C Programming Language

(10th class)

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Today …

- **Review Structure**

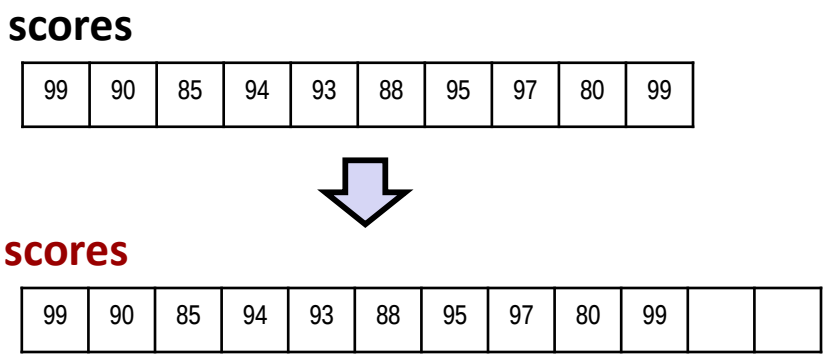
Dynamic Memory Allocation

- **#include<stdlib.h>**
  - void *malloc(int size);
  - void *calloc(int count, int unit_size);
  - void *realloc(void* ptr, int size);
  - void *free(void *ptr);

```
int scores[10];
```

```
int num = 10;
int *scores = malloc(num*sizeof(int));
/* int *scores = calloc(num, sizeof(int)); */
…
/* I want to add two new students */
scores = realloc(scores, (num+2)*sizeof(int));

/* the memory space is released */
free(scores);
```



Struct

- A data structure that combines data items of different kinds

```
struct mystruct{
   char[10] name;
   int id;
   int scores[3];
} student;
```

```
struct mystruct{
   char[10] name;
   int id;
   int scores[3];
} ;
…
struct mystruct student;
```

```
typedef struct {
   char[10] name;
   int id;
   int scores[3];
} Mystruct ;
…
Mystruct student;
```

- How to initialize each piece of data in the struct?

```
Mystruct student = {“Albert”, 20170000, {100, 100, 100}}
```

```
Mystruct student;
strcpy(student.name, “Albert”);
student.id = 20170000;
student.scores[0] = 100;
student.scores[1] = 100;
student.scores[2] = 100;
```

Struct

```
typedef struct mystruct{
  char* name;
   int id;
   int scores[3];
} Mystruct;

Mystruct student;
student.name = “Albert”;
student.id = 20170000;
student.scores[0] = 100;
student.scores[1] = 100;
student.scores[2] = 100;
```

Struct

```
typedef struct mystruct{
   char* name;
   int id;
   int scores[3];
} Mystruct;

void main() {
   Mystruct student;
   student.name = “Albert”;
   student.id = 20170000;
   student.scores[0] = 100;
   student.scores[1] = 100;
   student.scores[2] = 100;
   …
}
```

```
struct score{
   int math;
   int physics;
   int English;
   double average;
};

typedef struct mystruct{
   char* name;
   int id;
   struct score myScore;
} Mystruct;

void main() {
   Mystruct student;
   student.name = “Albert”;
   student.id = 20170000;
   student.myScore.math = 100;
   student.myScore.physics = 100;
   student.myScore.English = 100;
   ….
}
```

Today’s program

- **Let us write a C program for the library**
  - 도서관을 위한 C 프로그램을 작성한다
- **In the program, information of each book (1. book title, 2. name of author, 3. volumes (# of books)) should be managed using struct**
  - 구조체를 사용하여 각각의 책의 정보(도서 이름, 저자 이름, 권수) 를 관리한다.
- **struct variables are stored using linked lists.**
  - 각각의 구조체는 linked list로 연결되어 관리된다.

Today’s program

- **First of all, your program is suppose to show the user the menu**
  - 메뉴를 사용자에게 보여준다. (아래 그림과 같이..)
- **Get an integer from the user**
  - 메뉴(정수) 를 사용자로부터 입력받는다.

```
dhkim@Eins:~/lecture/cProgramming/structure$ ./lib
1. Add a new Book
2. Dispaly all the books in the library of a particular author
3. Dispaly the total number of books in the library
4. Borrow a book
0. Quit program

--> Choose a menu in the list:
```

Today's program

- **Your program is supposed to provide the following services**

  - 프로그램은 다음과 사용자의 입력에 따라 같은 서비스(메뉴)를 제공해야 한다.

