

## 1. 과제 개요

답안과 학생의 제출물이 주어지면 자동으로 채점하여 각 학생의 총점과 문제별 점수를 CSV 파일로 저장하는 프로그램이다. 제출물은 빈칸 채우기와 프로그램 작성 문제로 구성된다. 빈칸 채우기는 구문 분석을 통하여 중복 답안을 채점하며, 프로그램 작성 문제는 제출물과 답안을 컴파일한 후 출력 결과를 비교하여 정답 여부를 결정한다.

## 2. 기능

### 2-1. 빈칸 채우기 문제 채점

정답 파일의 txt는 콜론(:)으로 구분되어 복수의 답안을 처리할 수 있다. 답안 두 개가 주어지면, 문자열로는 다른 답안이더라도 구문 분석을 통해 같은 수식인지 아닌지 판단한다.

### 2-2. 프로그램 작성 문제 채점

정답 프로그램과 학생 프로그램을 컴파일한 후 직접 실행하고 표준 출력을 비교하는 형태로 진행된다. 표준 출력에서 공백, 대소문자는 무시하여 비교한다.

### 2-3. 점수 테이블 및 채점 결과 테이블 관리 (초기 실행, -n, -m 인자)

채점 결과는 score.csv, 채점 결과는 score\_table.csv에 저장된다. 초기 실행 시 score\_table.csv가 없으면 자동으로 생성하며 문제별 배점을 지정할 수 있다. 한편, -n 인자는 기본적으로 <ANS\_DIR>/score.csv로 지정되는 채점 결과 파일의 위치를 변경할 수 있으며, -m 인자는 이미 저장된 score\_table.csv에서 문제별 배점을 변경할 수 있다.

### 2-4. 학생별 정보 출력 (-p, -c 인자)

-p 인자는 학생마다 틀린 문제의 목록과 배점을 출력하며, -c 인자는 각 학생이 받은 점수를 출력한다. 해당 인자들은 동시에 사용될 수 있다.

### 2-5. 컴파일 시 -lpthread 옵션 추가 (-t 인자)

-t 인자로 들어오는 문제의 프로그램은 컴파일 시 -lpthread 옵션과 함께 진행된다.

### 2-6. 채점 결과 정렬 (-s 인자)

-s 인자는 -s <stdid | score> <1 | -1> 의 형식을 요구한다. stdid는 학번이며, score은 각 학생의 점수이다. 또한, 1은 오름차순, -1은 내림차순을 의미한다. 프로그램은 이 정보를 바탕으로 score.csv 파일을 정렬하여 저장한다.

### 2-7. 컴파일 에러 및 경고 관리 (-e 인자)

프로그램 작성 문제에서 학생이 제출한 답안을 컴파일할 때 발생하는 warning이나 error를 지정된 경로의 학생별 폴더에 각각 저장시키는 인자이다.

### 2-8. 도움말 출력 (-h 인자)

프로그램의 도움말을 출력한다.

### 3. 설계

프로그램은 하나의 파일에 대개 함수의 실제 실행 순서와 맞도록 함수들이 정의된 형태를 가진다. 프로그램의 시작 부분(entry point)은 main.c의 main 함수가 ssu\_score.c의 함수(ssu\_score)를 호출하는 것으로 진행된다. 또한, 수식 비교를 위해 ssu\_score.c에서는 blank.c의 함수를 호출한다. ssu\_score의 함수가 종료되면 main 함수에서는 프로그램의 수행 시간을 출력하고 종료한다.

#### 3-1. 파일(모듈) 전체 목록

프로젝트의 파일(모듈) 구성은 하기와 같으며, 모두 프로젝트 루트 폴더 아래에 있다.

blank.{c, h}  
linked\_list.{c, h}  
main.c  
Makefile  
ssu\_score.{c, h}

#### 3-2. 소스코드별 함수 개요

순서도에 표시되는 주요 함수만 작성하였다.

##### 3-2-1. main.c

프로그램의 진입점이다.

