LAB 1
REVIEW ON POINTERS + CLASSES

Data Structures
2021-2022

AGENDA

- Review on Pointers:
  - Declarations and Definition
  - Arrays and Pointers
  - New and Delete operators

- Classes:
  - Example: Student Class
  - Exercise: Student Class

REVIEW ON POINTERS

TASK 1

10 minutes

What will be the output of the following code?

```
int count = 10, *temp, sum = 0;
temp = &count;
*temp = 20;
temp = &sum;
*temp = count;
count++;
(*temp)--;
printf("count = %d, *temp = %d, sum = %d\n",
count, *temp, sum );
```

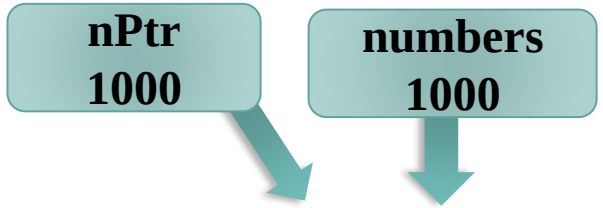
```
count = 21, *temp = 19, sum = 19
Press any key to continue . . .
```

Task 2

10 minutes

- **What will be the output in each?**

```
for (int i = 0; i < 10; i++)
{
 // pointer/subscript notation
 cout << numbers[i];
 cout << nPtr [i];
 // pointer/offset notation
 cout << *(nPtr + i) ;
 cout << *(numbers+i) << endl;
}
```



Address	Variable	Memory
1000	numbers [0]	0.0
1008	numbers [1]	1.1
1016	numbers [2]	2.2
1024	numbers [3]	3.3
1032	numbers [4]	4.4
...	...	...
1072	numbers [9]	9.9
996	[5]nPtr	1000

TASK 3


```
int *zPtr; // zPtr will reference array z
int number;
int z[ 5 ] = { 1, 2, 3, 4, 5 };
```

Find the error in the following:

```
++zPtr;
```

Error: zPtr has not been initialized.
Correction: Initialize zPtr first with zPtr = z;

TASK 3

```
int *zPtr; // zPtr will reference array z
int number;
int z[ 5 ] = { 1, 2, 3, 4, 5 };
```

Find the error in the following:

```
// use pointer to get first value of array
number = zPtr;
```

Error: The pointer is not dereferenced.
Correction: Change the statement to number = *zPtr;

TASK 3

```
int *zPtr; // zPtr will reference array z
int number;
int z[ 5 ] = { 1, 2, 3, 4, 5 };
```

Find the error in the following:

```
// assign array element 2 (the value 3) to number
number = *zPtr[2];
```

Error: zPtr[2] is not a pointer and should not be dereferenced.
Correction: Change *zPtr[2] to zPtr[2].

TASK 3

```
int *zPtr; // zPtr will reference array z
int number;
int z[ 5 ] = { 1, 2, 3, 4, 5 };
```

Find the error in the following:

```
++z;
```

Error: Trying to modify an array name with pointer arithmetic.
Correction: Use a pointer variable instead of the array name to accomplish pointer arithmetic,
or subscript the array name to refer to a specific element.

15 minutes

TASK 4

Trace the following code segment:

```
//prototype of function copyArray
void copyArray(int *, int *, int);

void main () {
    int size = 5;
    int* originalArr =
        new int [size];

    cout<<"Enter the array:\n";
    for (int i = 0; i < size; i++)
    {
        cin>>originalArr[i];
    }

    int *copiedArr = new int[size];
    copyArray(originalArr,
        copiedArr, size);
    cout<<"The copied array:\n";
    for (int i = 0; i < size; i++)
    {
        cout<<copiedArr[i]<<" ";
    }
    delete [] originalArr;
    delete [] copiedArr;
}

// the function copyArray
void copyArray(int * originalArr, int *
copiedArr , int size) {
    for (int i = 0; i < size; i++) {
        copiedArr[i] = originalArr[i];
    }
}
```

