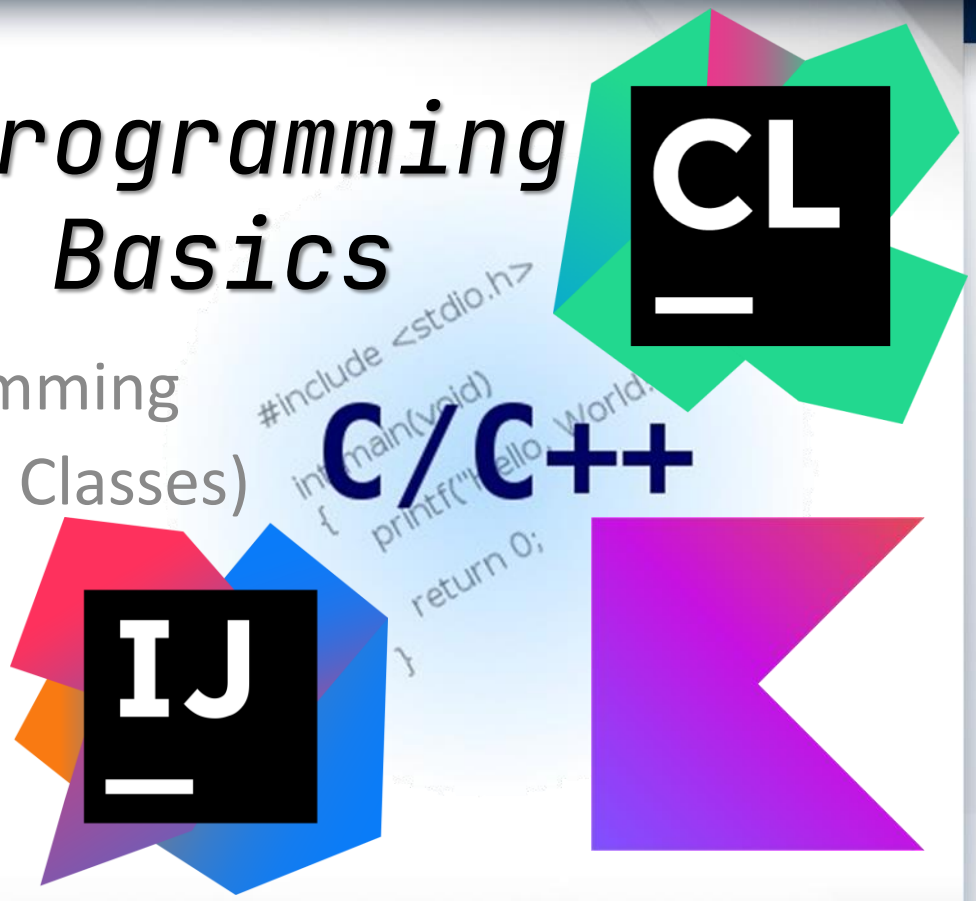
НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ КОРАБЛЕБУДУВАННЯ ІМЕНІ АДМІРАЛА МАКАРОВА

Algorithms & Programming
Programming Basics

C/C++/Kotlin programming

(p.5 – Structures / Data Classes)



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Structures in C/C++

- In C/C++, a structure is a user-defined data type that groups together variables of different data types under a single name.
- A structure is a way to organize data that is related to each other, and it provides a convenient way to access and manipulate multiple variables at once.

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Structures in C/C++

- A C/C++ structure is defined using the "struct" keyword, followed by the name of the structure and a set of braces that enclose the member variables of the structure.
- For example:

```
struct Person {
    char name[50];
    int age;
    double height;
};
```

Structures in C/C++

```
struct Person {
    char name[50];
    int age;
    double height;
};
```

In this example, we define a structure called "Person" that contains three member variables: a character array called "name" to store the name of the person, an integer variable called "age" to store their age, and a floating-point variable called "height" to store their height.

Structures in C/C++

- Once a structure is defined, we can create variables of that structure type and access the member variables using the dot operator.
- For example:

```
Person john;
strcpy(john.name, "John Smith");
john.age = 25;
john.height = 1.7;
```

Note: in this example "strcpy" – string function that copies value of string literal into character array

Declaring / Initialization

- In C++, structures can be declared and initialized in several ways.
- Here is an example of a structure declaration:

```
struct Person {
    string name;
    int age;
    double height;
};
```

This declares a structure named "Person" with three member variables: a string called "name", an integer called "age", and a floating-point number called "height".

Declaring / Initialization

- To initialize a structure variable, we can use either the C-style syntax or the C++11 uniform initialization syntax.
- Here's an example of initializing a structure using the C-style syntax:

```
Person johnSmith;
john.name = "John Smith";
john.age = 25;
john.height = 1.7;
```

In this example, we create a variable called "john" of type "Person" and assign values to its member variables using the dot operator.