##### 3-2-1-1. int main(int argc, char \*argv[])

시간 측정을 위한 작업을 진행한 후, ssu\_score 함수를 실행시켜 실제 프로그램을 동작시킨다.

##### 3-2-1-2. void ssu\_runtime(struct timeval \*begin\_t, struct timeval \*end\_t)

프로그램의 시작, 종료 시간을 받아 프로그램의 실행 시간을 출력한다.

##### 3-2-2. ssu\_score.c

실제 프로그램의 로직이 작성된 소스 파일이다.

##### 3-2-2-1. void ssu\_score(int argc, char \*argv[])

main 함수로부터 호출되어 시작되는 진입점이다. 명령어 인자 확인, 점수 파일 작성, 채점의 기능(함수)를 순서대로 실행시킨다.

##### 3-2-2-2. int check\_option(int argc, char \*argv[])

argv로부터 명령어 인자 확인을 진행한다.

##### 3-2-2-3. void set\_scoreTable(char \*ansDir)

score\_table.csv에 관련된 초기 작업을 진행한다.

##### 3-2-2-4. void set\_idTable(char \*stuDir)

STU\_DIR/로부터 학번을 배열에 하나씩 저장한다.

##### 3-2-2-5. void score\_students()

모든 학생에 대해 채점을 진행한 후, 그 결과를 정리한 후 score.csv에 저장하는 함수이다.

##### 3-2-2-6. double score\_student(int fd, char \*id)

fd는 더이상 사용되지 않는다. (기존에는 파일에 결과를 즉시 작성하기 위해 사용되었다.), id는 학번을 의미한다. 해당 학생의 모든 제출물에 대해 채점을 진행한 후, 총점을 리턴한다.

##### 3-2-2-7. int score\_blank(char \*id, char \*filename)

빈칸 문제를 채점하는 함수이다. 내부적으로 blank.c에 구현된 구문 분석(make\_tokens, make\_tree 함수) 관련 함수를 사용하여 중복 답안을 처리한다.

##### 3-2-2-8. double score\_program(char \*id, char \*filename)

프로그램 문제를 채점하는 함수이다. 내부적으로 compile\_program과 execute\_program 함수를 순차적으로 호출한다.

##### 3-2-2-9. double compile\_program(char \*id, char \*filename)

프로그램을 컴파일한다. 이 과정에서 발생하는 warning과 error는 -e 옵션이 있다면 별도로 저장하며, warning과 error에 따라서 0점 처리, 감점 등을 진행하고 실행 파일을 만든다.

### 3-2-2-10. int execute\_program(char \*id, char \*filename)

프로그램을 실행하여 출력 결과를 만들고, 실행한 두 프로그램의 출력 결과를 compare\_resultfile 함수를 사용하여 비교한다.

### 3-2-2-11. int compare\_resultfile(char \*file1, char \*file2)

공백은 무시하며 알파벳은 소문자로 바꾸어 두 파일의 내용을 비교한다.

### 3-2-2-12. void redirection(char \*command, int new, int old)

system 함수로 command를 실행할 때, 특정 파일 디스크립터(주로 표준 출력이나 표준 에러)로 들어오는 출력 값을 별도로 받기 위한 함수이다.

### 3-2-2-13. void rmdir(const char \*path)

해당 경로 아래에 있는 파일과 디렉터리를 재귀적으로 삭제한다. -e 옵션과 함께 들어오는 에러 폴더의 삭제에 쓰인다.

### 3-2-2-13. void to\_lower\_case(char \*c)

해당 문자가 대문자라면 소문자로 변경한다.

## 3-2-3. linked\_list.c

### 3-2-3-1. struct Node\_wrong\_problems \*create\_linked\_list\_wrong\_problems\_node(char \*str)

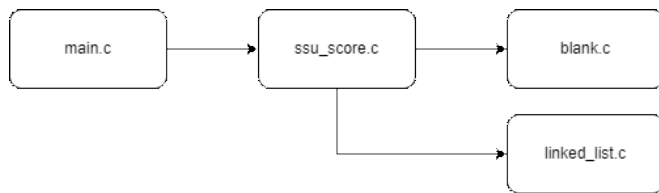
틀린 문제의 정보를 담는 연결 리스트 노드를 동적 할당하여 생성한다.

