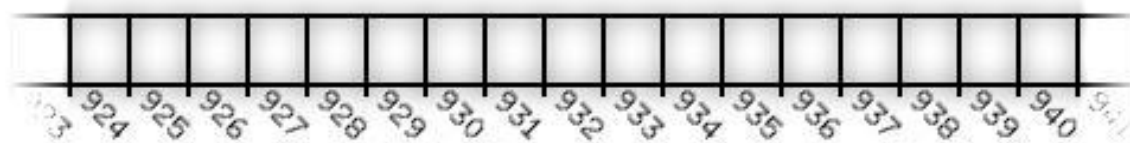# C Programming Introduction

week 11: Pointers

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Memory address

- Computer's memory is made up of bytes. Each byte has a number, an address, associated with it.

- In the picture below, addresses 924 through 940 are shown.

Memory address

- The unary operator **&** gives the address of a variable

```
#include <stdio.h>
int main(){
float fl=3.14;
printf("fl's address=%u\n", (unsigned int) &fl);
return 0;
}
```

Exercise 12.1

- Write a C program to input three integers. Set up a single pointer to point to each of these integers in turn. Display the value dereferencing the pointer.

Exercise 12.2

- Write a program that print out the address (in hexadecimal format) of first 5 elements of the array predefined as below:

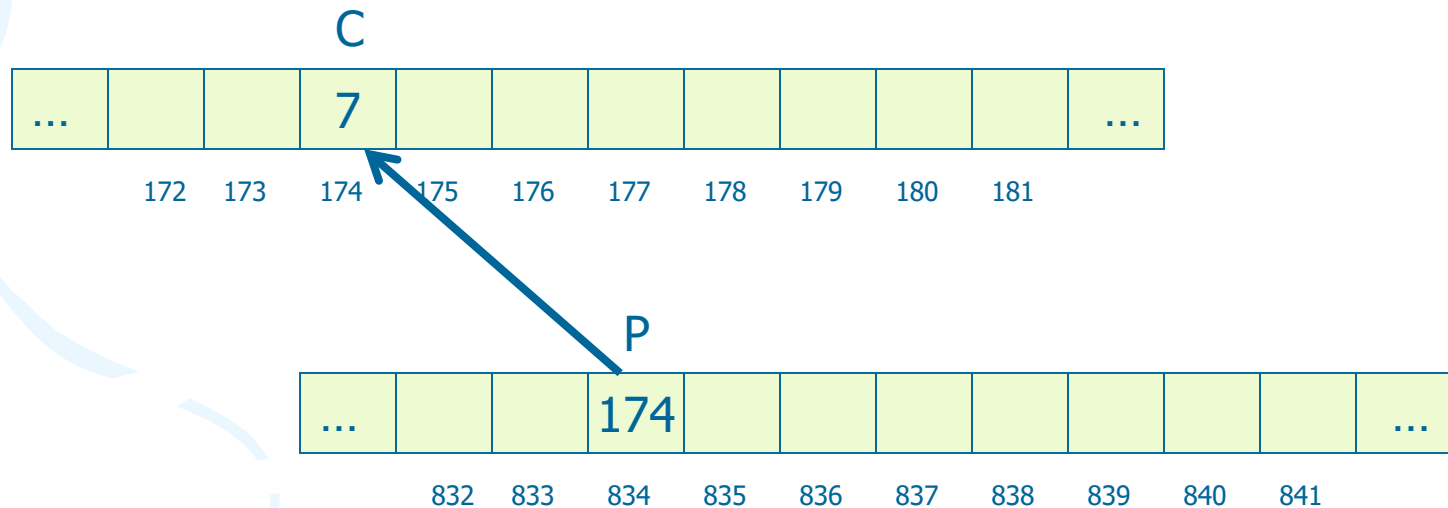 int a[7]= {13, -355, 235, 47, 67, 943, 1222} ;

Declaring a pointer variable

```
type *variable_name;
```

- A pointer is declared by adding a * before the variable name.
- Pointer is a variable that contains an address in memory.
- The address should be the address of a variable or an array that we defined.

