INC 141
Computer Programming

Lab 10

Learning Outcomes (Lab 11)

- Understand address and pointer
- Understand how to pass address and value into a function

Example 1 - Address

```
#include <stdio.h>
main() {
    int a[4] = {10,20,30,40};
    int b = 5;
    float c = 1.6;

    printf("%d %p\n", a[0], a);
    printf("%d %p\n", b, &b);
    printf("%f %p\n", c, &c);
}
```

We use & in front of variable's name to indicate address.

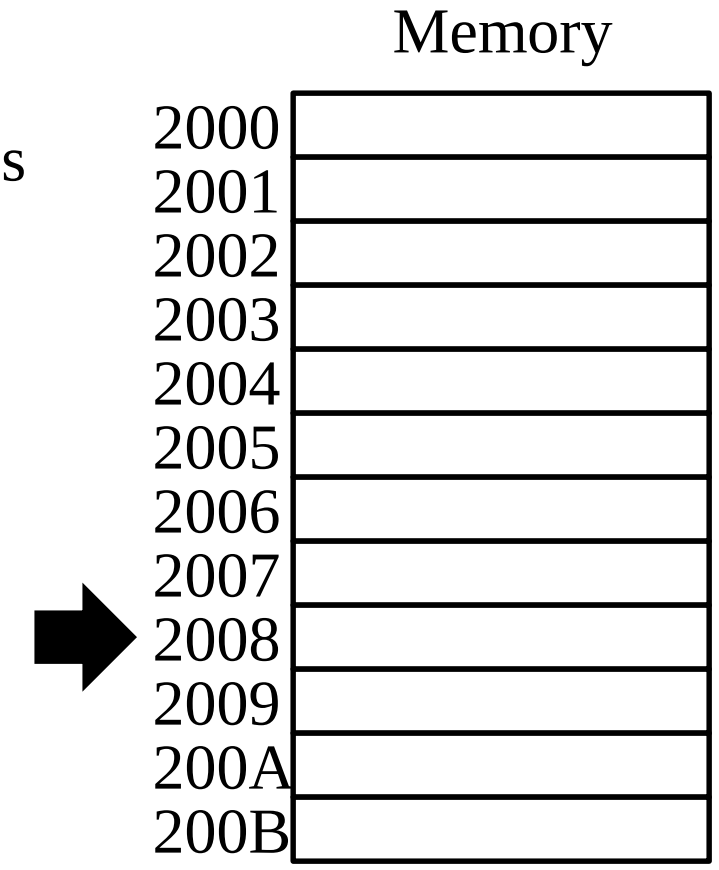
Array's name is address.

What is a pointer?

Pointers are variables that store address of memory where data is stored.

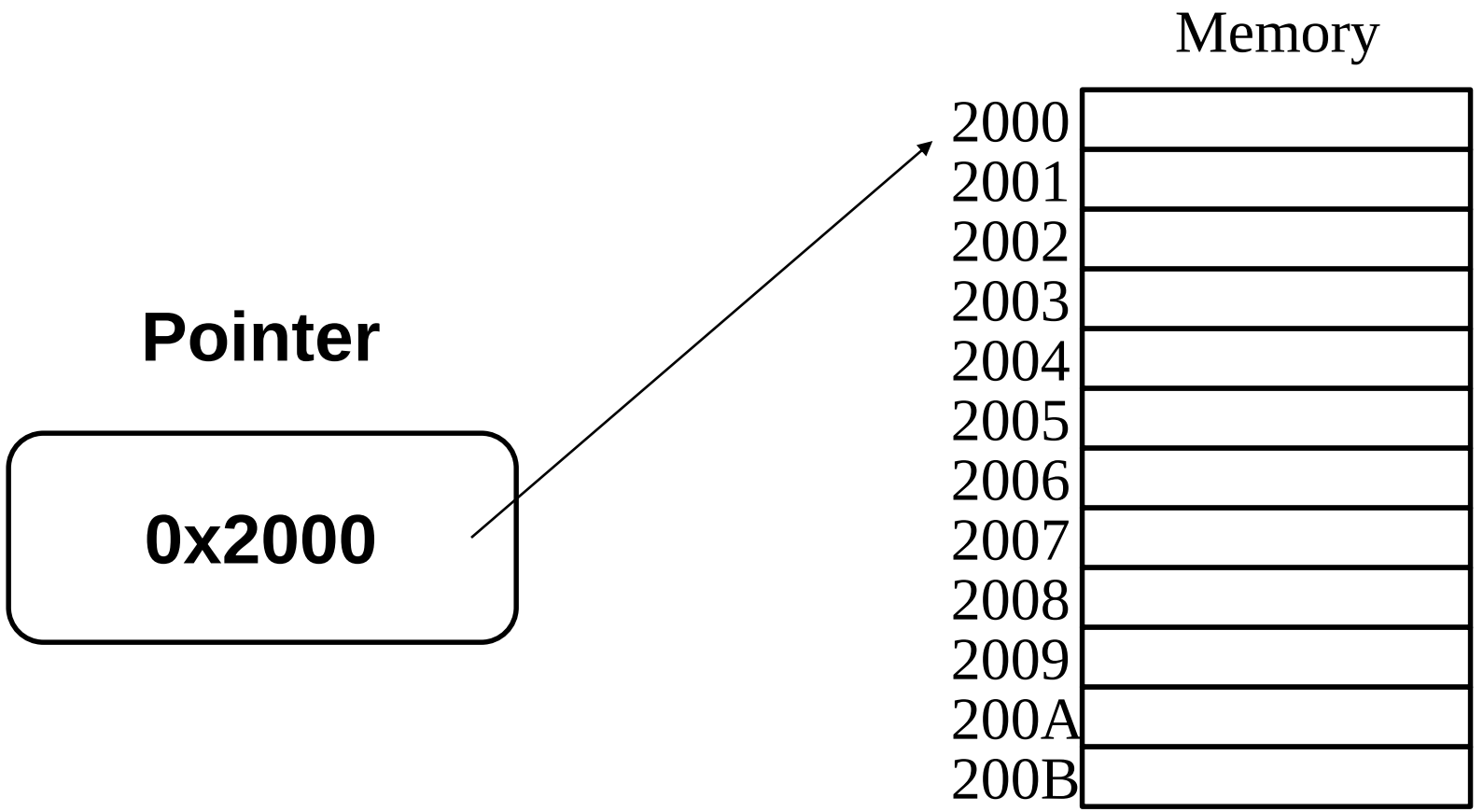
Pointers value are in hexadecimal.