### 3-2-3-2. struct Node\_sort \*create\_linked\_list\_sort\_node()

각 학생의 채점 정보를 담는 연결 리스트 노드를 동적 할당하여 생성한다.

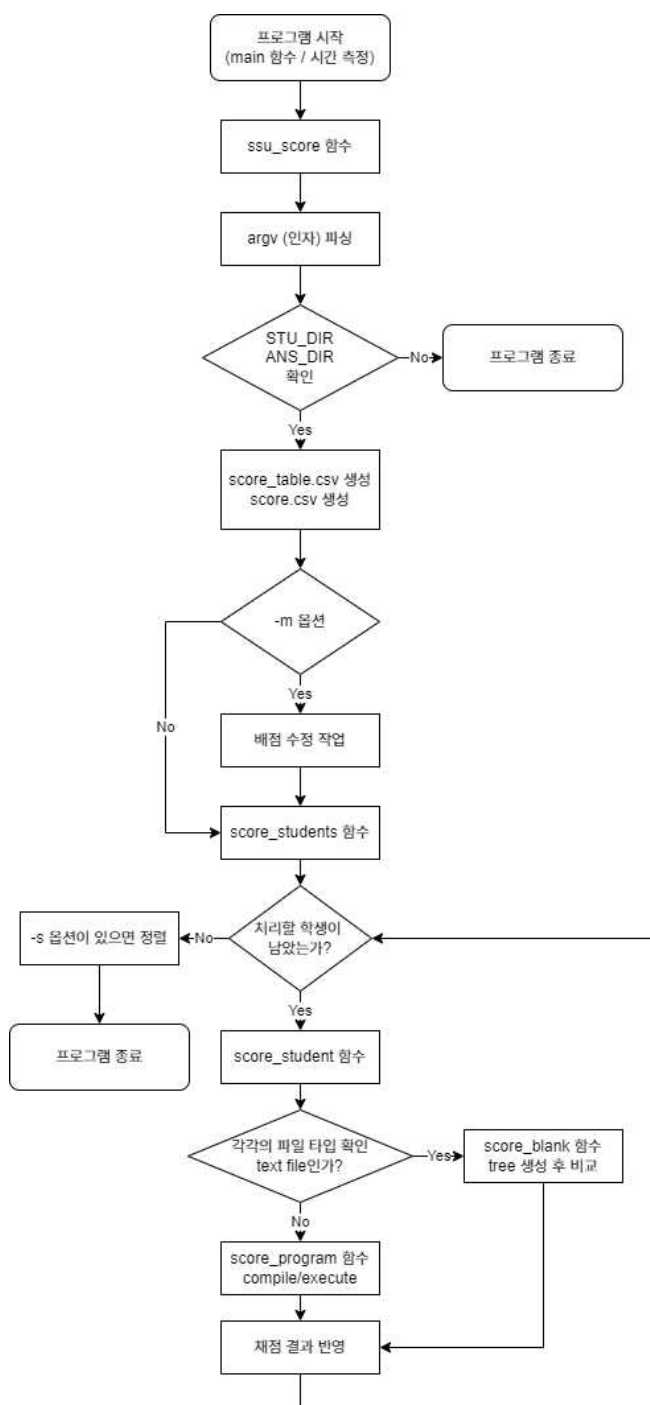
### 3-3. 종속성(dependency) 그래프

각 모듈(source, header file)이 어떤 모듈에 의존하는지 나타냈다. 작성된 Makefile의 종속성도 아래와 같으므로 Makefile의 종속성에 대한 내용은 생략한다.