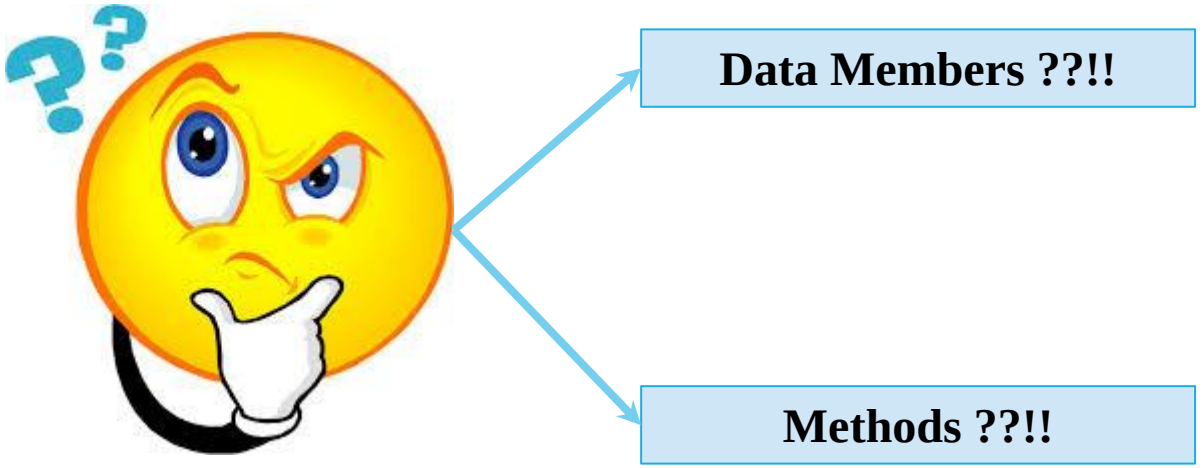
```
Enter the array values:
1
2
3
4
5
The copied array:
1 2 3 4 5
Press any key to continue . . .
```

CLASSES

STUDENT CLASS EXAMPLE

Assume each student in school has an ID and 3 marks for 3 different subjects.

Student affairs unit want to a program that allow them to enter the data for any number of students and calculate the total marks for each student then display the data of all students.



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

class Student{
    int ID;
    double marks[3];
    int total;
public:
    Student()
    {
        total = 0;
    }
    Student(int std_ID)
    {
        ID = std_ID;
        total = 0;
    }
```

Data Members

Constructors

Methods

```
    void readStudentData()
    {
        cout<<"ID: ";
        cin>>ID;
        for (int i = 0; i < 3; i++) {
            cout<<"Subject "<<i+1<<": ";
            cin>>marks[i];
        }
    }
    void sumStudentsMarks()
    {
        for (int i = 0; i < 3; i++) {
            total+=marks[i];
        }
    }
};
```

```cpp
#include "Student.h"
int main()
{
    int studsNum;
    cout<<"Enter the number of students:";
    cin>>studsNum;
    Student * studs = new Student[studsNum];
    // read the students' data; id & 3 grades
    for (int i = 0; i < studsNum; i++) {
        cout<<"Student :"<< i+1<<endl;
            studs[i].readStudentData();
            studs[i].sumStudentsMarks();
    }
    // display the students' data; id & 3 grades
    cout<<"*****Displaying:*****\n";
    for (int i = 0; i < studsNum; i++) {
        cout<<"Student :"<< i+1<<endl;
        studs[i].displayStudentData();

    }

}
```

MAIN FILE

STUDENT CLASS IN 2 SEPARATE FILES

.H FILE

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

class Student{
    int ID;
    double marks[3];
    int total;
public:
    Student();
    Student(int std_ID);
    void readStudentData() ;
    void sumStudentsMarks();
};
```

.CPP FILE

```
#include"Student.h"
   Student::Student()
    {
        total=0;
    }
   Student::Student(int std_ID)
    {
        ID = std_ID;
        total=0;
    }
    void  Student::readStudentData(){
        cout<<"ID: ";
        cin>>ID;
        for (int i = 0; i < 3; i++) {
            cout<<"Subject "<<i+1<<": ";
            cin>>marks[i];
        }
    }
```

```
void  Student::sumStudentsMarks(){
    for (int i = 0; i < 3; i++) {
        total+=marks[i];
    }
}
```

TASK 5

15 minutes

1. Write the previous student class using 2 separate files.
2. Add “DisplayStudentData” method that shows all student data.

TASK 5: SOLUTION

.H FILE

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

class Student{
    int ID;
    double marks[3];
    int total;
public:
    Student();
    Student(int std_ID);
    void readStudentData() ;
    void sumStudentsMarks();
    void DisplayStudentData();
};
```

.CPP FILE

```cpp
void Student::DisplayStudentData()
{
    cout << "ID:" <<  ID <<endl;
    cout << "Marks ";
    for(int i=0; i<3;i++)
    {
        cout << marks[i] << endl;
    }
    cout << "Total : " << total << endl;
}
```

MAIN FILE

```cpp
#include "Student.h"
int main()
{
    int studsNum;
    cout<<"Enter the number of students:";
    cin>>studsNum;
    Student * studs = new Student[studsNum];
    // read the students' data; id & 3 grades
    for (int i = 0; i < studsNum; i++) {
        cout<<"Student :"<< i+1<<endl;
            studs[i].readStudentData();
            studs[i].sumStudentsMarks();
    }
    // display the students' data; id & 3 grades
    for (int i = 0; i < studsNum; i++) {
        cout<<"Student :"<< i+1<<endl;
        studs[i].DisplayStudentData();
    }

}
```

Thank You