Solidity **data Types**:

1. **Value Type**
2. **Reference Type**

Value Type
Value Type ⇒ holds the data(value) directly within the memory owned by it
These Types stored the values with them instead of elsewhere

Value Type ⇒ do not take more than 32 bytes of memory in size (maximum size limit in solidity)

Reference Type:
⇒ store the reference of value stored variable
⇒ can take ake more than 32 bytes of memory in size (maximum size limit in solidity)

⇒ Solidity provides the following Reference Type

1. **Arrays**
2. **Struct**
3. **String**
4. **Mapping**

⇒ In Reference copy of the pointer is assigned not the values

Rules For Data Location:

Rule 1:
Variable declared as state-level outside the functions and at contract level declared as a Storage variable(Global variable)

⇒ you do not need to write a storage keyword(its automatically declared)
⇒ state variable may be a value type or reference type

Rule 2:
The default location of variables created in the function parameter(maybe int, bool) is **memory**
If you want to create a Reference type variable in parameter (like string or array) then you need to write explicitly **memory** keyword otherwise it will not compile

⇒ **mapping** can not be defined in memory level

Rule 3:

⇒ Rule 3 is basically for variables inside the function body and contain 5 additional case

Case 1 ⇒ Variables declared inside the function if value type (int, bool, unit, enum) are stored in memory level

Case 2 ⇒ For reference variables its compulsory to mention either its memory level or storage level
reference variables declared storage type inside the function can not store the direct value they always point state variable

Case 3 ⇒ If its memory level e.g. single or double quotes allowed
String memory a = 'Hello'
Compile
Case 4 ⇒ If its storage level e.g only double quotes allowed
String storage a = 'Hello'
Error

Case 5 ⇒ Mapping will always be a storage type variable. They can not be declared inside the function or as memory type

⇒ It's compulsory to tell the variable inside the function body is memory or storage type

Rule 4:
⇒ The argument in function calls will be stored in calldata location (which is immutable)

Rule 5
Rule 5 ⇒ when value type or reference type variable is assigned by another value or reference type then it will be **Pass By Copy** not Pass by reference.
The change will not affect by other variables

```
e.g.      int[2] age = [int(20),30];
          int[2] age2 = [int(50),60];

      Function testAge() public returns(int) {

           age  = age2;
          age2[0] = 100;

       return age[0]; // it will return 50 not the 100 because it is passed by copy;

}
```

Rule 6:

⇒ **memory = Storage**
Assignment of value type from memory to state also create a copy(Its passed by Copy)

e.g. int age = 30;
int age2 = 50;

function testAge() public returns(int) {

age = age2;
age2 = 100;

return age[0]; // it will return 50 not the 100 because it is passed by copy;

}

Rule 7:

⇒ **Storage = memory**

⇒ It will also be **Pass by copy** either its value type or Reference type(changes will not affect to copy variables)

Rule 8:
Value type variable will be **passed by value** in another memory type variable

function testAge() public view returns(int) {
int age = 30;
int age2 = 15;
age = age2;
age2 = 100;

return age; // it will return 15 not the 100 because it is passed by copy;