### 3-4. 순서도

프로그램의 순서도이다. 명령어 인자 추가로 인하여 전체 프로그램의 순서도는 크게 변하지 않으므로 각각의 인자에 대한 구체적인 순서도는 생략한다.



```
nlog@nlog-vm-lsp:~/p2$ ls a
ls: cannot access 'a': No such file or directory
nlog@nlog-vm-lsp:~/p2$ ./ssu_score a ANS_DIR/
a doesn't exist
Runtime: 0:0000065(sec:usec)
nlog@nlog-vm-lsp:~/p2$
```

## 4-2. score\_table.csv 기본 배점 설정 (자동 생성 시)

### 4-2-1. 점수 일괄 등록

```
nlog@nlog-vm-lsp:~/p2$ ./ssu_score STD_DIR/ ANS_DIR/
score_table.csv file doesn't exist in "/home/nlog/p2/ANS_DIR"!
1. input blank question and program question's score. ex) 0.5 1
2. input all question's score. ex) Input data of 1-1: 0.1
select type >> 1
Input data of blank question : 0.5
Input data of program question : 1
grading student's test papers..
20200001 is finished..
20200002 is finished..
```

### 4-2-2. 문제별 점수 등록

```
nlog@nlog-vm-lsp:~/p2$ ./ssu_score STD_DIR/ ANS_DIR/
score_table.csv file doesn't exist in "/home/nlog/p2/ANS_DIR"!
1. input blank question and program question's score. ex) 0.5 1
2. input all question's score. ex) Input data of 1-1: 0.1
select type >> 2
Input of 1-1.txt: 1
Input of 1-2.txt: 1
Input of 2-1.txt: 1
Input of 2-2.txt: 1
Input of 3-1.txt: 1
Input of 4-1.txt: 1
Input of 5-1.txt: 1
Input of 6-1.txt: 1
Input of 6-2.txt: 1
Input of 7-1.txt: 1
Input of 7-2.txt: 1
Input of 7-3.txt: 1
```

(이하 생략)

## 4-3. -n 옵션

### 4-3-1. 절대 경로

```
nlog@nlog-vm-lsp:~/p2$ ./ssu_score STD_DIR/ ANS_DIR/ -n /home/nlog/p2/test.csv
grading student's test papers..
20200001 is finished..
20200002 is finished..
20200003 is finished..
20200004 is finished..
20200005 is finished..
20200006 is finished..
20200007 is finished..
20200008 is finished..
20200009 is finished..
20200010 is finished..
result saved.. (/home/nlog/p2/test.csv)
Runtime: 87:551761(sec:usec)
nlog@nlog-vm-lsp:~/p2$
```

### 4-3-2. 상대 경로

```
nlog@nlog-vm-lsp:~/p2$ ./ssu_score STD_DIR/ ANS_DIR/ -n ./test.csv
grading student's test papers..
20200001 is finished..
20200002 is finished..
20200003 is finished..
20200004 is finished..
20200005 is finished..
20200006 is finished..
20200007 is finished..
20200008 is finished..
20200009 is finished..
20200010 is finished..
result saved.. (/home/nlog/p2/test.csv)
Runtime: 87:243611(sec:usec)
nlog@nlog-vm-lsp:~/p2$
```

#### 4-3-3. 확장자가 .csv가 아닌 경우

```
nlog@nlog-vm-lsp:~/p2$ ./ssu_score STD_DIR/ ANS_DIR/ -n ./test.csv1
given score path(./test.csv1) is not 'csv' extension
nlog@nlog-vm-lsp:~/p2$ |
```

#### 4-3-4. overwrite file

```
nlog@nlog-vm-lsp:~/p2$ echo 123,123 > test.csv
nlog@nlog-vm-lsp:~/p2$ ./ssu_score STD_DIR/ ANS_DIR/ -n ./test.csv
grading student's test papers..
20200001 is finished..
20200002 is finished..
20200003 is finished..
20200004 is finished..
20200005 is finished..
20200006 is finished..
20200007 is finished..
20200008 is finished..
20200009 is finished..
20200010 is finished..
result saved.. (/home/nlog/p2/test.csv)
Runtime: 87:768967(sec:usec)
nlog@nlog-vm-lsp:~/p2$ cat test.csv
,1-1.txt,1-2.txt,2-1.txt,2-2.txt,3-1.txt,4-1.txt,5-1.txt,6-1.txt,6-2
,7-7.txt,8-1.txt,8-2.txt,8-3.txt,8-4.txt,8-5.txt,8-6.txt,8-7.txt,8-8
xt,10-3.txt,10-4.txt,11-1.txt,11-2.txt,11-3.txt,11-4.txt,11-5.txt,11
13-3.txt,13-4.txt,13-5.txt,14-1.txt,14-2.txt,14-3.txt,15-1.txt,15-2.
```