  - **Add a book to the library**

    - 책을 도서관에 추가한다. (새 책일수도 있고 이미 등록되어 있는 책일수도 있음)

  - **Display all books in the library of a particular author**

    - 특정 저자 이름 입력시 도서관에서 보관하고 있는 해당 저자의 책 정보들을 화면에 보여준다.

  - **Display the total number of books in the library**

    - 도서관에서 보관하고 있는 책들의 총 수를 화면에 보여준다.

  - **Borrow a book (decrease the number of book by 1)**

    - 책을 빌리고자 할때 해당 책이 존재할 경우 권수를 하나 줄이고,
    - 책이 등록되어 있지 않을 경우 경우 존재하지 않음을,
    - 책이 등록은 되어 있으나 모든 책이 대출중 일경우, 남은 책이 없음을 화면에 출력한다.

Add a book to the library

- **Get the book title from the user**
  - 도서 이름을 입력받는다.

- **If the book is already in the library, increase the number of volume**
  - 입력받은 도서가 이미 도서관에 등록되어 있으면, 해당 도서의 권수를 하나 증가한다.

```
1. Add a new Book
2. Dispaly all the books in the library of a particular author
3. Dispaly the total number of books in the library
4. Borrow a book
0. Quit program

--> Choose a menu in the list: 1


Input Book title: JAVA_Programming

Input Author: Kim




================================================
The book entitled "JAVA_Programming" is added to the library
================================================
```

- **Otherwise, 1) get the author's name and 2) create a new linked list element (struct) containing the book title, author name, and volumes (1) 3) add it to the linked list**
  - 도서가 등록되어 있지 않을 경우, 나머지 정보 (저자 이름) 을 입력받아 구조체를 만들고, linked list에 추가한다.

Display all books in the library of a particular author

- **Get the author name from the user**
  - 저자의 이름을 입력받는다

- **Display information of all books written by the author**
  - 저자가 쓴 모든 책의 정보를 화면에 출력한다.

```
1. Add a new Book
2. Dispaly all the books in the library of a particular author
3. Dispaly the total number of books in the library
4. Borrow a book
0. Quit program

--> Choose a menu in the list: 2


Input Author: Kim


================================================
Book title: cProgramming
Author information: Kim
Number of books in the library: 1
================================================


================================================
Book title: JAVA_Programming
Author information: Kim
Number of books in the library: 1
================================================
```

Display the total number of books in the library

- **Show the total number of books stored in the library**
  - 현재 도서관에 있는 책 (빌려준 책 빼고) 의 권수를 화면에 출력한다.

```
1. Add a new Book
2. Dispaly all the books in the library of a particular author
3. Dispaly the total number of books in the library
4. Borrow a book
0. Quit program

--> Choose a menu in the list: 3



==============================================
total number of books in the library: 2
==============================================
```

Borrow a book

- **Borrow a book (decrease the number of book by 1)**

```
1. Add a new Book
2. Dispaly all the books in the library of a particular author
3. Dispaly the total number of books in the library
4. Borrow a book
0. Quit program

--> Choose a menu in the list: 4


Input Book title: Python


================================================
The book that you have requested is not currently available
================================================
```

```
1. Add a new Book
2. Dispaly all the books in the library of a particular author
3. Dispaly the total number of books in the library
4. Borrow a book
0. Quit program

--> Choose a menu in the list: 4


Input Book title: cProgramming


============================================================
You should return the book within next 30 days. Here it is.
============================================================


1. Add a new Book
2. Dispaly all the books in the library of a particular author
3. Dispaly the total number of books in the library
4. Borrow a book
0. Quit program

--> Choose a menu in the list: 4


Input Book title: cProgramming


============================================================
Oops! Sorry. All books in the library are currently on loan.
============================================================
```

Main

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

struct book {
    ....
};

Struct book* library = NULL;  /* global variable */

...
```

```c
void main(){

  int menu;

  while(1){
    printf("1. Add a new Book\n");
    printf("2. Dispaly all the books in the library of a particular author\n");
    printf("3. Dispaly the total number of books in the library\n");
    printf("4. Borrow a book\n");
    printf("0. Quit program\n\n");
    printf("--> Choose a menu in the list: ");
    scanf("%d", &menu);

    switch(menu){
      case 0:
        return;
      case 1:
        addBook();
        break;
      case 2:
        bookbyAuthor();
        break;
      case 3:
        countBooks();
        break;
      case 4:
        borrowBook();
        break;
      default:
        printf("You have input a wrong number\n");
        continue;
    }
  }
}
```

Q and A