    int digitCount = 0;
    int sumFirstHalf = 0;
    int sumSecondHalf = 0;

    // Using above array and variables, complete the program as per given
    description

    //ONE POSSIBLE SOLUTION:

    // Array to hold the digits
    int digits[8]; // Max size for 8 digits
    int digitCount = 0;
    int sumFirstHalf = 0;
    int sumSecondHalf = 0;

    // Extract digits from the inputNumber
    long long temp = inputNumber;
    while (temp > 0) {
        digits[digitCount] = temp % 10;
        temp /= 10;
        digitCount++;
    }

    // Reverse the order of digits in the array
    for (int i = 0; i < digitCount / 2; i++) {
        int tempDigit = digits[i];
        digits[i] = digits[digitCount - 1 - i];
        digits[digitCount - 1 - i] = tempDigit;
    }

    // Calculate the sum of the first and second halves
    for (int i = 0; i < digitCount / 2; i++) {
        sumFirstHalf += digits[i];
    }
}
```

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```
        sumSecondHalf += digits[digitCount / 2 + i];
    }

    // Compare the sums and print the result

    if (sumFirstHalf > sumSecondHalf) {
        cout << "True" << endl; // Condition is true
    } else {
        cout << "False" << endl; // Condition is false
    }
    return 0; // Exit the program successfully}
```

### ROUGH WORK

Question 5:..... [10 marks]

Complete the given C++ program that displays following pattern (below example is for n = 4) where n represents number of lines using SINGLE LOOP only.

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```
1 3 5 7
  4 6 8
    7 9
      10
```

**Note: You are not allowed to use any extra variable or a new loop other than defined in the code below. Use of external libraries is also not allowed.**

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

int main() {

    cout << "Enter an integer: ";
    cin >> n;
    for(int col=0, row=0, spaces = -1; row<n ;col++,spaces++) //ONE POSSIBLE
    SOLUTION
    {
        if(col == 0)
            spaces = 0;
        if(spaces < row)
        {
            cout<<" ";
        }
        else
        {
            cout << (row+1)+(col*2) << " ";
        }
        if(col == n-1)
        {
            row++;
            col=-1;
            cout<<endl;
        }
    }

    return 0; }
```

**ROUGH WORK**

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**Question 6:**..... [5 marks]

Complete the following `checkPowerOfTwo` function in the given program. The function checks if it is a power of two using bitwise operations. If it is, print "Power of 2"; if not, print "Not a power of 2".

Examples:

Input:

Enter a number: 16

Output:

Power of 2

Input:

Enter a number: 20

Output:

Not a power of 2

Input:

Enter a number: 32

Output:

Power of 2

**Note:** you have to complete the code by writing on the blank lines. Each line should contain only one statement. Built-in functions not allowed.

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

void checkPowerOfTwo() {
    if (n < 0) {
        cout << "Invalid input" << endl;
    }

    else if ((n & (n - 1)) == 0){
        cout << "Power of 2" << endl;
    } else {
        cout << "Not a power of 2" << endl;
    }
}

int main() {

    cout << "Enter an integer: ";
    cin >> n;
    checkPowerOfTwo();
    return 0;
}
```

**ROUGH WORK**

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### Question 7:..... [10 marks]

A company has a secure file access control system that tracks user permissions using bitwise flags. Each user has a unique integer value representing their permissions, where each bit in the integer corresponds to a specific access level. The permissions are as follows:

- Bit 0 (1): Read access
- Bit 1 (2): Write access
- Bit 2 (4): Execute access
- Bit 3 (8): Delete access
- Bit 4 (16): Admin access (includes all other permissions)

Each user can request permission to access a file by inputting a code number. You need to implement a system that checks if the user has the required permissions and grants or denies access based on their permission code and request type.

The program should:

- Prompt the user to enter their permission code.
- Display the permissions available to the user.
- Ask the user to enter the type of access they want (1 for Read, 2 for Write, 4 for Execute, 8 for Delete, 16 for Admin).
- Verify if the user has the requested access permission.
- Grant or deny access based on the permissions.

#### Sample Run:

Enter your permission code: 10

Available Permissions:

- Write

- Delete

Enter the access you want (1: Read, 2: Write, 4: Execute, 8: Delete, 16: Admin): 4

Access Denied

Complete the following program (i.e. fill in the following spaces) so that it works as per the description given above.

```
#include <iostream>
using namespace std;
int permissionCode, accessRequest;

void displayPermissions() {
    cout << "Available Permissions:" << endl;
    if (permissionCode & 1)           // Check Read permission (Bit 0)
        cout << "- Read" << endl;
    if (permissionCode & 2)           // Check Write permission (Bit 1)
        cout << "- Write" << endl;
    if (permissionCode & 4)           // Check Execute permission (Bit 2)
        cout << "- Execute" << endl;
    if (permissionCode & 8)           // Check Delete permission (Bit 3)
        cout << "- Delete" << endl;
    if (permissionCode & 16)          // Check Admin permission (Bit 4)
        cout << "- Admin (All permissions)" << endl;
}

void requestAccess() {
    if (permissionCode & accessRequest) {
        cout << "Access Granted" << endl;
    } else {
        cout << "Access Denied" << endl;
    }
}
```

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```
int main() {  
  
    // Prompt user to enter their permission code  
    cout << "Enter your permission code: ";  
    cin >> permissionCode;  
  
    // Display available permissions based on the code  
    displayPermissions();  
  
    // Prompt user to enter the access they want  
    cout << "Enter the access you want (1: Read, 2: Write, 4: Execute, 8:  
Delete, 16: Admin): ";  
    cin >> accessRequest;  
  
    // Check and print access result  
    requestAccess();  
  
    return 0;  
}
```

**ROUGH WORK!!!!**