(이하 생략)

#### 4-4. -m 옵션

##### 4-4-1. 배점 수정 기능

```
nlog@nlog-vm-lsp:~/p2$ ./ssu_score STD_DIR/ ANS_DIR/ -m
Input question's number to modify >> 1-1
Current score : 1.00
New score : 2
Input question's number to modify >> no
grading student's test papers..
20200001 is finished..
20200002 is finished..
20200003 is finished..
20200004 is finished..
20200005 is finished..
20200006 is finished..
20200007 is finished..
20200008 is finished..
20200009 is finished..
20200010 is finished..
result saved.. (/home/nlog/p2/ANS_DIR/score.csv)
Runtime: 91:066540(sec:usec)
nlog@nlog-vm-lsp:~/p2$ |
```

##### 4-4-2. 점수 테이블 파일이 존재하지 않는 경우

```
nlog@nlog-vm-lsp:~/p2$ rm ANS_DIR/score_table.csv
nlog@nlog-vm-lsp:~/p2$ ./ssu_score STD_DIR/ ANS_DIR/ -m
given -m option, but doesn't exist score table file.
nlog@nlog-vm-lsp:~/p2$ |
```



#### 4-5. -c 옵션

##### 4-5-1. 가변인자 입력

```
nlog@nlog-vm-lsp:~/p2$ ./ssu_score STD_DIR/ ANS_DIR/ -c 20200001 20200005
grading student's test papers..
20200001 is finished.. score : 65.00
20200002 is finished..
20200003 is finished..
20200004 is finished..
20200005 is finished.. score : 67.00
20200006 is finished..
20200007 is finished..
20200008 is finished..
20200009 is finished..
20200010 is finished..
Total average : 66.00
result saved.. (/home/nlog/p2/ANS_DIR/score.csv)
Runtime: 87:033878(sec:usec)
nlog@nlog-vm-lsp:~/p2$ |
```

##### 4-5-2. 가변인자 미입력

```
nlog@nlog-vm-lsp:~/p2$ ./ssu_score STD_DIR/ ANS_DIR/ -c
grading student's test papers..
20200001 is finished.. score : 65.00
20200002 is finished.. score : 65.00
20200003 is finished.. score : 63.00
20200004 is finished.. score : 64.00
20200005 is finished.. score : 68.00
20200006 is finished.. score : 73.00
20200007 is finished.. score : 76.00
20200008 is finished.. score : 75.00
20200009 is finished.. score : 75.00
20200010 is finished.. score : 70.00
Total average : 69.40
result saved.. (/home/nlog/p2/ANS_DIR/score.csv)
Runtime: 86:842970(sec:usec)
nlog@nlog-vm-lsp:~/p2$ |
```

##### 4-5-3. 가변인자 개수 초과

```
nlog@nlog-vm-lsp:~/p2$ ./ssu_score STD_DIR/ ANS_DIR/ -c 20200001 20200005 20200006 20200007 20200008 20200009 20200010
Maximum Number of Argument Exceeded. :: 20200009 20200010
grading student's test papers..
20200001 is finished.. score : 66.00
20200002 is finished..
20200003 is finished..
20200004 is finished..
20200005 is finished.. score : 67.00
20200006 is finished.. score : 73.00
20200007 is finished.. score : 76.00
20200008 is finished.. score : 76.00
20200009 is finished..
20200010 is finished..
Total average : 71.60
result saved.. (/home/nlog/p2/ANS_DIR/score.csv)
Runtime: 86:385999(sec:usec)
nlog@nlog-vm-lsp:~/p2$ |
```

