Structures (Recap)

- Some important points to remember:

  - Aggregate I/O is **not allowed**. I/O must be performed on a member by member basis.
  - Aggregate assignment is allowed. All data members (fields) are copied (**if both structure variables are of same type**)
  - Aggregate arithmetic is **not allowed**.
  - Aggregate comparison is **not allowed**. Comparisons must be performed on a member by member basis.
  - A struct is a valid return type for a value returning function.

Passing structure to function

- Example of comparison:

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

struct StudentRecord
{
    string Name;
    int      id;
    float   CGPA;
};

bool compare_name(StudentRecord a, StudentRecord b)
{
    if (a.Name == b.Name)
        return true;
    else
        return false;
}
```

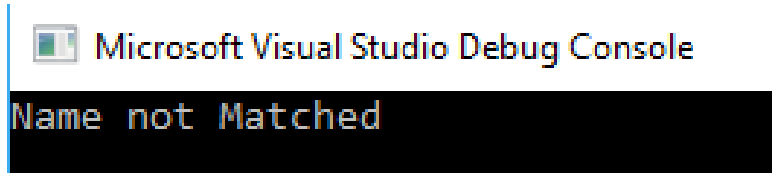
```
int main()
{
    StudentRecord Students[2];

    Students[0].Name = "Naveed";
    Students[0].id = 7;
    Students[0].CGPA = 3.9;

    Students[1].Name = "Ali";
    Students[1].id = 8;
    Students[1].CGPA = 4;

    if (compare_name(Students[0], Students[1]))
        cout << "Name Matched" << endl;
    else
        cout << "Name not Matched" << endl;

    return 0;
}
```



Passing structure to function

- Exercise: Find the output of the following program

```
struct MyBox
{
    int length, breadth, height;
};

void dimension(MyBox M)
{
    cout << M.length << "x" << M.breadth << "x";
    cout << M.height << endl;
}
```

```
int main()
{
    MyBox B1 = { 10, 15, 5 }, B2, B3;
    ++B1.height;
    dimension(B1);
    B3 = B1;
    ++B3.length;
    B3.breadth++;
    dimension(B3);
    B2 = B3;
    B2.height += 5;
    B2.length--;
    dimension(B2);

    return 0;
}
```

Output:

```
10x15x6
11x16x6
10x16x11
```

Passing structure to function

- Example of addition:

```
struct Fraction
{
    float numerator;
    float denominator;
};
```

```
Fraction add(Fraction a, Fraction b)
{
    Fraction temp;
    temp.numerator = (a.numerator * b.denominator) +
        (a.numerator * b.denominator);
    temp.denominator = (a.denominator * b.denominator);
    return temp;
}
```

```
int main()
{
    Fraction num1, num2, result;

    cout << "For 1st fraction," << endl;
    cout << "Enter numerator and denominator:" << endl;
    cin >> num1.numerator >> num1.denominator;

    cout << endl << "For 2nd fraction," << endl;
    cout << "Enter numerator and denominator:" << endl;
    cin >> num2.numerator >> num2.denominator;

    result = add(num1, num2);
    cout << "Sum = "<<result.numerator<<'/'<< result.denominator<<endl;

    return 0;
}
```

Output:

```
For 1st fraction,
Enter numerator and denominator:
1
2

For 2nd fraction,
Enter numerator and denominator:
1
2
Sum = 4/4
```

Passing Structure Array to Function

Option 1

```
void myFunction(StudentRecord Student[10])
{
   .
   .
   .
}
```

Option 2

```
void myFunction(StudentRecord Student[], int size)
{
   .
   .
   .
}
```

Pointers to Structure

Here is how you can create pointer for structures:

```
#include <iostream>
using namespace std;
struct temp {
    int i;
    float f;
};
int main() {
    temp *ptr;
    return 0;
}
```

Pointers to Structure

- Example

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

struct Distance
{
    int feet;
    float inch;
};
int main()
{
    Distance *ptr, d;
    ptr = &d;

    cout << "Enter feet: ";
    cin >> (*ptr).feet;
    cout << "Enter inch: ";
    cin >> (*ptr).inch;

    cout << "Displaying information." << endl;
    cout << "Distance = " << (*ptr).feet << " feet " << (*ptr).inch << " inches"<<endl;
    return 0;
}
```

Note: Since pointer ptr is pointing to variable d in this program, (*ptr).inch and d.inch is exact same cell. Similarly, **(*ptr).feet** and **d.feet** is exact same cell.

The syntax to access member function using pointer is ugly and there is alternative notation -> which is more common..

ptr->feet is same as (*ptr).feet

ptr->inch is same as (*ptr).inch

Pointers to Structure

- Example

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

struct Distance
{
    int feet;
    float inch;
};
int main()
{
    Distance *ptr, d;
    ptr = &d;

    cout << "Enter feet: ";
    cin >> (*ptr).feet;
    cout << "Enter inch: ";
    cin >> (*ptr).inch;

    cout << "Displaying information." << endl;
    cout << "Distance = " << (*ptr).feet << " feet " << (*ptr).inch << " inches"<<endl;
    return 0;
}
```

Can you tell me the sizeof(ptr)?

Unions

- A union is comprised of two or more variables that share the same memory location.

- A union declaration is similar to that of a structure, as shown below:

```
union example
{
    int     a;
    double  b;
    char    c;
};
```

Unions

- Example

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

union example_test
{
    short int       count;
    char            ch[2];
};
example_test test;


int main()
{
    test.ch[0] = 'X';
    test.ch[1] = 'Y';
    cout << "union as chars: " << test.ch[0] << test.ch[1] << endl;
    cout << "union as integer: " << test.count << endl;
    return(0);
}
```

Output:

```
union as chars: XY
union as integer: 22872
```

- **Be clear on one point: It is not possible to have this union hold both an integer and a character at the same time, because *count* and *ch* overlay each other.**
- **Advantage of union?**

Unions

- Example

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

union example1 {
    int a;
    float b;
    char *c;
}U;

struct example2 {
    int a;
    float b;
    char *c;
}S;

int main()
{
    cout<< sizeof(U)<< endl;
    cout << sizeof(S) << endl;

    return 0;
}
```

Can you tell me the output?

Thanks a lot

If you are taking a Nap, **wake up**.....Lecture Over