# CSC 211: Computer Programming

## Structs

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Spring 2022


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## Structures

```
struct structureName {
    member1;
    member2;
    member3;
    .
    .
    .
    memberN;
};
```

Structures in C++ are user defined data types which are used to store multiple items (members) of possibly different data types



## Structures

- Definition is generally outside any function
  - new 'data type' will be available to all code that follows
- Structures can be declared in the same way as basic data types
- Can also use { } notation for initialization
- Use the **dot operator** for accessing data members



## Example

```
// defining the struct
struct Point {
    int x;
    int y;
};

int main() {
    // creating a variable
    struct Point p1;
}
```

# Initializing …

```
// defining the struct
struct Point {
    int x;
    int y;
};

int main() {
    // initializing (follows order)
    struct Point p1 = { 10, 20 };
}
```



# The dot operator

```
#include <iostream>

struct Point {
    int x;
    int y;
};

int main() {
    struct Point p1 = { 10, 20 };
    p1.x += 5;
    std::cout << p1.x << ' ' << p1.y << '\n';
}
```



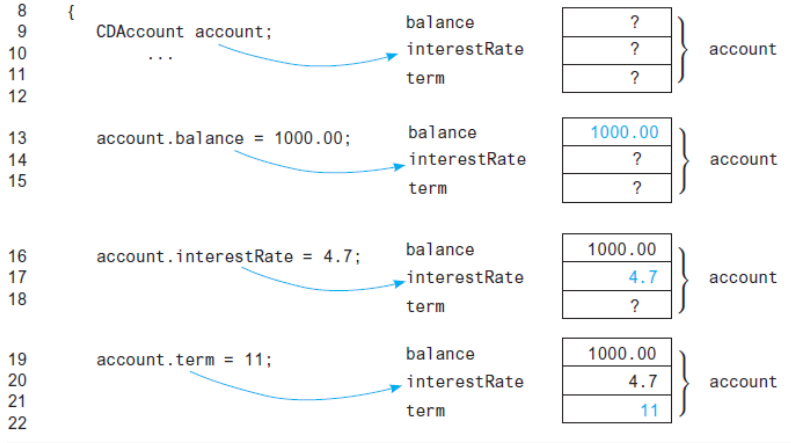
# The dot operator

```
#include <iostream>

struct Point {
    int x;
    int y;
};

int main() {
    struct Point p1 = { 10, 20 };
    struct Point p2 = { 30, 40 };
    struct Point p3 = { 50, 60 };
    p1.x += 5; p2.y += 10; p3.y += 15;
}
```



**DISPLAY 10.2 Member Values**

```
1   struct CDAccount
2   {
3       double balance;
4       double interestRate;
5       int term; //months until maturity
6   };
7   int main( )
8   {
9      CDAccount account;
10          ...
11
12
13      account.balance = 1000.00;
14
15
16      account.interestRate = 4.7;
17
18
19      account.term = 11;
20
21
22
```




from: Problem Solving with C++, 10th Edition, Walter Savitch

# Array of structures

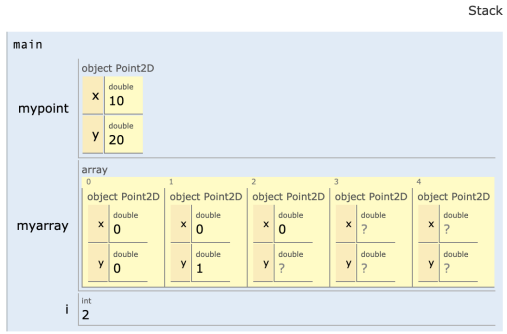
```cpp
#include <iostream>

struct Point2D {
    double x;
    double y;
};

int main() {

    Point2D mypoint;
    Point2D myarray[5];

    mypoint.x = 10;
    mypoint.y = 20;

    for (int i = 0 ; i < 5 ; i ++) {
        myarray[i].x = 0;
        myarray[i].y = i;
    }
}
```



# pythontutor.com

C++ (gcc 4.8, C++11)
EXPERIMENTAL! known limitations

```cpp
1  struct Point2D {
2    double x;
3    double y;
4  };
5
6  int main() {
7    struct Point2D mypoint;
8    struct Point2D myarray[5];
9
10   mypoint.x = 10;
11   mypoint.y = 20;
12
13   for (int i = 0 ; i < 5 ; i++) {
14     myarray[i].x = 0;
15     myarray[i].y = i;
16   }
17
18 }
```






# Functions

```cpp
// defining the struct
struct Point {
    int x;
    int y;
};

void distance(Point P1,Point P2);
```



# Passing structures to functions

DISPLAY 10.1 A Structure Definition

```cpp
//Program to demonstrate the CDAccount structure type.
#include <iostream>
using namespace std;
//Structure for a bank certificate of deposit:
struct CDAccount
{
    double balance;
    double interestRate;
    int term; //months until maturity
};


void getData(CDAccount& theAccount);
//Postcondition: theAccount.balance and theAccount.interestRate
//have been given values that the user entered at the keyboard.


int main( )
{
    CDAccount account;
    getData(account);

    double rateFraction, interest;
    rateFraction = account.interestRate / 100.0;
    interest = account.balance * rateFraction * (account.term / 12.0);
    account.balance = account.balance + interest;

    cout.setf(ios::fixed);
    cout.setf(ios::showpoint);
    cout.precision(2);
    cout << "When your CD matures in "
         << account.term << " months,\n"
         << "it will have a balance of $"
         << account.balance << endl;
    return 0;
}

//Uses iostream:
void getData(CDAccount& theAccount)
{
    cout << "Enter account balance: $";
    cin >> theAccount.balance;
    cout << "Enter account interest rate: ";
    cin >> theAccount.interestRate;
    cout << "Enter the number of months until maturity\n"
         << "(must be 12 or fewer months): ";
    cin >> theAccount.term;
}
```

from: Problem Solving with C++, 10th Edition, Walter Savitch

# Example

- Write a Student struct that contains
  - Name
  - StudentID
  - Major
- Implement functions:
  - void buildStudent(Student &someStudent)
    - Initialize member variables of student Struct
  - void changeMajor(Student someStudent);
    - Change the major of a student structure
  - void printStudent(Student someStudent);
    - Prints out all member variables of student structure