##### 4-5-4. 없는 학생 입력

```
nlog@nlog-vm-lsp:~/p2$ ./ssu_score STD_DIR/ ANS_DIR/ -c 20200000
20200000 doesn't exist in STD_DIR/.
nlog@nlog-vm-lsp:~/p2$ |
```



#### 4-6. -p 옵션

##### 4-6-1. 가변인자 입력

```
nlog@nlog-vm-lsp:~/p2$ ./ssu_score STD_DIR/ ANS_DIR/ -p 20200001 20200005
grading student's test papers..
20200001 is finished.. wrong problem : 2-1.txt(1), 3-1.txt(1), 7-5.txt(1), 9-2.txt(1), 10-4.txt(1), 11-5.txt(1), 13-3.txt(1), 13-4.txt(1), 16-1.txt(1), 17-1.txt(1), 19-3.txt(1), 19-5.txt(1), 20.c(1), 23.c(1)
20200002 is finished..
20200003 is finished..
20200004 is finished..
20200005 is finished.. wrong problem : 7-1.txt(1), 7-2.txt(1), 7-3.txt(1), 9-3.txt(1), 11-1.txt(1), 11-2.txt(1), 13-1.txt(1), 17-5.txt(1), 18-1.txt(1), 19-2.txt(1), 22.c(1), 23.c(1), 25.c(1)
20200006 is finished..
20200007 is finished..
20200008 is finished..
20200009 is finished..
20200010 is finished..
result saved.. (/home/nlog/p2/ANS_DIR/score.csv)
Runtime: 87:386141(sec:usec)
nlog@nlog-vm-lsp:~/p2$
```

##### 4-6-2. 가변인자 미입력

```
nlog@nlog-vm-lsp:~/p2$ ./ssu_score STD_DIR/ ANS_DIR/ -p
grading student's test papers..
20200001 is finished.. wrong problem : 2-1.txt(1), 3-1.txt(1), 7-5.txt(1), 9-2.txt(1), 10-4.txt(1), 11-5.txt(1), 13-3.txt(1), 13-4.txt(1), 16-1.txt(1), 17-1.txt(1), 19-3.txt(1), 19-5.txt(1), 20.c(1), 23.c(1)
20200002 is finished.. wrong problem : 1-1.txt(1), 3-1.txt(1), 7-5.txt(1), 9-1.txt(1), 11-5.txt(1), 11-6.txt(1), 14-2.txt(1), 16-1.txt(1), 17-3.txt(1), 18-3.txt(1), 19-2.txt(1), 19-3.txt(1), 22.c(1), 23.c(1), 24.c(1)
20200003 is finished.. wrong problem : 1-1.txt(1), 1-2.txt(1), 5-1.txt(1), 6-1.txt(1), 7-1.txt(1), 8-1.txt(1), 8-4.txt(1), 10-4.txt(1), 11-6.txt(1), 13-4.txt(1), 13-5.txt(1), 15-1.txt(1), 15-3.txt(1), 16-3.txt(1), 19-1.txt(1), 19-5.txt(1), 22.c(1), 25.c(1)
20200004 is finished.. wrong problem : 1-1.txt(1), 2-1.txt(1), 6-1.txt(1), 9-1.txt(1), 9-2.txt(1), 11-1.txt(1), 11-3.txt(1), 11-6.txt(1), 13-2.txt(1), 13-4.txt(1), 15-1.txt(1), 16-1.txt(1), 19-4.txt(1), 27.c(1), 28.c(1)
20200005 is finished.. wrong problem : 7-1.txt(1), 7-2.txt(1), 7-3.txt(1), 9-3.txt(1), 11-1.txt(1), 11-2.txt(1), 13-1.txt(1), 17-5.txt(1), 18-1.txt(1), 19-2.txt(1), 22.c(1), 23.c(1), 25.c(1)
20200006 is finished.. wrong problem : 8-1.txt(1), 9-1.txt(1), 11-6.txt(1), 13-3.txt(1), 13-4.txt(1), 15-1.txt(1), 17-1.txt(1), 22.c(1)
20200007 is finished.. wrong problem : 1-2.txt(1), 5-1.txt(1), 29.c(1)
20200008 is finished.. wrong problem : 3-1.txt(1), 9-2.txt(1), 11-2.txt(1), 29.c(1)
20200009 is finished.. wrong problem : 8-1.txt(1), 12-1.txt(1), 22.c(1), 23.c(1), 25.c(1)
20200010 is finished.. wrong problem : 4-1.txt(1), 8-1.txt(1), 9-1.txt(1), 9-4.txt(1), 13-2.txt(1), 13-3.txt(1), 13-4.txt(1), 17-3.txt(1), 22.c(1), 23.c(1)
result saved.. (/home/nlog/p2/ANS_DIR/score.csv)
Runtime: 87:807227(sec:usec)
nlog@nlog-vm-lsp:~/p2$
```

