 មហាវិទ្យាល័យវិស្វកម្ម
FACULTY OF ENGINEERING

Data Structure & Algorithm

**Lecture 8
Pointer and Reference**

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Content

- Midterm

- Pointer and Reference

Descript the information in figure below:

Computer		Programmers		
Address	Content	Name	Type	Value
90000000	00			
90000001	00	sum	int	$000000FF(255_{10})$
90000002	00		(4 bytes)	
90000003	FF			
90000004	FF	age	short	$FFFF(-1_{10})$
90000005	FF		(2 bytes)	
90000006	1F			
90000007	FF			
90000008	FF			
90000009	FF	averge	double	1FFFFFFFFFFFFFFF
9000000A	FF		(8 bytes)	$(4.45015E-308_{10})$
9000000B	FF			
9000000C	FF			
9000000D	FF			
9000000E	90			
9000000F	00	ptrSum	int*	90000000
90000010	00		(4 bytes)	
90000011	00			

Note: All numbers in hexadecimal

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Pointer

- is a variable that holds the memory address of another variable.

- Normal variable which stores a value (such as an int, a double, a char), but a pointer stores a memory address.

- A pointer needs to be dereferenced with the * operator to access the memory location it points to.

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Declaring Pointers

- must be declared before they can be used, just like a normal variable.

- The syntax of declaring a pointer is to place a * in front of the name.

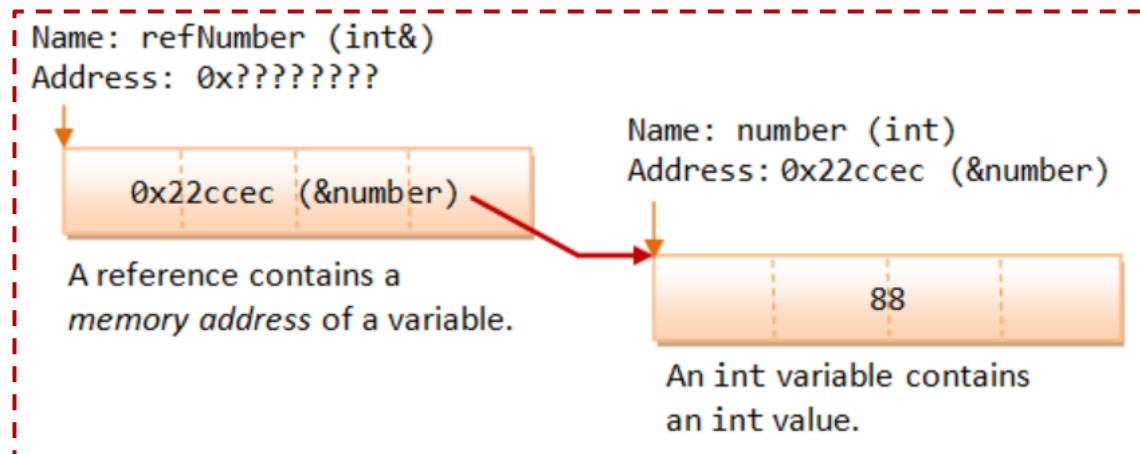- A pointer is also associated with a type (such as int and double).

```
type *ptr;    // Declare a pointer variable called ptr as a pointer of type
// or
type* ptr;
// or
type * ptr;  // I shall adopt this convention
```

References

- A reference variable is an alias

- A reference, like a pointer, is also implemented by storing the address of an object.

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Declaring References

- A reference works as a pointer.

- A reference is declared as an alias of a variable.

- It stores the address of the variable

```
Name: refNumber (int&)
Address: 0x????????

                                    Name: number (int)
                                    Address: 0x22ccec  (&number)

    0x22ccec  (&number)

                                              88
A reference contains a
memory address of a variable.

                                    An int variable contains
                                    an int value.
```

```
type &newName = existingName;
// or
type& newName = existingName;
// or
type & newName = existingName;  // I shall adopt this convention
```

References

- Write a comment after **//** to show what that line means

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

int main() {
    int number = 88;        //
    int & refNumber = number; //
                            //

    cout << number << endl;   //
    cout << refNumber << endl; //

    refNumber = 99;         //
    cout << refNumber << endl;
    cout << number << endl;   //

    number = 55;            //
    cout << number << endl;
    cout << refNumber << endl; //
}
```

Answers

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

int main() {
    int number = 88;          // Declare an int variable called number
    int & refNumber = number; // Declare a reference (alias) to the variable number
                              // Both refNumber and number refer to the same value

    cout << number << endl;    // Print value of variable number (88)
    cout << refNumber << endl; // Print value of reference (88)

    refNumber = 99;            // Re-assign a new value to refNumber
    cout << refNumber << endl;
    cout << number << endl;    // Value of number also changes (99)

    number = 55;               // Re-assign a new value to number
    cout << number << endl;
    cout << refNumber << endl; // Value of refNumber also changes (55)
}
```

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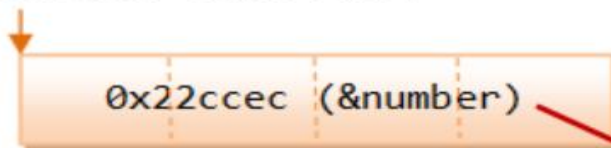# Initializing Pointers via the Address-Of Operator (&)

- The address-of operator (&) operates on a variable, and returns the address of the variable

```
int number = 88;      // An int variable with a value
int * pNumber;        // Declare a pointer variable called pNumber pointing to an int (or int pointer)
pNumber = &number;    // Assign the address of the variable number to pointer pNumber

int * pAnother = &number; // Declare another int pointer and init to address of the variable number
```

```
Name: pNumber (int*)
Address: 0x????????

    0x22ccec  (&number)

An int pointer variable
contains a memory address
pointing to an int value.


                          Name: number (int)
                          Address: 0x22ccec  (&number)


                                      88

                          An int variable contains
                          an int value.
```
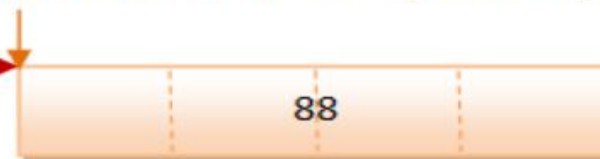
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W8 – Lab 8

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Prechecking:

After watching the video, answer the following Questions:

1. What is a Reference?
2. How is a reference different from a pointer?
3. What they are used for?
4. How do references work?

Midterm 1.5 h

Thanks!