American International University Bangladesh (AIUB)

Faculty of science & Technology
Department of Computer Science

LAB MANUAL-01

CSC 2211: Algorithms

TITLE

Algorithmic and Computational Thinking

PREREQUISITE

- To be able to write, build and run a C++ program in CodeBlocks.
- To be able to identify and understand the basic components of a C++ program
- Able to write user define function and to use the library function (e.g. math.h, rand()).
- Good knowledge to use Array/List as argument of functions.
- Good knowledge to use pointers as argument of functions and function return a pointer.
- Function call by reference and call by value (swap example)
- Dynamic memory allocation in C++
- Standard Template library(STL in C++)

OBJECTIVE

- Algorithmic and Computational Thinking

Step by step learn C++

- Download Code Blocks that is open source, cross platform, free C, C++ and Fortran IDE.
- C++ data types and variables
- Operator and expression
- Conditional structure (if, if else, if else if…. Else, switch)
- Loops(for, while, do while loop)
- **Functions**
- **Array**
- **Pointer**
- **Function, array and pointer**
- String
- Structure and class
- Object Oriented programming

Basic building blocks of C++ program

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

int main()
{
    double a, b, c;
    cout<<"Enter two number: ";
    cin>>a>>b;
    c = a+b;
    cout<<"the result: "<<c;
    return 0;
}
```

Data Type or variable:

C++ Fundamental Data Types:

int ------ Integer ------ 2 or 4 bytes

float ------ Floating point ------ 4 bytes

double ------ Double Floating-point ------ 8 bytes

char ------ Character ------ 1 byte

bool ------ Boolean ------ 1 byte

Type	Bits	Range
int	16	-32768 to -32767
unsigned int	16	0 to 65535
signed int	16	-31768 to 32767
short int	16	-31768 to 32767
unsigned short int	16	0 to 65535
signed short int	16	-32768 to -32767
long int	32	-2147483648 to 2147483647
unsigned long int	32	-2147483648 to 2147483647
signed long int	32	0 to 4294967295
float	32	3.4E-38 to 3.4E+38
double	64	1.7E-308 to 1.7E+308
long double	80	3.4E-4932 to 3.4E+4932
char	8	-128 to 127
unsigned char	8	0 to 255
signed char	8	-128 to 127

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

int main()
{
    int myNum = 5; // Integer (whole number)
    float myFloatNum = 5.99; // Floating point number

    double myDoubleNum = 9.98; // Floating point number
    char myLetter = 'D'; // Character
    bool myBoolean = true; // Boolean
    string myText = "Hello"; // String
    return 0;
}
```

C++ Arithmetic Operators

Operator	Operation
+	Addition
-	Subtraction
*	Multiplication
/	Division
%	Modulo Operation (Remainder after division)

C++ Relational Operators

Operator	Meaning	Example
`= =`	Is Equal To	`3 == 5` gives us **false**
`!=`	Not Equal To	`3 != 5` gives us **true**
`>`	Greater Than	`3 > 5` gives us **false**
`<`	Less Than	`3 < 5` gives us **true**
`>=`	Greater Than or Equal To	`3 >= 5` give us **false**
`<=`	Less Than or Equal To	`3 <= 5` gives us **true**

Function, Array and Pointer

```
#include<bits/stdc++.h>
using namespace std;

void printList(int *m, int s){
    for(int i=0;i<s;i++){
        cout<<m[i]<<" ";
    }
}

int sumList(int *m, int s){
        int result = 0;
    for(int i=0;i<s;i++){
        result+= m[i];
    }
return result;
}

int *doubleList(int *x, int s){
        int *result = new int[s];
```

```
    for(int i=0;i<s;i++){
        result[i]= x[i]*2;
    }
return result;
}

int main(){

int  a[]={10,20,30,40};

printList(a,4);
cout<<"\nSum List= "<<sumList(a,4)<<endl;

cout<<"Double the list: ";
int *p=doubleList(a,4);
printList(p,4);

return 0;
}
```

2D dynamic memory

```
#include<bits/stdc++.h>
using namespace std;

int **Matrix(int r, int c)
{
    int **m = new int*[r];
    for(int i=0; i<r; i++)
    {
        m[i]= new int[c];
    }


    return m;
}

void printMatrix(int **p, int rows, int colums)
{
    for(int i=0; i<rows; i++)
    {
        for(int j=0; j<colums; j++)
        {
            cout<<p[i][j]<<" ";
        }
```

```
        cout<<endl;
    }
    cout<<endl;
}

void addValuse(int **k,int r,int c){


    for(int i=0; i<r; i++)
    {
        for(int j=0; j<c; j++)
        {
            k[i][j]=rand()%10;
        }
    }
}

int main()
{

    srand(time(0));
    int **A = Matrix(5,5);
    addValuse(A,5,5);
    printMatrix(A,5,5);

    int **B = Matrix(5,5);
    addValuse(B,5,5);
    printMatrix(B,5,5);


    return 0;
}
```

Call By Reference

```


    return 0;
}
```

LAB WORK

Write the following functions in C++

1. $f(x) = \mathrm{x}^2$
2. $\sum_{i=1}^{10} i$
3. $\sum_{i=1}^{10} i^2$
4. $\sum_{x=1}^{5} f(x),\ f(x) = x^2 + 5$
5. $\prod_{x=3}^{6} f(x),\ f(x) = x - 2$