**LAB CONTENT**

**MODULE – CPP**

**Some Common terminology which we used in further programs -**

**#include :** It is a way of including a standard or user-defined file in the program and is mostly written at the beginning of any C++ program. The #include preprocessor directive is read by the preprocessor and instructs it to insert the contents of a user-defined or system header file in our C++ program.

**Iostream:** Iostream is an predefine standard library which stands for input-output stream.

**Using namespace std :** we can use names for objects and variables from the standard library.

**int main() :** The int main() defines the entry or the starting point of the C++ program code. Here int is a keyword that tells us about the integer data type. So when one runs the file on their local computer, the operating system executes the main () function.

**Cout :** The [cout object](https://www.geeksforgeeks.org/basic-input-output-c/) in C++ is an object of class i[ostream](https://www.geeksforgeeks.org/c-stream-classes-structure/). It is defined in [iostream header file](https://www.geeksforgeeks.org/header-files-in-c-cpp-and-its-uses/). It is used to display the output to the standard output device i.e. monitor.

**Cin :** The [cin object](https://www.geeksforgeeks.org/basic-input-output-c/) in C++ is an object of class [iostream](https://www.geeksforgeeks.org/c-stream-classes-structure/). It is used to accept the input from the standard input device i.e. keyboard.

**Insertion Operator (<<) :** The data needed to be displayed on the screen is inserted in the standard output stream (cout) using the [insertion operator(<<)](https://www.geeksforgeeks.org/overloading-stream-insertion-operators-c/).

**Extraction Operator (>>) :** The [extraction operator(>>)](https://www.geeksforgeeks.org/manipulators-in-c-with-examples/) is used along with the object cin for reading inputs.

**return 0 :** Return 0 in main function means that the program executed successfully and returning 0.

**Lab Assignment –** 1 **Date –** 22/04/2024

**Question 0 –**

**C++ Program to print “Hello World.”**

**Program**

//Printing Hello World in CPP

#include <iostream> // header file library

using namespace std;//we can use names for objects and variables from the standard library.

int main() //Main is the point from where compiler starts reading the program.

{

// Write C++ code here

cout << "Hello World";

return 0;

}

**Output**

Hello World

=== Code Execution Successful ===

**Question 1 –**

**Accept a number and bitPos from user... toggle the bit mentioned in bitPos on any given number(num).**

**Program**

#include <iostream> // header file library

using namespace std;//we can use names for objects and variables from the standard library.

int main() //Main is the point from where compiler starts reading the program.

{

// Write C++ code here

int num,bitpos; //int num,bitpos where int is the data type and num and bitpos are the two local variables.

cout << "Enter The Number : ";//Cout is used to print output, "<<" this is called as insertion operator.

cin >> num; //cin is used to take input from user, ">>" is an extraction operator;

cout << "Enter a bitpos to toggle : ";

cin >> bitpos;

num = num ^ (1<< bitpos) ;

// Left Shift ( << ) – It is a binary operator that takes two number, left shift the bits of the first // operand, and second number is decided the number of places to shift.

// Bitwise XOR ( ^ ) – It takes two numbers as operands and does XOR on every bit of two number. The result of XOR is 1 if the two bits are different.

cout << "Number After Toggle bit at position : " << bitpos << ":" << num << endl;

return 0;

}

**Output**

Enter The Number : 10

Enter a bitpos to toggle : 5

Number After Toggle bit at position : 5:42

=== Code Execution Successful ===

**Question 2 –**

**Accept a number and bitPos from user. Identify the nibble in which the bitPos occurs... Toggle all four bits present in that nibble.**

**//Nibble index - 7 6 5 4 3 2 1 0**

**//Nibbles - 1111 1111 1111 1111 1111 1111 1111 1111**

**Program**

#include <iostream> // header file library

using namespace std;//we can use names for objects and variables from the standard library.

int main() //Main is the point from where compiler starts reading the program.

