Topic 8: Function pointer and callback function

Function pointer

- Function pointer: A pointer which direct to the address of a function
- The declaration of function pointer
  - `void (*foo)(int);`
  - `int (*foo)(int, int);`
  - `double (*foo)(int *, int *);`

- The usage
  - To have a prototype first → `void func (int x)`
  - Then assign the pointer by → `foo = func;`

```c
#include <stdio.h>
void func1(int x)
{
    printf ("function 1: %d\n", x );
}

void func2(int x)
{
    printf ("function 2: %d\n", x );
}

int main()
{
    void (*foo)(int);

    foo = func1;
    foo (2); /* calling */

    foo = func2;
    foo (3); /* calling */

return 0;
}
```

Callback function

- The application of function pointer

- Usage:
  - When a function receives a command, you can have a common interface to deal with multiple commands
    - For example, the communication protocol in kernel
    - The packet may be TCP or UDP
    - In the IP layer, there many have a common interface, named

      `segment (control, `**`proto`**`)`

      - where the Proto can be TCP or UDP

```c
#include <stdio.h>

/* calling function with callback declaration
*/
void AddNumbers(int x, int (*ySrc)(int)) {
    int z = ySrc(x);
    printf("result: %d\n", x + z);
}

/* One possible callback. */
int DoubleY(int y) {
    return (2*y);
}

/* Another possible callback. */
int MultiY(int y) {
    return (y*y);
}

int main(void) {
    AddNumbers(30, DoubleY);
    AddNumbers(30, MultiY);
}
```

```c
#include <stdio.h>
#include <stdlib.h>

void f1 (int input)
{
    printf("you entered %d\n", input);
}

void f2 (int input)
{
    printf("here you entered %d\n", input);
}

void f3(int input)
{
    printf("this time you entered %d\n", input);

}
```

```c
int main(void)
{
    int choice;
    void (*func[3])(int) = {f1, f2, f3};

    printf("please choice from 0 to 2: ");
    scanf("%d", &choice);

    func[choice](choice);
}
```

W11- on site assignment

- Use the concept of function pointer and callback to implement a bubble sort program
  - Choose 0 or 1 to sort by increasing or decreasing order
  - No static array is allowed !

```
ryanpan@RyanPanPC /Volumes/MyWorks/D_Data/teaching/111/C/week11$ ./a.out
Please enter (0) increasing or (1) descesing sort: 0
  Please enter a string: sdfkljsdl
    Result: ddfjkllss
Please enter (0) increasing or (1) descesing sort: 1
  Please enter a string: ekwjlfj
    Result: wlkjjfe
Please enter (0) increasing or (1) descesing sort: 
```

W11- on site assignment 2

- Implement a HEX and binary to decimal
  - User input h2B → the result will be 43
  - User input b1011 → the result will be 11

  - Use the concept of callback function to implement