Declaring / Initialization

- We can also initialize a structure using the C++11 uniform initialization syntax:

```
Person jane{"Jane Doe", 30, 1.6};
```

or

```
Person jane = {"Jane Doe", 30, 1.6};
```

In this example, we create a variable called "jane" of type "Person" and initialize its member variables using curly braces.

Pointer to structure

- In C++, a pointer to a structure can be used to access and manipulate the members of a structure.
- A pointer is a variable that stores the memory address of another variable, and it can be used to indirectly access the value stored in that variable.

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Pointer to structure

- To declare a pointer to a structure in C++, we can use the same syntax as declaring a pointer to any other data type, with the addition of the structure name:

```
struct Person {
    char name[50];
    int age;
    double height;
};
```

```
Person *ptrPerson;
// declare a pointer to a Person structure
```

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Pointer to structure

```
struct Person {
    char name[50];
    int age;
    double height;
};
```

```
Person *ptrPerson;
// declare a pointer to a Person structure
```

- In this example, we declare a pointer to a structure called "Person" using the "*" symbol. The pointer variable is named "ptrPerson".

Pointer to structure

- To initialize the pointer to point to a specific instance of the structure, we can use the "address-of" operator "&" with the variable name:

```
Person johnSmith = {"John Smith", 25, 1.7};

// set the pointer to point to the "johnSmith" variable
ptrPerson = &johnSmith;
```

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Pointer to structure

```
Person johnSmith = {"John Smith", 25, 1.7};

// set the pointer to point to the "johnSmith" variable
ptrPerson = &johnSmith;
```

- In this example, we create an instance of the "Person" structure called "johnSmith" and initialize its member variables.
- We then set the pointer "ptrPerson" to point to the address of the "johnSmith" variable using the "&" operator.

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Pointer to structure

- Once the pointer is initialized, we can access and manipulate the members of the structure using the "->" operator:

```
cout << "Name: " << ptrPerson-> name << endl;
cout << "Age: " << ptrPerson-> age << endl;
```

- In this example, we use the "->" operator to access the member variables of the structure through the pointer.
- The "->" operator is used to dereference the pointer and access the members of the structure.

Declaring / Initialization

- We can also use the "new" operator to dynamically allocate memory for a structure:

```
Person *ptrPerson2 = new Person{"Mike Smith", 35, 1.65};
```

- In this example, we create a pointer to a "Person" structure called "ptrPerson2" and dynamically allocate memory for a new "Person" structure.
- We initialize the member variables using curly braces.

Finalization

- When we're done using the dynamically allocated structure, we should free the memory using the "delete" operator:

```
delete ptrPerson2;
```

- This frees the memory that was allocated for the structure.

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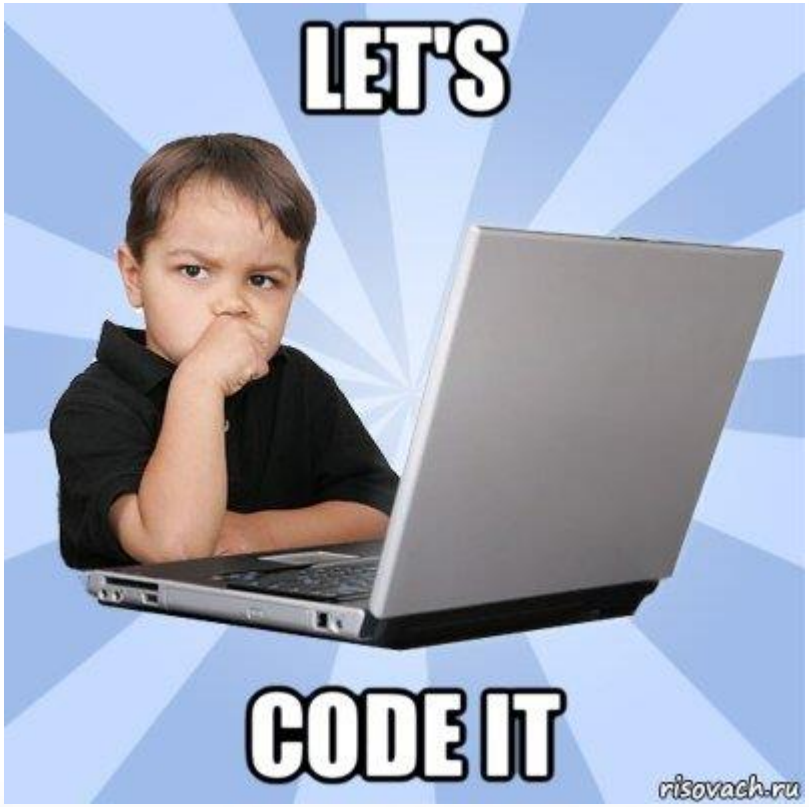
Demo



Arrays of structures

```
const int ARRAY_SIZE = 10;
Person people[ARRAY_SIZE];
```

- This creates an array of Person structures with a size of 10.
- You can access the elements of the array using the index notation, just like with any other array.