{

// Write C++ code here

int num,bitpos; //int num,bitpos where int is the data type and num and bitpos are the two local variables.

cout << "Enter The Number : ";//Cout is used to print output, "<<" this is called as insertion operator.

cin >> num; //cin is used to take input from user, ">>" is an extraction operator;

cout << "Enter Position : ";

cin >> bitpos;

int nibbleIndex = bitpos/4;

int mask = 0xF << (nibbleIndex\*4);

/\* 0xF is an Hexadecimal representation of 15 and left shift (<<) it is a binary operator that takes two numbers, left shifts the bits of the first operand, and the second operand decides the number of places to shift. In other words, left-shifting an integer “a” with an integer “b” denoted as ‘(a<<b)’ is equivalent to multiplying a with 2^b (2 raised to power b). \*/

num = num ^ mask; /\*The ^ (bitwise XOR) in C++ takes two numbers as operands and does XOR on every bit of two numbers. The result of XOR is 1 if the two bits are different.\*/

cout << "Number after Toggling all four bit in the nibble : " << num << endl;

//endl - stands for end of line.

return 0;

// return 0 in the main function means that the program executed successfully.

}

**Output**

Enter The Number : 10

Enter Position : 5

Number after Toggling all four bit in the nibble : 250

=== Code Execution Successful ===

**Question 3 –**

**Accept dd,mm, yy , from Disparate variation algorithm formula ... determine the day of the week.**

**Program**

#include <iostream> // header file library

using namespace std;//we can use names for objects and variables from the standard library.

int getDayOfMonth(int day,int month,int year){

if (month < 3){

month+=12;

year--;

}

int century = year/100;

year %= 100;

int dayofweek = (day+(13\*(month+1)/5)+year+(year/4)+(century/4)+5\*century)%7;

// Formula is from disparate variation algorithm.

return (dayofweek+5)%7;

}

int main() //Main is the point from where compiler starts reading the program.

{

int dd,mm,yy;

cout << "Enter Date, Month and Year : ";

cin >> dd >> mm >> yy;

int dayOfWeek = getDayOfMonth(dd,mm,yy);

string days[] = {"Monday","Tuesday","Wednesday","Thursday","Friday","Saturday","Sunday"};

cout << "The day of the week is : "<< days[dayOfWeek] << endl;

return 0;

// return 0 in the main function means that the program executed successfully.

}

**Output**

Enter Date, Month and Year : 24 10 2000

The day of the week is : Tuesday

**Question 4 –**

**Accept and number, print series of 5 even and odd numbers..**

**Program**

#include <iostream> // header file library

using namespace std;//we can use names for objects and variables from the standard library.

int main() //Main is the point from where compiler starts reading the program.

{

// Write C++ code here

int num;

cout << "Enter The Number : ";

cin >> num;

int temp = num;

if(num%2==0){

cout << "Even Series : ";

for(int i=0;i<5;i++){ //This Loop is giving us even series.

cout << num << " ";

num+=2;

}

cout << "\nOdd Series : ";

for(int i=0;i<5;i++){ //This Loop is giving us odd series

cout << temp+1 << " ";

temp += 2;

}

}

else if(num%2!=0){

cout << "Odd Series : ";

for(int i=0;i<5;i++){

cout << num << " ";

num+=2;

}

cout << "\nEven Series : ";

for(int i=0;i<5;i++){

cout << temp+1 << " ";

temp+=2;

}

}

return 0;

}

**Output**

Enter The Number : 3

Odd Series : 3 5 7 9 11

Even Series : 4 6 8 10 12

=== Code Execution Successful ===

**Question 5 Part I –**

**Take a copy from 3rd Program, find the 1st day of the month of any given year.**

**Program**

#include <iostream> // header file library

using namespace std;//we can use names for objects and variables from the standard library.

int getDayOfYear(int year){

int day =1;

int month= 1;

if (month < 3){

month+=12;

year--;

}

int century = year/100;

year %= 100;

int dayofweek = (day+(13\*(month+1)/5)+year+(year/4)+(century/4)+5\*century)%7;

return (dayofweek+5)%7;

}

int main() //Main is the point from where compiler starts reading the program.

{

// Write C++ code here

int yy;

cout << "Enter Year : ";

cin >> yy;

int firstdayofyear = getDayOfYear(yy);

string days[] = {"Monday","Tuesday","Wednesday","Thursday","Friday","Saturday","Sunday"};

cout << "First day of the year : "<< days[firstdayofyear] << endl;

return 0;

// return 0 in the main function means that the program executed successfully.

}

**Output**

Enter Year : 2023

First day of the year : Sunday

=== Code Execution Successful ===

**Part II –**

**Program**

**Print 1 to 30 based on the week day based on the formula from program #3**

#include <iostream> // header file library

#include <iomanip>

using namespace std;//we can use names for objects and variables from the standard library.

int main() //Main is the point from where compiler starts reading the program.

