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Initialization and access
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Solution: struct
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Single struct
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Struct of structs

Structs

Comp Sci 1570 Introduction to C++

Missouri S&T | Computer Science

Outline

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The struct

- A data structure is a group of data elements grouped together under one name.
- These data elements, known as members, can have different types and different lengths.
- Basic Object Oriented Programming (OOP)
- Allows us to abstract at a higher level to build entities more complex than short, long, int, float, double, char, and bool
- With it programmers can create their own types to define what should make up a student, a class, a department, a university, etc

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General syntax

```
struct type_name
{
    member_type1 member_name1;
    member_type2 member_name2;
                .
                .
                .
    member_typeN member_nameN;
};
```

- This code should be placed in a header file.
- If this new type has potential to be used in other programming projects, it should have its own header dedicated to its definition for ease of portability.
- In a lot of cases, the struct is particular to a project and it is fine to include it in the header file with all the function prototypes and global constants.

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General syntax

```
struct type_name
{
    member_type1 member_name1;
    member_type2 member_name2;
                 .
                 .
                 .
    member_typeN member_nameN;
} object_names;
```

- Object names optional

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Initialization and access

```
struct type_name
{
    member_type1 member_name1;
};

int main(){
        type_name object_name;
        object_name.member_name1;
}
```

- To access any member of a structure, we use the member access operator '.'
- The member access operator is coded as a period between the structure variable name and the structure member that we wish to access.

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Aggregate data

- There are many instances in programming where we need more than one variable in order to represent an object.
- For example, to represent yourself, you might want to store your name, your birthday, your height, your weight, or any other number of characteristics about yourself.

```
string myName;
int myBirthYear;
int myBirthMonth;
int myBirthDay;
int myHeightInches;
int myWeightPounds;
```

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Aggregate data problems

- However, you now have 6 independent variables that are not grouped in any way.
- If you wanted to pass information about yourself to a function, you'd have to pass each variable individually.
- Furthermore, if you wanted to store information about someone else, you'd have to declare 6 more variables for each additional person!

```
string myName;
int myBirthYear;
int myBirthMonth;
int myBirthDay;
int myHeightInches;
int myWeightPounds;
```

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Aggregate data type: struct

- An aggregate data type is a data type that groups multiple individual variables together.
- One of the simplest aggregate data types is the struct.
- A **struct** (short for structure) allows us to group variables of mixed data types together into a single unit.
- Because structs are user-defined, we first have to tell the compiler what our struct looks like before we can begin using it.
- To do this, we declare our struct using the struct keyword. Here is an example of a struct declaration and definition:

```
struct Employee
{
    short id;
    int age;
    double wage;
};
```

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Declaration in main

In order to use the Employee struct, we simply declare variables of type Employee:

```
Employee joe; // create an Employee struct
Employee frank; // create another
```

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Access in main

- When we define a variable such as Employee joe, joe refers to the entire struct (which contains the member variables).
- In order to access the individual members, we use the member selection operator (which is a period).
- Here is an example of using the member selection operator to initialize each member variable:

```
Employee joe; //create an Employee struct
joe.id=14; //assign value to member id in joe
joe.age=32; //assign value to member age
joe.wage=24.15;

Employee frank;
frank.id=15;
frank.age=28;
frank.wage=18.27;
```

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A simple struct

```
// this code to be placed in a header file
struct point
{
    float m_Xcoord;
    float m_Ycoord;
};
```

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In main()

```
int main()
{
  point p1, p2;
  P1.m_Xcoord = 4;
  P1.m_Ycoord = 6;
  cout << "enter␣p2's␣x:␣";
  cin >> p2.m_Xcoord;
  cout << "and␣the␣y:␣";
  cin >> p2.m_Ycoord;
  cout << "the␣x␣coordinate␣of␣p1␣is␣"
       << p1.m_Xcoord;
...
```

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Struct of structs

```
struct point
{
    float m_Xcoord;
    float m_Ycoord;
};

struct line
{
    point m_Left;
    point m_Right;
};

int main()
{
    line my_line; // line object
    my_line.m_Left.m_Xcoord = 5; // point obj.
    my_line.m_Left.m_Ycoord = 8; // ...
```

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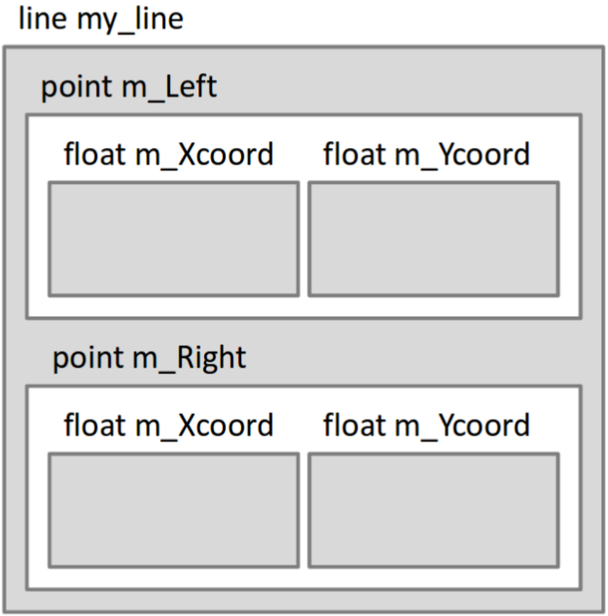

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Carpart struct example

```
struct carpart
{
    string m_description;
    long m_partNumber;
    float m_wholesalePrice;
    float m_retailPrice;
    string m_color;
    etc
};
```