Pointers

- Here ptr is said to *point* to the address of variable c

c

...			7								...

172   173   174   175   176   177   178   179   180   181

P

...			174								...

832   833   834   835   836   837   838   839   840   841

Referencing

- The unary operator **&** gives the address of a variable

- The statement: **ptr = &c;**

-     assigns the address of **c** to the pointer variable **ptr**, and now **ptr points to c**
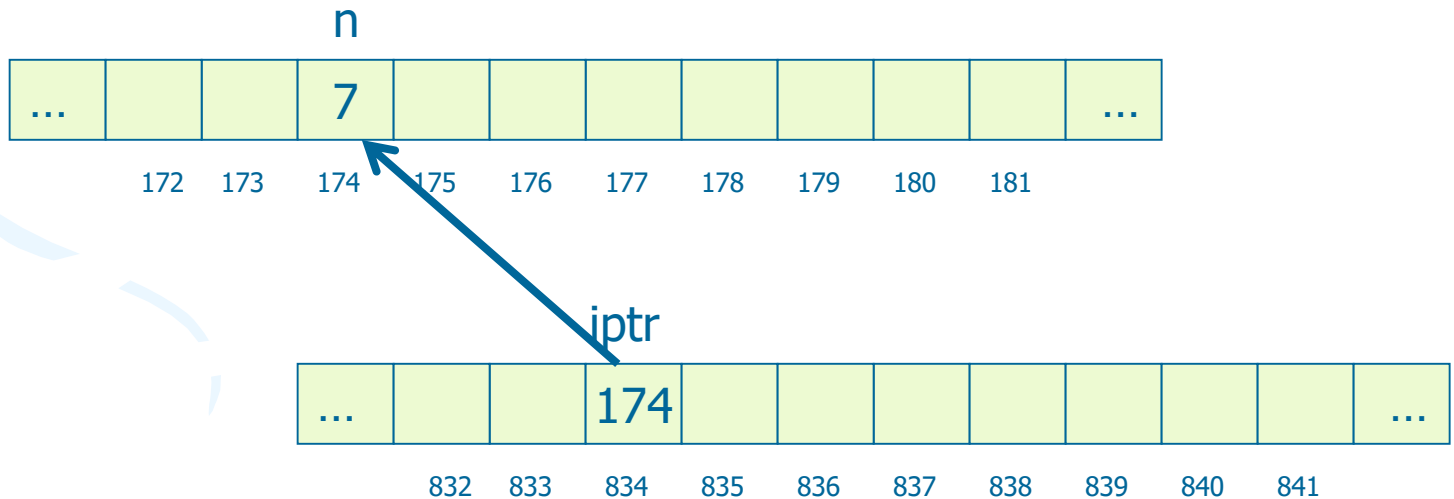
- To print a pointer, use **%p** format.

Referencing

```
int n;
int *iptr;  /* Declare P as a pointer to int */
n = 7;
iptr = &n;
```

Dereferencing

- The unary operator ***** is the dereferencing operator

- Applied on pointers

- Access the object the pointer points to

- The statement: ***iptr = 5;**

  puts in **n** (the variable pointed to by **iptr**) the value 5

Exercise 12.3

- Write a program asking the value from user for 3 float variable a, b, c. Then add 100 to the content of them by using just a pointer.