{

// Write C++ code here

int mm,yy;

cout << "Enter Month and year : ";

cin >> mm >>yy;

int day =1;

if (mm < 3){

mm+=12;

yy--;

}

int century = yy/100;

yy %= 100;

int dayofweek = (day+(13\*(mm+1)/5)+yy+(yy/4)+(century/4)+5\*century)%7;

int daynum = (dayofweek+5)%7; //your formula logic here

cout<<"Su Mo Tu We Th Fr Sa"<<endl;

for(int cnt = 0; cnt < daynum;++cnt){

cout.width(3);

cout<<"";

}

for(int cnt = 1; cnt <= 30;++cnt){

cout.width(3);

cout<<cnt;

if ((daynum + cnt) % 7 == 0)

cout<<endl;

}

cout<<endl;

return 0;

}

**Output –**

Enter Month and year : 04 2024

Su Mo Tu We Th Fr Sa

1 2 3 4 5 6 7

8 9 10 11 12 13 14

15 16 17 18 19 20 21

22 23 24 25 26 27 28

29 30

=== Code Execution Successful ===

**Question 6 –**

**Accept a number, print whether the number is prime or not. (simple loop)**

**Program**

#include <iostream> // header file library

using namespace std;

int main(){

int num;

bool flag = false; //Bool Flag is boolean variable that signals when some condition exist in the program.

cout << "Enter The Number : ";

cin >> num;

for(int i=2;i<=num-1;i++){

if(num%i == 0){

cout << "Number is not prime.";

flag = true;

break;

}

}

if(flag == false){

cout << "Number is prime.";

}

return 0;

}

**Output**

Enter The Number : 21

Number is not prime.

=== Code Execution Successful ===

**Question 7 –**

**Accept any number and print prime number series till next 100 values.**

**Program**

#include<iostream>

using namespace std;

bool isPrime(int n) // Function to check the number where number is prime or not.

{

if(n==0 || n==1)

return false;

for(int i=2;i<n;i++){

if(n%i==0)

return false;

}

return true;

}

int main(){

int starting;

cout << "Enter Number ";

cin >> starting;

for(int i =starting ;i< starting + 100;i++){

if(isPrime(i))

cout << i << " ";

}

return 0;

}

**Output**

Enter Number 100

101 103 107 109 113 127 131 137 139 149 151 157 163 167 173 179 181 191 193 197 199

=== Code Execution Successful ===

**Question 8 -**

**Accept a number : 11**

**11 12 13 14 15 16 17 18 19 20**

**11 121 132 143 154 . 220**

**12 132 144 156 .. 240**

**13**

**14**

**15**

**16**

**.**

**.**

**.**

**20 220 240 260 280 300 320 ........ 400**

**Program-**

#include<iostream>

using namespace std;

int main(){

int num;

cout << ”Enter First Number To Print into the table format : ”;

cin >> num;

for(int i=num-1;i<num+10;i++){

cout << i << ” ”;

}

cout << endl;

for(int i=num;i<num+10;i++){

cout << i << ” ”;

for(int j=num;j<num+10;j++){

cout << i\*j << ” ”;

}

cout << endl;

} return 0;

}

**Output**

Enter First Number To Print into the table format : 11

10 11 12 13 14 15 16 17 18 19 20

11 121 132 143 154 165 176 187 198 209 220

12 132 144 156 168 180 192 204 216 228 240

13 143 156 169 182 195 208 221 234 247 260

14 154 168 182 196 210 224 238 252 266 280

15 165 180 195 210 225 240 255 270 285 300

16 176 192 208 224 240 256 272 288 304 320

17 187 204 221 238 255 272 289 306 323 340

18 198 216 234 252 270 288 306 324 342 360

19 209 228 247 266 285 304 323 342 361 380

20 220 240 260 280 300 320 340 360 380 400

=== Code Execution Successful ===

**Lab Assignment –** 2 **Date –** 23/04/2024

**Question 1 –**

**Print number from 1 to 10 using recursion.**

**Recursion** is the technique of making a function call itself.

**Program**

#include <iostream>

using namespace std;

void recur(int num)

{

if(num <=10){

cout << num << " ";

recur(num+1);

}

}

int main() {

recur(1);

cout << endl;

}

**Output**

1 2 3 4 5 6 7 8 9 10

=== Code Execution Successful ===

**Question 2 –**

**Find factorial of any given number using recursion.**

**Factorial** is the product of all positive integer less than or equal to a given positive integer.

Mathematical Expression – Let 4! = 4 x 3 x 2 x 1.