##### 4-6-3. 가변인자 개수 초과

```
nlog@nlog-vm-lsp:~/p2$ ./ssu_score STD_DIR/ ANS_DIR/ -p 20200001 20200005 20200006 20200007 20200008 20200009 20200010
Maximum Number of Argument Exceeded. :: 20200009 20200010
grading student's test papers..
20200001 is finished.. wrong problem : 2-1.txt(1), 3-1.txt(1), 7-5.txt(1), 9-2.txt(1), 10-4.txt(1), 11-5.txt(1), 13-3.txt(1), 13-4.txt(1), 16-1.txt(1), 17-1.txt(1), 19-3.txt(1), 19-5.txt(1), 20.c(1), 22.c(1), 23.c(1)
20200002 is finished..
20200003 is finished..
20200004 is finished..
20200005 is finished.. wrong problem : 7-1.txt(1), 7-2.txt(1), 7-3.txt(1), 9-3.txt(1), 11-1.txt(1), 11-2.txt(1), 13-1.txt(1), 17-5.txt(1), 18-1.txt(1), 19-2.txt(1), 22.c(1), 23.c(1), 25.c(1)
20200006 is finished.. wrong problem : 8-1.txt(1), 9-1.txt(1), 11-6.txt(1), 13-3.txt(1), 13-4.txt(1), 15-1.txt(1), 17-1.txt(1), 22.c(1)
20200007 is finished.. wrong problem : 1-2.txt(1), 5-1.txt(1), 29.c(1)
20200008 is finished.. wrong problem : 3-1.txt(1), 9-2.txt(1), 11-2.txt(1), 22.c(1), 29.c(1)
20200009 is finished..
20200010 is finished..
result saved.. (/home/nlog/p2/ANS_DIR/score.csv)
Runtime: 87:581848(sec:usec)
nlog@nlog-vm-lsp:~/p2$
```

##### 4-6-4. 없는 학생 입력

```
nlog@nlog-vm-lsp:~/p2$ ./ssu_score STD_DIR/ ANS_DIR/ -p 202000000
202000000 doesn't exist in STD_DIR/.
nlog@nlog-vm-lsp:~/p2$
```

#### 4-7. -p와 -c 옵션 동시 사용

##### 4-7-1. 가변인자 입력

```
nlog@nlog-vm-lsp:~/p2$ ./ssu_score STD_DIR/ ANS_DIR/ -p -c 20200001 20200005
grading student's test papers..
20200001 is finished.. score : 65.00, wrong problem : 2-1.txt(1), 3-1.txt(1), 7-5.txt(1), 9-2.txt(1), 10-4.txt(1), 11-5.
txt(1), 13-3.txt(1), 13-4.txt(1), 16-1.txt(1), 17-1.txt(1), 19-3.txt(1), 19-5.txt(1), 20.c(1), 22.c(1), 23.c(1)
20200002 is finished..
20200003 is finished..
20200004 is finished..
20200005 is finished.. score : 67.00, wrong problem : 7-1.txt(1), 7-2.txt(1), 7-3.txt(1), 9-3.txt(1), 11-1.txt(1), 11-2.
txt(1), 13-1.txt(1), 17-5.txt(1), 18-1.txt(1), 19-2.txt(1), 22.c(1), 23.c(1), 25.c(1)
20200006 is finished..
20200007 is finished..
20200008 is finished..
20200009 is finished..
20200010 is finished..
Total average : 66.00
result saved.. (/home/nlog/p2/ANS_DIR/score.csv)
Runtime: 86:580694(sec:usec)
nlog@nlog-vm-lsp:~/p2$ |
```