}

}

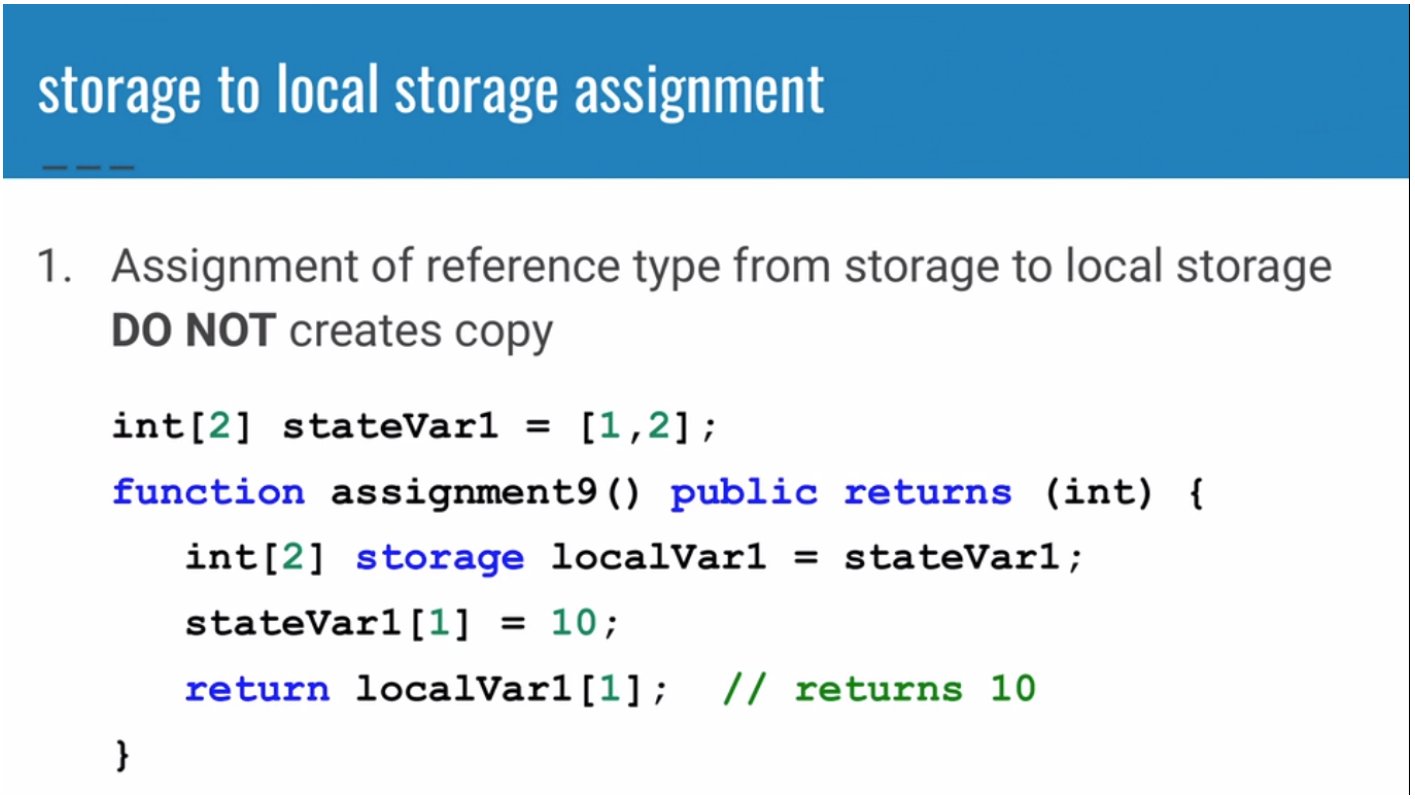
Reference Type variable will be **passed by Reference** in another memory type variable

```
   function testAge() public view  returns(int ) {
            int[2] memory age = [int(20),30];
            int[2] memory age2 = [int(50),60];
             age  = age2;
             age2[0] = 300;
             return age[0]; // it will return 300 the change value because its passed by refernce;

}
```

Storage to local Storage

Storage = storage ⇒ it is passed by Reference



Literals:
⇒ literals are the **hard coded** value which remain constant e.g int a = 5;
5 is the constant value