**Program without Recursion**

#include <iostream>

using namespace std;

int main() {

int num ,fact = 1;

cout << "Enter Number : ";

cin >> num;

for(int i=1;i<=num;i++){

fact\*=i;

}

cout << fact;

return 0;

}

**Output**

Enter Number : 5

120

=== Code Execution Successful ===

**Using Recursion**

#include <iostream>

using namespace std;

int factorial(int num)

{

if(num>=1)

return num\*factorial(num-1);

else

return 1;

}

int main()

{

int num ;

cout << "Enter Number : ";

cin >> num;

cout << "Factorial of "<<num<< " is :"<<factorial(num)<<endl;

return 0;

}

**Output**

Enter Number : 6

Factorial of 6 is :720

=== Code Execution Successful ===

**Question 3 –**

**Print fibonacci series using recursion.**

**Fibonacci Series –** Addition of first two numbers in a series resulting of third number.

Example – 0,1,1,2,3,5,8,….

**Program**

#include <iostream>

using namespace std;

void fibonacci(int num){

static int num1=0,num2=1,num3;

if(num>0){

num3 = num1+num2;

num1 = num2;

num2 = num3;

cout << num3 << " ";

fibonacci(num-1);

}

}

int main() {

int num ;

cout << "Enter Number : ";

cin >> num;

cout << "Fibonaaci Series ";

cout << "0 " << "1 ";

fibonacci(num-2);

return 0;

}

**Output**

Enter Number : 15

Fibonaaci Series 0 1 1 2 3 5 8 13 21 34 55 89 144 233 377

=== Code Execution Successful ===

**Question 4 –**

**Reverse a number using recursion.**

**Without Recursion**

#include <iostream>

using namespace std;

int main() {

int num ;

cout << "Enter Number : ";

cin >> num;

int reverse=0;

while(num!=0){

int digit = num%10; // It is providing last digit of the number.

reverse = reverse\*10+digit; //It is used to merge the digit in a reverse format.

num= num/10; //It is providing remaining number.

}

cout << "Reverse of given number : " << reverse;

return 0;

}

**Output**

Enter Number : 12345

Reverse of given number : 54321

=== Code Execution Successful ===

**Using Recursion**

#include <iostream>

using namespace std;

void reverse(long num){

if(num < 10){

cout << num;

return;

}

else {

cout << num%10;

reverse (num/10);

}

}

int main() {

long num ;

cout << "Enter Number : ";

cin >> num;

cout << "Reversed Number : ";

reverse(num);

return 0;

}

**Output**

Enter Number : 456123

Reversed Number : 321654

=== Code Execution Successful ===

**Question 5 –**

**Write a recursion function to calculate the sum of the first N natural numbers.**

**Without Recursion**

#include <iostream>

using namespace std;

int main() {

long num ;

cout << "Enter Number : ";

cin >> num;

int sum = 0;

for(int i=1;i<=num;i++){

sum+=i;

}

cout << "Sum of Number from 0 to " << num << " : "<< sum;

return 0;

}

**Output**

Enter Number : 10

Sum of Number from 0 to 10 : 55

=== Code Execution Successful ===

**Using Recursion**

#include <iostream>

using namespace std;

int naturalSum(int num){

int sum = 0;

if(num!=0){

sum = num+naturalSum(num-1);

}

return sum;

}

int main() {

long num ;

cout << "Enter Number : ";

cin >> num;

cout <<"Sum of Number from 0 to " << num << " : " << naturalSum(num);

return 0;

}

**Output**

Enter Number : 10

Sum of Number from 0 to 10 : 55

=== Code Execution Successful ===

**Lab Assignment –** 3 **Date –** 24/04/2024

**Question 1 –**

**Declare an array of 100 elements accept first value from the user (arr[0])...**

**fill the remaining elements with consecutive values and print them.**

**Enter the first value : 101**

**101 102 103 .... 200**

**Program**

#include <iostream> // header file library

using namespace std;//we can use names for objects and variables from the standard library

int main() //Main is the point from where compiler starts reading the program.