Pass arguments by value

- The functions we saw until now received their arguments "by value"
- They could manipulate the passed values
- They couldn't change values in the calling function

Wrong Swap

- A swap that gets integers as variables does **_not_** change the value in the original variables.

```
void swap(int x,  int y)
{
    int tmp = x;
    x = y;
    y = tmp;
}
```

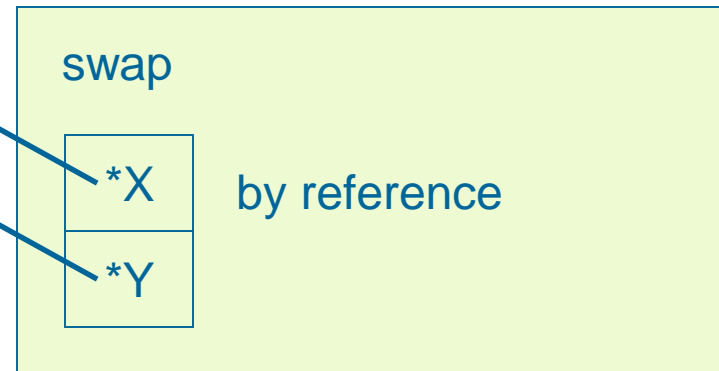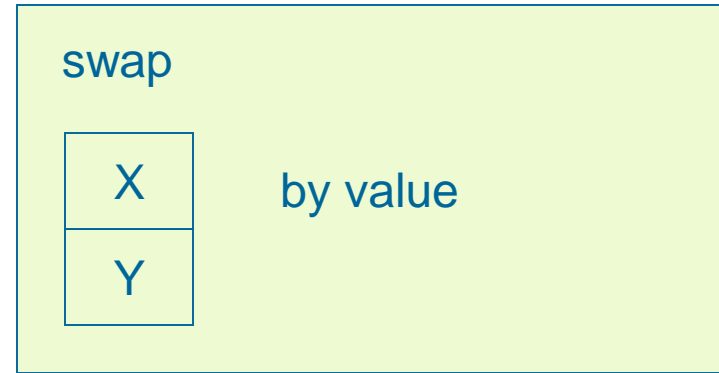# How can we fix it?
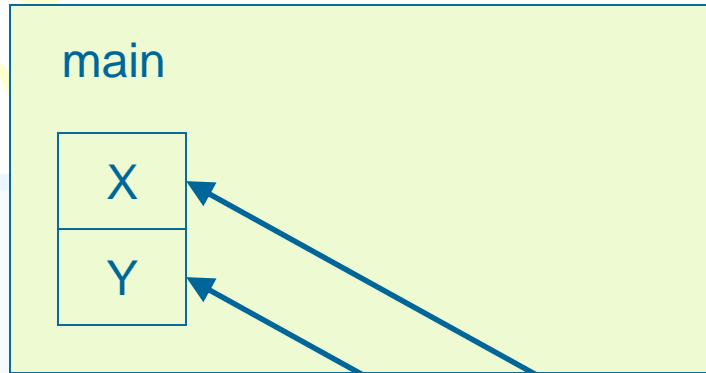
- We can define swap so it gets <u>pointers to</u> integers instead of integers

```
void swap(int *x,  int *y)
{
        int temp = *x;
        *x = *y;
        *y = temp;
}
```

- We then call swap by   `swap(&x, &y);`
- This is pass by reference

Exercise 12.4

- Write a function that takes three variable (a, b, c) in as separate parameters and rotates the values stored so that value a goes to be, b, to c and c to a. Test this function in a program

Exercise 12.5

Introduce **int** variables **x**, **y**, **z** and **int*** pointer variables **p**, **q**, **r**. Set **x**, **y**, **z** to three distinct values. Set **p**, **q**, **r** to the addresses of **x**, **y**, **z** respectively.

1) Print with labels the values of **x**, **y**, **z**, **p**, **q**, **r**, ***p**, ***q**, ***r**.

2) Swapping values of x, y, z. Print with labels the values of **x**, **y**, **z**, **p**, **q**, **r**, ***p**, ***q**, ***r**.

3) Swapping values of p, q, r. Print with labels the values of **x**, **y**, **z**, **p**, **q**, **r**, ***p**, ***q**, ***r**.

Exercises 12.6

- To increase salary for an employee, write a function *incomeplus* that is based on the current salary and the number of years passed from the beginning years (must > 3) of current salary.

- Test it in a program.