시스템프로그래밍기초 실습

Ch5. Functions

실습 예제 1) Storage class

main.c extern.c static.c

```c
#include <stdio.h>

int a = 1, b = 2;
int c = 3;

int extern_function(void);
int static_function(void);

int main(void)
{
    printf("%3d\n", extern_function()); /* 12 is printed */
    printf("%3d%3d%3d\n", a, b, c);     /* 4 2 3 is printed */
    static_function();
    static_function();          /* Why is it different? */
    return 0;
}
```

실습 예제 1) Storage class
main.c extern.c static.c

```c
int extern_function(void)
{
    extern int a;
    int b, c;

    a = b = c = 4;
    return a + b + c;
}
```

실습 예제 1) Storage class
main.c extern.c static.c

```c
void static_function(void)
{
    static int cnt = 0;
    ++cnt;
    printf("static int cnt is %d.\n", cnt);
}
```

```
#gcc –o storage main.c extern.c static.c
```

실습 예제 2) Large program

pgm.h main.c fct.c wrt.c

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

#define N 3

void fct1(int k);
void fct2(void);
void wrt_info(char*);
```

실습 예제 2) Large program
pgm.h main.c fct.c wrt.c

```c
#include "pgm.h"

int main(void)
{
    char ans;
    int i, n = N;
    printf("%s",
        "This program does not do very mcuh.\n"
        "Do you want more information? ");
    scanf(" %c", &ans);
    if (ans == 'y' || ans == 'Y')
        wrt_info("pgm");
    for (i = 0; i < n; ++i)
        fct1(i);
    printf("Bye!\n");
    return 0;
}
```

실습 예제 2) Large program
pgm.h main.c fct.c wrt.c

```c
#include "pgm.h"

void fct1(int n)
{
    int i;
    printf("Hello from fct1()\n");
    for (i = 0; i < n; ++i)
        fct2();
}

void fct2(void)
{
    printf("Hello from fct2()\n");
}
```

실습 예제 2) Large program
pgm.h main.c fct.c wrt.c

```c
#include "pgm.h"

void wrt_info(char *pgm_name)
{
    printf("Usage: %s\n\n", pgm_name);
    printf("%s\n",
        "This program illustrates how one can write a program\n"
        "in more than one file. In this example, we have a\n"
        "single .h file that gets included at the top of our\n"
        "three .c files. Thus, the .h file acts as the \"glue\"\n"
        "that birds the program together.\n");
}
```

GNU Make – Makefile 작성하기

Target

```
pgm : pgm.h main.o fct.o wrt.o
    gcc -o pgm pgm.h main.o fct.o wrt.o

main.o : main.c
    gcc -c -o main.o main.c

fct.o : fct.c
    gcc -c -o fct.o fct.c

wrt.o : wrt.c
    gcc -c -o wrt.o wrt.c

clean :
    rm *.o pgm
```

Dependency

Command

GNU Make – Makefile 작성하기(매크로 사용)

```
CC = gcc
TARGET = pgm
OBJECTS = pgm.h main.o fct.o wrt.o

$(TARGET) : $(OBJECTS)
	$(CC) -o $@ $^

clean :
	rm *.o pgm
```

Macro

$@ : 현재 타겟의 이름
$^ : 현재 타켓의 의존 리스트

GNU Make – make 명령어

```
#make
#make clean
```

```
inshik@mymmp:~/syspro/pgm$ make
gcc     -c -o main.o main.c
gcc     -c -o fct.o fct.c
gcc     -c -o wrt.o wrt.c
gcc -o pgm pgm.h main.o fct.o wrt.o
inshik@mymmp:~/syspro/pgm$ ls
fct.c  fct.o  main.c  main.o  Makefile  Makefile1  pgm  pgm.h  wrt.c  wrt.o
inshik@mymmp:~/syspro/pgm$ make clean
rm *.o pgm
inshik@mymmp:~/syspro/pgm$ ls
fct.c  main.c  Makefile  Makefile1  pgm.h  wrt.c
inshik@mymmp:~/syspro/pgm$
```

과제 1) Tower of Hanoi

hanoi.h main.c move.c get.c

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

extern int cnt; /* count of the number of moves */

int get_n_from_user(void);
void move(int n, char a, char b, char c);
```

과제 1) Tower of Hanoi
hanoi.h main.c move.c get.c

```c
#include "hanoi.h"

int cnt = 0;

int main(void)
{
    int n;
    n = get_n_from_user();
    assert(n > 0);
    /*
    // Move n disks from tower A to tower C,
    // using tower B as an intermediate tower.
    */
    move(n, 'A', 'B', 'C'); /* recursive fct */
    return 0;
}
```

과제 1) Tower of Hanoi
hanoi.h main.c move.c get.c

```c
#include "hanoi.h"

void move(int n, char a, char b, char c)
{
    if (n == 1) {
        ++cnt;
        printf("%5d: %s%d%s%c%s%c.\n", cnt,
            "Move disk ", 1, " from tower ", a, " to tower ", c);
    }
    else {
        move(n - 1, a, c, b);
        ++cnt;
        printf("%5d: %s%d%s%c%s%c.\n", cnt,
            "Move disk ", n, " from tower ", a, " to tower ", c);
        move(n - 1, b, a, c);
    }
}
```

과제 1) Tower of Hanoi
hanoi.h main.c move.c get.c

```c
#include "hanoi.h"

int get_n_from_user(void)
{
    int n;
    printf("%s",
        "---\n"
        "TOWER OF HANOI:\n"
        "\n"
        "Input n: ");
    if (scanf("%d", &n) != 1 || n < 1) {
        printf("\nERROR: Positive integer not found - bye!\n\n");
        exit(1);
    }
    printf("\n");
    return n;
}
```

과제 검사방법

예제 1) Storage class

1. 코드 실행시키기
2. 출력에 대한 질문에 구두로 답하기

예제 2) Large Program

1. make 명령어로 코드 실행시키기

과제 1) Tower of Hanoi

1. make 명령어로 코드 실행시키기
2. 작성한 Makefile 검사받기(Makefile은 매크로 사용하여 작성)