C Programming Introduction

week 12: Arrays and Pointers

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For HEDSPI Project

Pointers and Arrays

- Recall that an array **s** holds the address of its first element **s[0]**
- **s** is actually a pointer to **s[0]**

```
int s[10];
int *iptr;
iptr=s; /* From now iptr is equivalent to s  */
```

- Both **iptr** and **s** now point to **s[0]**

Pointer-array equivalence

- Arrays are actually a kind of pointers!
- When an array is defined, a fixed amount of memory (the size of the array) is allocated.
  - The array variable is set to point to the beginning of that memory segment
- When a pointer is declared, it is uninitialized (like a regular variable)
- Unlike pointers, the value of an array variable cannot be changed

Pointer arithmetic

- Pointers can be incremented and decremented
- If **p** is a pointer to a particular type, **p+1** yields the correct address of the next variable of the same type
- **p++**, **p+i**, and **p += i** also make sense

Pointer arithmetic

- If **p** and **q** point to elements in an array, **q-p** yields the number of elements between **p** and **q**.
- However, there is a difference between pointer arithmetic and "regular" arithmetic.

Pointer arithmetic - example

```
int main(void)
{
    int a[3] = {17,289,4913}, *p, *q;

    p = a;   /* p points to the beginning of a, that is &a[0] */
    q = p+2; /* q points to a[2]. Equivalent to q = &a[2]     */

    printf("a is %p\n", a);
    printf("p is %p, q is %p\n", p, q);
    printf("p points to %d and q points to %d\n", *p, *q);
    printf("The pointer distance between p and q is %d\n", q-p);
    printf("The integer distance between p and q is %d\n",
        (int)q-(int)p);
    return 0;
}
```

```
a is 0012FECC
p is 0012FECC, q is 0012FED4
p points to 17 and q points to 4913
The pointer distance between p and q is 2
The integer distance between p and q is 8
```

Passing arrays to function

- Another way to pass arrays to function is using pointer
- In fact, we pass just the array's address, or more precisely a pointer to the array.
- The function calculate the sum of all array elements.

```
#include <stdio.h>
int addNumbers(int *fiveNumber){
  int i,sum=0;
  for(i=0; i<5; i++, fiveNumbers++){
      sum+= *fiveNumbers
  }
  return sum;
}
```

Exercise 12.1

- Write a function countEven(int*, int) which receives an integer array and its size, and returns the number of even numbers in the array.

Exercise 12.2

- Write a function that returns a pointer to the maximum value of an array of double's. If the array is empty, return NULL.

  double* maximum(double* a, int size);

Exercise 12.3

Write a function getSale uses a pointer to accept the address of an array. It asks the user to enter the sales figures and stores those figures in the array.

Write a function totalSale return the total of the element int the array.

Use these two functions in a program to input the sales figure from different quarteurs and display the total. Using pointers instead of array in function's parameters.

Exercise 12.4

- Write a program to list all the sub array of an given array. For example the array 1 3 4 2 has the following sub array:

```
1
1 3
1 3 4
1 3 4 2
3
3 4
3 4 2
4
4 2
2
```

Exercise 12.5

- Write a program to reverse an array in two different ways: using indexes and using pointers.