{

// Write C++ code here

int arr[100];

int j;

cout << "Enter First Element of an array : ";

cin >> arr[0];

for(int i = 0; i<100; i++)

{

arr[i] = arr[0]+i;

cout << arr[i] << " " ;

}

return 0;

// return 0 in the main function means that the program executed successfully.

}

**Output**

Enter First Element of an array : 101

101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200

=== Code Execution Successful ===

**Question 2 –**

**Write a function isPrime(num) --> returning true or false**

**read each element from the array and pass it to the function above. If prime leave it as it is, if not make the element 0. Print the whole array.**

**which consists of prime numbers and zeroes..**

**101 102 103 104 105 106 ... 200**

**101 0 103 0 0107 0 ... 0**

**Program**

#include <iostream>

using namespace std;

bool isPrime(int num){

if(num == 0 || num == 1){

return false;

}

for(int i=2;i<num;i++){

if(num%i==0)

return false;

}

return true;

}

int main() {

int num;

int arr[100];

cout << "Enter First Number : ";

cin >> num;

cout << isPrime(num);

for(int i=num;i<num+100;i++){

if(isPrime(i)){

cout << i << " ";

}

else

cout << 0 << " ";

}

return 0;

}

**Output**

Enter First Number : 100

00 101 0 103 0 0 0 107 0 109 0 0 0 113 0 0 0 0 0 0 0 0 0 0 0 0 0 127 0 0 0 131 0 0 0 0 0 137 0 139 0 0 0 0 0 0 0 0 0 149 0 151 0 0 0 0 0 157 0 0 0 0 0 163 0 0 0 167 0 0 0 0 0 173 0 0 0 0 0 179 0 181 0 0 0 0 0 0 0 0 0 191 0 193 0 0 0 197 0 199

=== Code Execution Successful ===

**Lab Assignment –** 4 **Date –** 25/04/2024

**//Magic Matrix**

**Program**

#include <iostream>

using namespace std;

#ifndef ROW

#define ROW 5

#endif

#ifndef COL

#define COL 5

#endif

void fillNormal(int arr[][COL], int row, int col);

void fillMagic(int arr[][COL], int row, int col);

void printMatrix(int arr[][COL], int row, int col);

int main(){

int arr[ROW][COL];

if (ROW == COL && ROW % 2 )

fillMagic(arr, ROW, COL);

else

fillNormal(arr, ROW, COL);

printMatrix(arr, ROW, COL);

}

void fillNormal(int arr[][COL], int row, int col){

int num=1;

for (int rCnt = 0; rCnt < row; ++rCnt){

for (int cCnt = 0; cCnt < col; ++cCnt)

arr[rCnt][cCnt] = num++;

}

}

void fillMagic(int arr[][COL], int row, int col){

if (row == col){

int rCnt, cCnt, num;

rCnt =0, cCnt = col/2;

num = 1;

while (num <= (row \* col)){

arr[rCnt][cCnt] = num;

if ((rCnt == 0) && (cCnt != col - 1) ){

rCnt = row - 1;

cCnt++;

}else if ((cCnt == col - 1) && (rCnt != 0)){

rCnt --;

cCnt = 0;

}else if ((rCnt != 0) && (cCnt!=col-1) && (num % row != 0)) {

rCnt--;

cCnt++;

}else

rCnt++;

num++;

}

}

}

void printMatrix(int arr[][COL], int row, int col){

for (int rCnt = 0; rCnt < row; ++rCnt){

for (int cCnt = 0; cCnt < col; ++cCnt)

cout<<arr[rCnt][cCnt] <<" ";

cout<<endl;

}

}

**Output**

17 24 1 8 15

23 5 7 14 16

4 6 13 20 22

10 12 19 21 3

11 18 25 2 9

**Introduction to pointer**

#include <iostream>

using namespace std;

int main(){

int var=10;

int \*ptr = &var;

cout<<"var: "<<var<<"\t&var: "<<&var<<endl;

cout<<"ptr: "<<ptr<<"\t&ptr: "<<&ptr<<endl;

cout<<"\*ptr: "<<\*ptr<<"\t\*&ptr: "<<\*&ptr<<endl;

cout<<"\*\*&ptr: "<<\*\*&ptr<<endl;

}

**Output**

var: 10 &var: 0x7ffd74a5920c

ptr: 0x7ffd74a5920c &ptr: 0x7ffd74a59210

\*ptr: 10 \*&ptr: 0x7ffd74a5920c

\*\*&ptr: 10