Integeres:
⇒ Two types of Integers

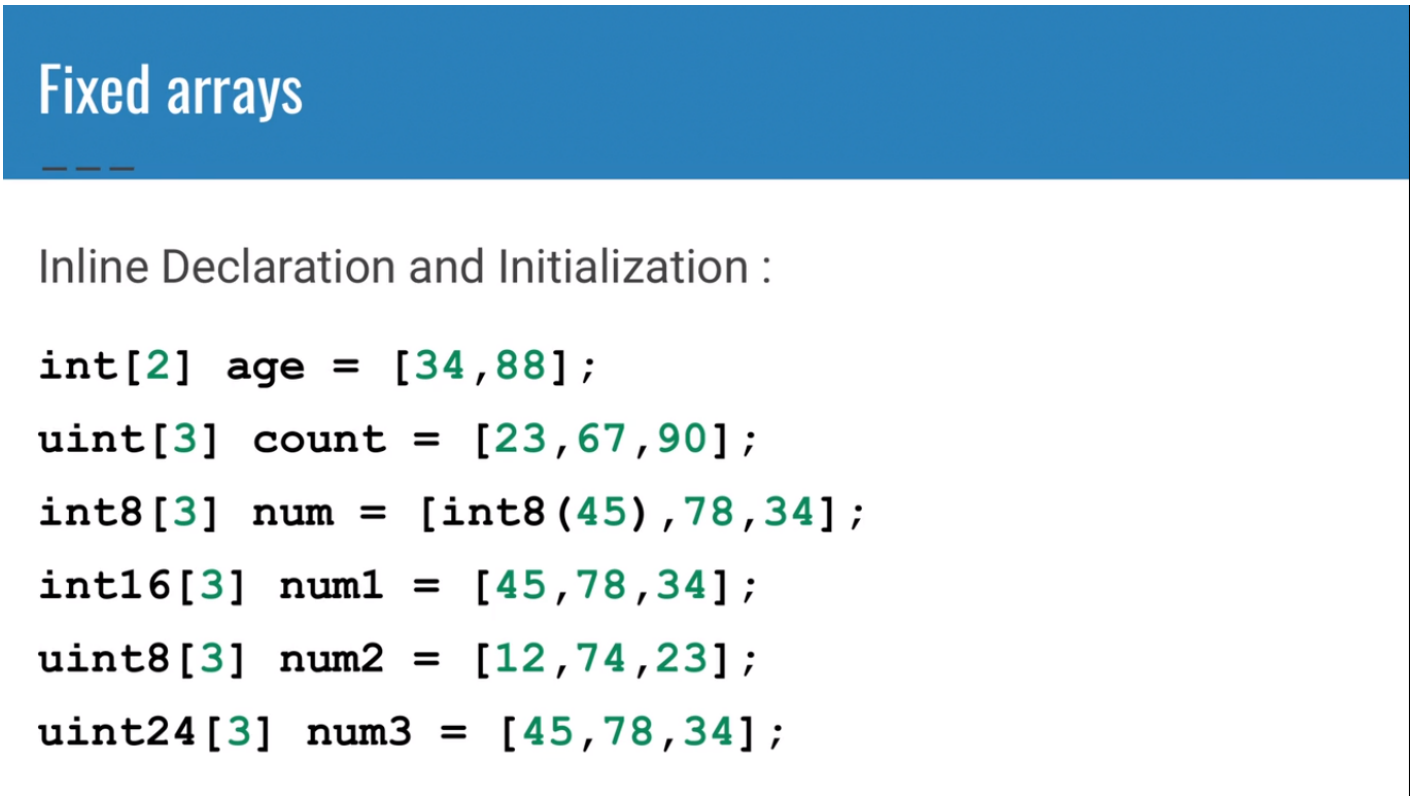
1. Signed
2. Unsigned

Bool:
⇒ In solidity bool can not be converted into inetegeres like Javascript

Array:

1. Fixed Array
2. Dynamic Array

⇒ fixed array



Array will return default value 0 if its empty

```
 int[4] list;

   function testAge() public  returns(int) {
              return list[0];
}

}
```

Dynamic Array:

⇒ Two ways to declare

```
        int[] list = [1,2,3];
        int[] list = new int[] (5);
```

⇒ lenght can be modified in only **Dynamic array** (not in fixed array)