e.g. A pointer “P” has a value of 0x2008 which means it points to this address



Pointer stores address value.

It is used to refer to the data at that address.



Example 2 - Pointer

```
#include <stdio.h>
main() {
    int a[4] = {10,20,30,40};
    int b = 5;

    int *p;
    p = a;
    printf("%d %p\n", *p, p);
    p = &b;
    printf("%d %p\n", *p, p);
}
```

We use * in front of a pointer to look up its data.

Example 3 – Pointer and Array

```
#include <stdio.h>

main() {
    int a[4] = {10,20,30,40};
    int *p;

    p = a;
    printf("%p %d\n", p, *p);
    printf("%d %d %d %d\n",p[0],a[1],2[a],3[p]);
    p = p + 1;
    printf("%p %d\n", p, *p);
    p = &a[3];
    printf("%p %d\n", p, *p);
}
```

Task 1

Use the debugger to evaluate these expressions:

a *a &a
p *p &p

a[0] a[1] a[2] a[3]
p[0] p[1] p[2] p[3]

p+1 p+2 p+3 a+1 a+2 a+3
&a[0] &a[1] &a[2] &a[3]

***(p+1) *p+1**

Example 4

```
#include <stdio.h>

void swap(int x, int y) {
    int temp;

    temp = x;
    x = y;
    y = temp;
}

main() {
    int a = 5, b = 6;

    swap(a, b);
    printf("a = %d, b = %d\n", a, b);  // a = 5, b = 6
}
```

Can the function swap the values of a and b?

To pass a value in and out of a function,

Pass a pointer to the variables instead.

Function definition (accept pointer)

```
void function(int *xx) {
      :
}

main() {
      int x;
      :
      function(&x)
      :
}
```

Declaration (regular variable)

Usage: pass pointer

Example 5

```
#include <stdio.h>

void swap(int *pa, int *pb) {
    int temp;

    temp = *pa;
    *pa = *pb;
    *pb = temp;
}

main() {
    int a = 5, b = 6;

    swap(&a, &b);
    printf("a = %d, b = %d\n", a, b);  // a = 6, b = 5
}
```

Can the function swap the values of a and b?

Task 2

Write down the address for all variables in example 4, 5

Example 4

Variables	Address
a	
b	
x	
y	

Example 5

Variables	Address
a	
b	
pa (value)	
pb (value)	

Try to understand the difference.

Extra Task (submit to LEB2)

From the main() given below, write the function that sort a, b, c from low to high. Do not change anything in main().

```
#include <stdio.h>

// Write your function here

main() {
    int a,b,c;
    scanf("%d %d %d", &a, &b, &c);
    sort(&a, &b, &c);
    printf("%d %d %d\n", a, b, c);
}
```

Hint: Use if() to compare and swap