

- (iii) In a class, what is a destructor and why we need it? (2)
- (b) Write a procedure 'ReverseString' which takes a string as input and return reverse of it. Write main function which takes string from the user and display the reversed string using 'ReverseString' procedure and displays the length of the string. Also, it should compare the string entered by the user and reversed string. (6½)
- (c) Write a program which takes two permutation maps f and g , using maps in C++, on the set $\{1,2,3,4,5,6\}$ entered by the user. The program then finds the composition of these maps and display the output on the screen. (Composition of f and g is defined as: $f \circ g(x) = f(g(x))$). Mention which composition you want to find out $f \circ g$ or $g \circ f$ or both? (6½)

[This question paper contains 12 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1134

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Unique Paper Code : 32357503
 Name of the Paper : DSE-1, C++ Programming for Mathematics
 Name of the Course : **B.Sc. (Hons.) Mathematics, Part III (CBCS (LOCF))**
 Semester : V
 Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
 2. This question paper has **six** questions in all.
 3. Attempt any **two** parts from each question.
 4. **All** questions are compulsory.
1. (a) (i) Write a C++ program to find the epsilon values of integer and real data types. (2)

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- (ii) Write down the C++ commands for finding the maximum and minimum values of four data types. (2)
- (iii) Describe the difference between the increment and decrement operator. (2)
- (b) (i) Write down the values of y, z and b, c in the following program

```
#include <iostream>
using namespace std;
int main() {
int x,y,z,a,b,c;
x=15;
y = ++ x * 3.3-15 % 3;
z = z *z;
cout << y << endl << z << endl;
a=30;
b=a +2.2-Z*x % 3+ y--;
c = c/b;
cout << c << endl << b << endl;
return 0;
}
```

(2)

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```
print_list(L);
L.remove_if(is_even);
print_list(L);
return 0;
}
```

(6½)

- (c) (i) Write a program that reads numbers in a file till the end of the file, and displays the sum. Also, it should display a proper message if the file is empty. (4½)

- (ii) Write the command to append data to an already existing file on your computer, with required declaration. (2)

6. (a) (i) What is the difference between getline and get method in string class. (2)

- (ii) What is the output of the following program code :

```
int main()
{
cout<<setw(10)<<left<<"Math"<<setw(7)<<showpos<<setfill("#")<<78<<endl;
cout<<setw(10)<<setfill('$')<<"Physics"<<setw(7)<<setfill('@')<<50<<endl;
return 0;
}
```

(2½)

P.T.O.

```

int main() {
list<long> L;

L.insert(L.begin(),-5);
L.insert(L.end(),6);
L.insert (L.begin(),3);
L.push_front(2);
L.push_back(0);
L.push_front(-22);
list<long>:: iterator Li;
Li = L.begin();
Li++;

L.insert (Li,0);

print_list(L);

cout << L.front() << endl;
cout << L.back() << endl;
cout << L.size() << endl;

L.sort();

print_list(L);

L.pop_front();

L.pop_back();

```

(ii) What are the header files for finding maximum and minimum size of integer and real data types? (1)

(iii) Write a program to input two complex numbers and find the sum, multiplication and division of two complex numbers using 'complex' header file. (3)

(c) If p_n is the probability that two integers chosen independently and uniformly from $\{1,2,\dots,n\}$ are relatively prime. Write a program to calculate p_{15} by creating a header file gcd.h, which calculates the gcd of two numbers. (6)

2. (a) (i) Write the output of the following code in the matrix form. (4)

```

for (i = 0; i < 4; i++) {
for (j = 0; j < 4; j++)
{
if(i == j)
A[i][j] = (i + j + 1)%2;
else
A[i][j] = (i*j+1)%2;
}
}

```

(ii) Explain the difference between while and do while loop using an example in C++. (2)

(b) (i) Write a program which outputs the following pattern : (2)

```
1 2 3 4 5
1 2 3
1 2
1
```

(ii) Define a procedure which takes long type argument k to calculate and return the value

of $\sum_{n=1}^k \frac{1}{n^3}$. Write a program which uses this procedure and displays the value of this expression for $k > 1$ entered by the user. (4)

(c) (i) Write the equivalent C++ expressions for the following :

(A) $y = 5(\cos x + \sin x)$; (B) $z = (x + y)^{z^2-5}$;

(C) $s = \frac{1}{200} \text{gt}^{30}$; (3)

5. (a) Write a program to find the elements of $U(10)$, where $U(10)$ is the group under multiplication modulo 10 having elements less than and co-prime to 10, and store them in a Set A. The program then displays the element of $U(10)$ and order of each element of $U(10)$. (Order of an element x is the least positive integer n such that $x^n = 1$).

(6½)

(b) What is the output of the following program.

```
#include <iostream>
#include <list>
using namespace std;
void print_list (list<long> & L1) {
list<long>::const_iterator Li;
for (Li = L1.begin(); Li != L1.end(); Li++) {
cout << *Li << " ";
}
cout << endl;
}
bool is_even(long n) {
return!(n%2 == 0);
}
```

- (ii) What does the rand() procedure return? Write the header file required for this. (2)
4. (a) Write a C++ procedure to find the Euler's totient function $\Phi(n)$. (6)
- (b) (i) Write the syntax of the trigraph operator in C++. Explain it through an example. (2)
- (ii) Explain function overloading with appropriate examples. (3)
- (iii) Explain the inline procedures in C++. (1)
- (c) (i) Write a C++ procedure to generate a random numbers in an arbitrary real interval [a, b]. (3)
- (ii) Write a C++ program that prompts the user to input 15 positive integers and save them into an array. Perform the sorting on the array and print the sorted array to the screen. Program also display second largest element of the array. (3)

- (ii) Evaluate the following expression :

```
ini x = 1, y = 2;
do {
y++;
++x;

cout<<x<<" "<<y << endl;

} while ((x == 3) || (y == 3)); (3)
```

3. (a) Design the matrix class to represent an element of the group

$$M_2(Z_{11}) = \left\{ \begin{bmatrix} a & b \\ c & d \end{bmatrix} : a, b, c, d \in Z_{11} \right\}$$

under component wise addition under modulo 11, having the following features :

- (i) It should include four private data variables a, b, c, and d of double type. Why we are working on integers?
- (ii) It should include the following two constructors :
- (a) A default constructor to represent the zero matrix.

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- (b) A four argument constructor to represent the 2 by 2 real matrix.
- (iii) It should include get methods to learn the values held by a, b, c, and d.
- (iv) It should include an operator + method to add two objects of this class.
- (v) It should include an operator << procedure

for printing objects in the form

a	b
c	d

Create any two objects A and B of this class to perform the addition A+B and display it to the screen. (6½)

- (b) (i) What is the output of following program (3½)

```
#include <iostream>
#include "Myprog.h"
using namespace std;
int main(){
    Myprog a;
    Myprog b(5);
```

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```
cout<<a.get()<< " and "<<b.get();
return 0;}
```

Where associated header file Myprog.h is given by

```
#ifndef MYPROG_H
#define MYPROG_H
Class Myprog{
    Private: int x;
    Public: Myprog() {x=0;}
    Myprog(int y){x=y*y;}
    int get() const{return x;}
};
#endif
```

- (ii) In the header file Myprog.h defined above, include an operator << procedure to print the object to the screen. (3)

- (c) (i) Write a C++ program to generate pseudo random numbers in interval [0, 4) using LCG (linear congruential generator) defined as $x_{n+1} = (a x_n + b) \text{ mod } c$, where $a=17$, $b=3$, $c=64$ and $x_0=0$. (4.5)