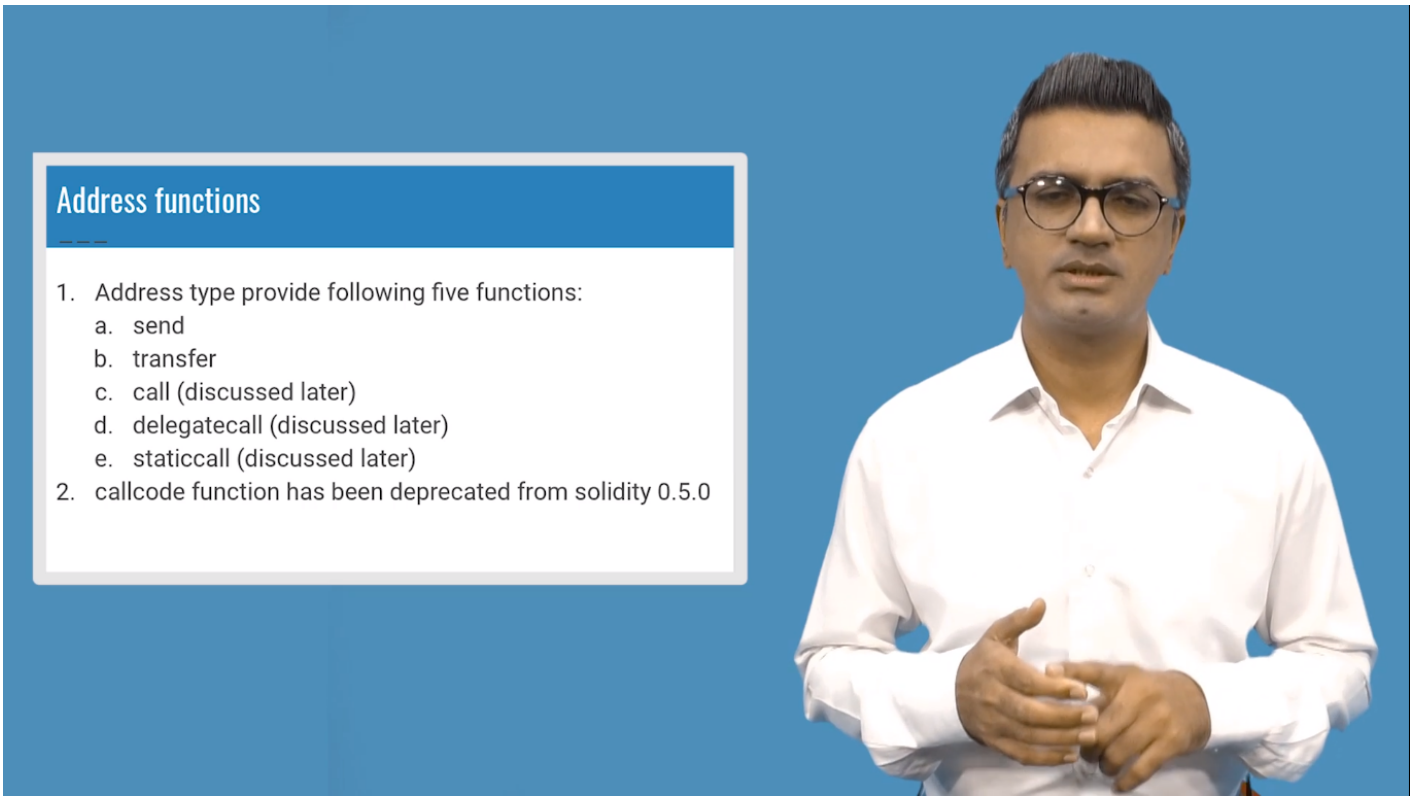
```
  int[] list = [1,2,3];
// lenght is 3
List.length = 10;
//lenght is 10
```

Solidity Special Array:

1. Bytes Array ⇒ store raw data in binary format
2. String Array

Address Data Type:
⇒ address is a 20 bytes data type which is used to hold the account address in ethereum which are 160 bits or 20 bytes in size.

Address Payable ⇒ used to send or receive balance(ether) while only **address can not send ether**



Sending Ether

```
contract MyBalance {

            address payable myAddress2 =
0x4B20993Bc481177ec7E8f571ceCaE8A9e22C02db;
            function testBalance() public payable returns(bool){

                bool isSent = myAddress2.send(2 ether);
                return isSent;
            }

}
```

Address - transfer function

1. The transfer method is similar to the send method.
2. It is responsible for sending Ether or wei to an address.
3. However, the difference here is that transfer raises an exception in the case of execution failure, instead of returning false , and all changes are reverted.
4. The transfer method is preferred over the send method as it raises an exception in the event of an error, meaning exceptions are bubbled up in the stack and halt execution.

Address - transfer function

```
address payable myAddress2 =
0x4B0897b0513fdC7C541B6d9D7E929C4e5364D2dB;

function sendFunds() public payable {
   myAddress2.transfer(msg.value);
}
```

Mapping:
⇒ mapping is similar to hashing r dictionaries in other languages
⇒ used for key-value pair (=>)