Arrays of structures

- To initialize the elements of the array, you can use a loop like this:

```
for (int i = 0; i < ARRAY_SIZE; i++) {
    cout << "Enter name for person #" << i+1 << ": ";
    getline(cin, people[i].name);
    cout << "Enter age for person #" << i+1 << ": ";
    cin >> people[i].age;
    cout << "Enter height for person #" << i+1 << ": ";
    cin >> people[i].height;
    cin.ignore(); // to consume the newline
                  // character left in the input stream
}
```

Arrays of structures

- You can then access the data in the array using the same index notation:

```
cout << "Name of person #3 is: "
     << people[2].name << endl;
cout << "Age of person #5 is: "
     << people[4].age << endl;
cout << "Height of person #9 is: "
     << people[8].height << endl;
```

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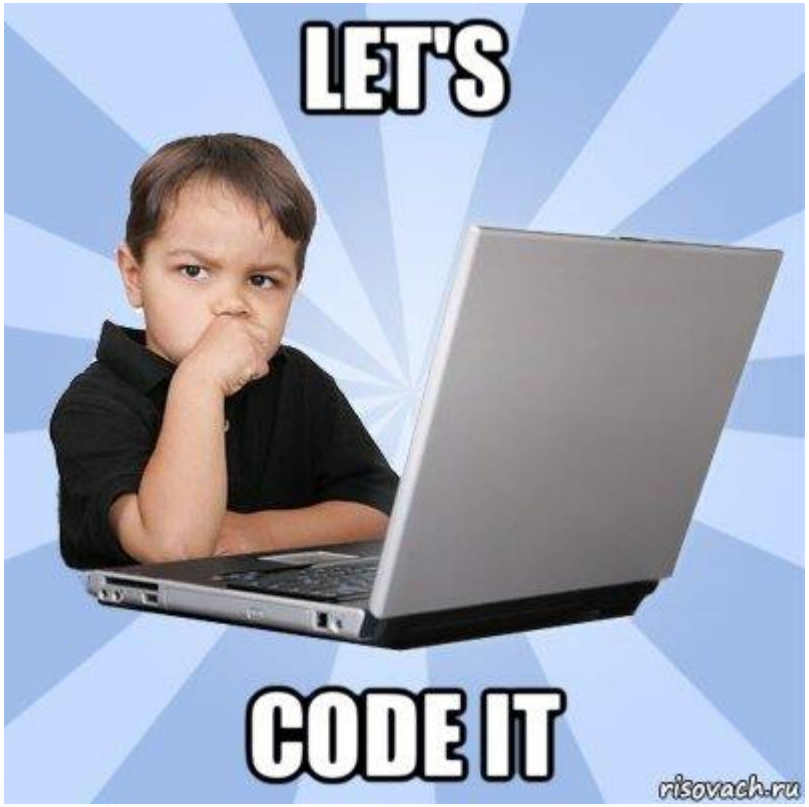

Kotlin: Data Class

- In Kotlin, a data class is a special type of class that is primarily used to hold data.
- It is often used to create objects that represent entities in an application such as a user, a product, or a message.

```
data class User(
    val name: String,
    val age: Int,
    val email: String
)
```

Kotlin: Data Class

```
data class User(
    val name: String,
    val age: Int,
    val email: String
)
```

- In this example, the User class has three properties: name, age, and email.
- The data keyword before the class name tells the compiler to generate some common methods such as toString(), equals(), hashCode(), and copy() for this class.

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Kotlin: Data Class

- You can create an instance of this class by using the constructor:

```
val user = User("John Doe", 25, "john.doe@example.com")
```

The toString() method is automatically generated for the data class, so you can print the object like this:

```
println(user)
// prints
//"User(name=John Doe, age=25, email=john.doe@example.com)"
```

Kotlin: Data Class

- The equals() and hashCode() methods are also generated, so you can compare two User objects like this:

```
val user2 = User("John Doe", 25, "john.doe@example.com")
val user3 = User("Jane Doe", 30, "jane.doe@example.com")

println(user == user2) // prints true
println(user == user3) // prints false
```

The copy() method is also generated, which allows you to create a new object with some properties copied from the original:

```
val updatedUser = user.copy(name = "John Smith")
println(updatedUser) // prints "User(name=John Smith,
age=25, email=john.doe@example.com)"
```