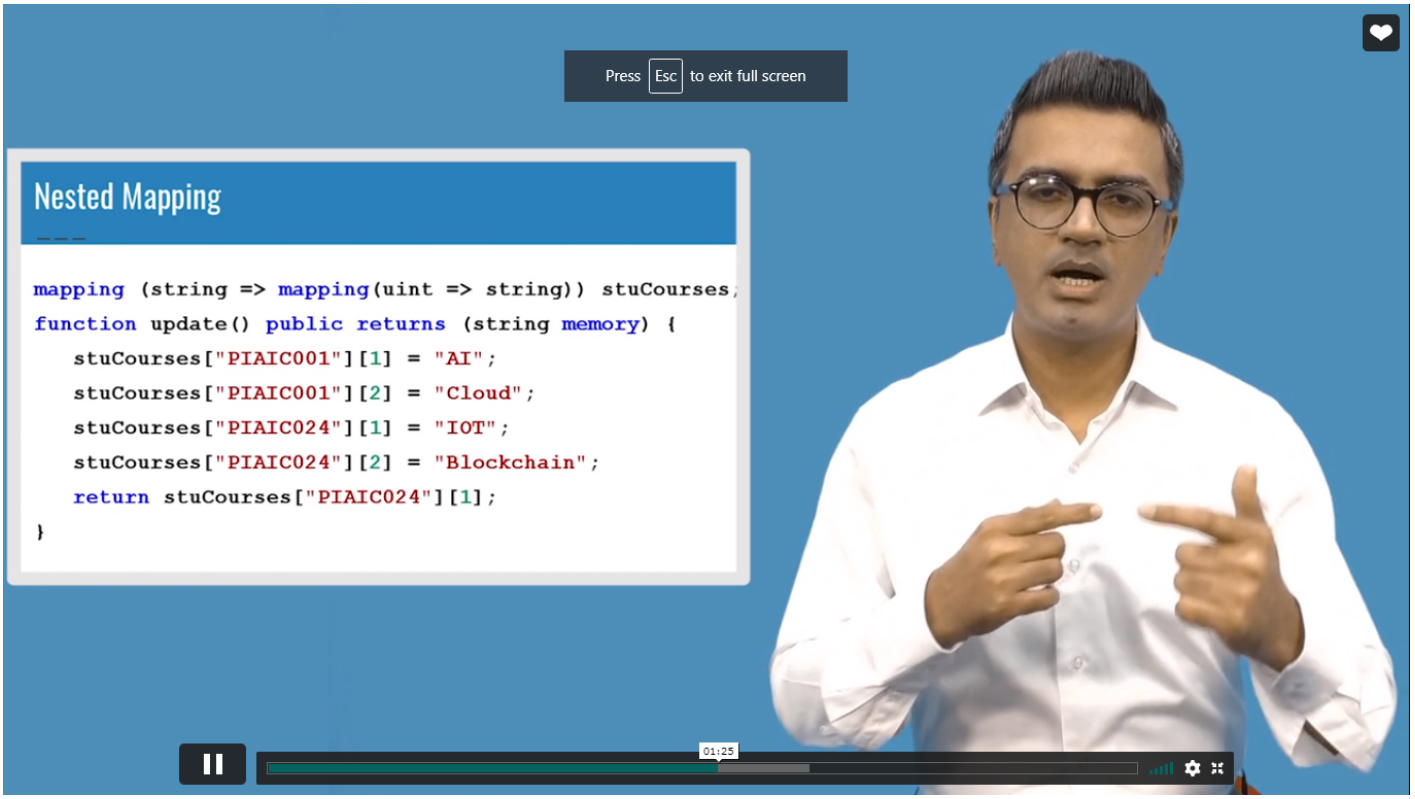
⇒ mapping (int ⇒ string) m1;

⇒ **enum and struct can be used as value but not as key**
⇒ loop can not applied on mapping
⇒ map is only declared in state level (storage level) not in memory level
⇒ In function if you want to create mapping then you have to refer it with state level mapping

```
contract First{
          mapping ( int => string ) m1;
          function updateValue(int a,string memory val) public{
              m1[a] = val;
          }
          function checkVal(int key) public view returns(string memory){
              return m1[key];
          }
}
```

⇒ mapping can not be receive in function return argument neither return from the function

Nested Mapping:


Press Esc to exit full screen
Nested Mapping
mapping (string => mapping(uint => string)) stuCourses;
function update() public returns (string memory) {
stuCourses["PIAIC001"][1] = "AI";
stuCourses["PIAIC001"][2] = "Cloud";
stuCourses["PIAIC024"][1] = "IOT";
stuCourses["PIAIC024"][2] = "Blockchain";
return stuCourses["PIAIC024"][1];
}
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