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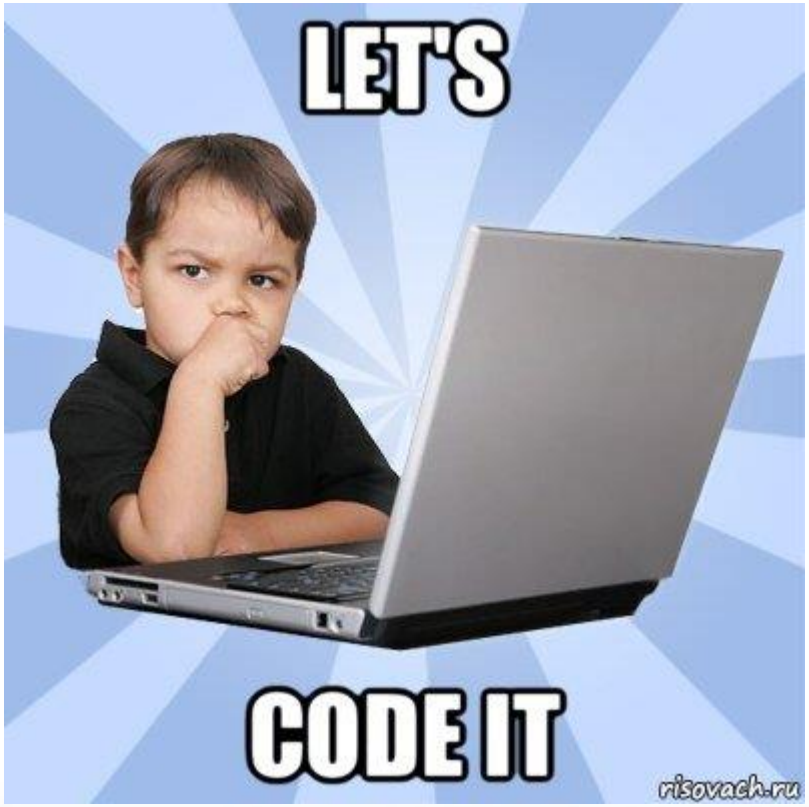
Demo



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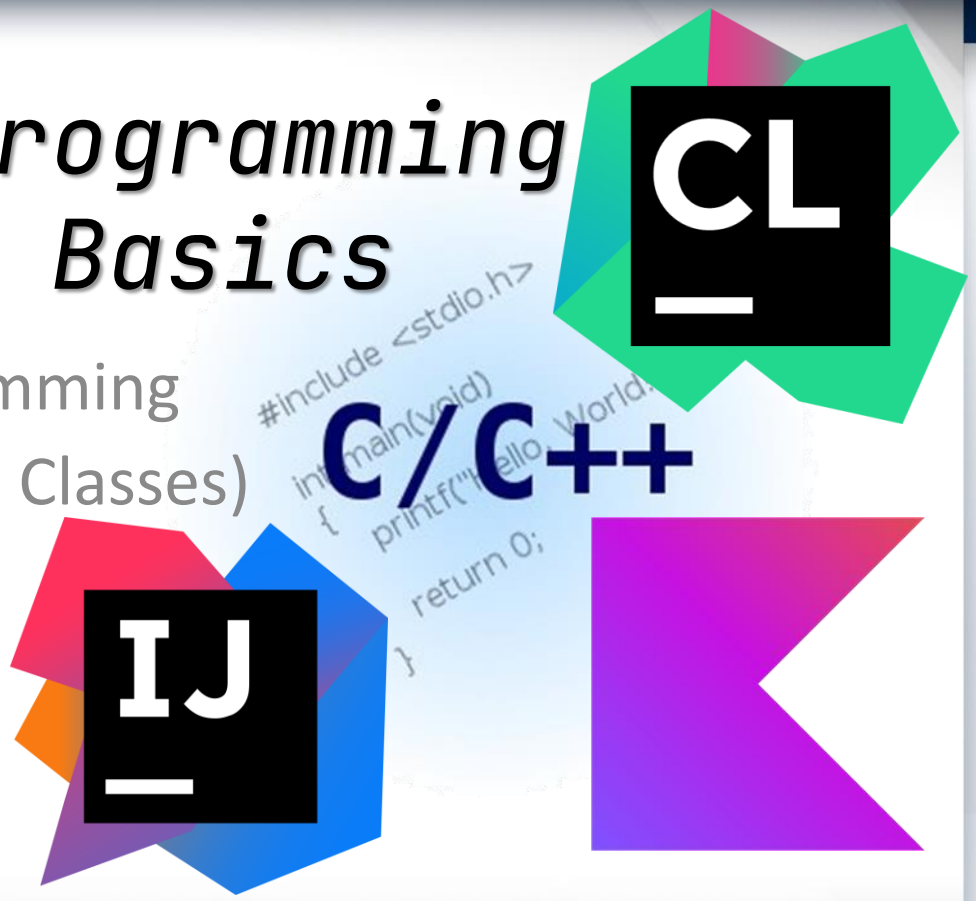

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