##### 4-7-2. 가변인자 미입력

```
nlog@nlog-vm-lsp:~/p2$ ./ssu_score STD_DIR/ ANS_DIR/ -c -p
grading student's test papers..
20200001 is finished.. score : 66.00, wrong problem : 2-1.txt(1), 3-1.txt(1), 7-5.txt(1), 9-2.txt(1), 10-4.txt(1), 11-5.
txt(1), 13-3.txt(1), 13-4.txt(1), 16-1.txt(1), 17-1.txt(1), 19-3.txt(1), 19-5.txt(1), 20.c(1), 23.c(1)
20200002 is finished.. score : 65.00, wrong problem : 1-1.txt(1), 3-1.txt(1), 7-5.txt(1), 9-1.txt(1), 11-5.txt(1), 11-6.
txt(1), 14-2.txt(1), 16-1.txt(1), 17-3.txt(1), 18-3.txt(1), 19-2.txt(1), 19-3.txt(1), 22.c(1), 23.c(1), 24.c(1)
20200003 is finished.. score : 62.00, wrong problem : 1-1.txt(1), 1-2.txt(1), 5-1.txt(1), 6-1.txt(1), 7-1.txt(1), 8-1.tx
t(1), 8-4.txt(1), 10-4.txt(1), 11-6.txt(1), 13-4.txt(1), 13-5.txt(1), 15-1.txt(1), 15-3.txt(1), 16-3.txt(1), 19-1.txt(1)
, 19-5.txt(1), 22.c(1), 25.c(1)
20200004 is finished.. score : 65.00, wrong problem : 1-1.txt(1), 2-1.txt(1), 6-1.txt(1), 9-1.txt(1), 9-2.txt(1), 11-1.t
xt(1), 11-3.txt(1), 11-6.txt(1), 13-2.txt(1), 13-4.txt(1), 15-1.txt(1), 16-1.txt(1), 19-4.txt(1), 27.c(1), 28.c(1)
20200005 is finished.. score : 68.00, wrong problem : 7-1.txt(1), 7-2.txt(1), 7-3.txt(1), 9-3.txt(1), 11-1.txt(1), 11-2.
txt(1), 13-1.txt(1), 17-5.txt(1), 18-1.txt(1), 19-2.txt(1), 23.c(1), 25.c(1)
20200006 is finished.. score : 72.00, wrong problem : 8-1.txt(1), 9-1.txt(1), 11-6.txt(1), 13-3.txt(1), 13-4.txt(1), 15-
1.txt(1), 17-1.txt(1), 22.c(1)
20200007 is finished.. score : 76.00, wrong problem : 1-2.txt(1), 5-1.txt(1), 22.c(1), 29.c(1)
20200008 is finished.. score : 76.00, wrong problem : 3-1.txt(1), 9-2.txt(1), 11-2.txt(1), 29.c(1)
20200009 is finished.. score : 75.00, wrong problem : 8-1.txt(1), 12-1.txt(1), 22.c(1), 23.c(1), 25.c(1)
20200010 is finished.. score : 70.00, wrong problem : 4-1.txt(1), 8-1.txt(1), 9-1.txt(1), 9-4.txt(1), 13-2.txt(1), 13-3.
txt(1), 13-4.txt(1), 17-3.txt(1), 22.c(1), 23.c(1)
Total average : 69.50
result saved.. (/home/nlog/p2/ANS_DIR/score.csv)
Runtime: 87:313532(sec:usec)
nlog@nlog-vm-lsp:~/p2$
```

##### 4-7-3. 가변인자 중복 입력

```
nlog@nlog-vm-lsp:~/p2$ ./ssu_score STD_DIR/ ANS_DIR/ -c 20200001 -p 20200001
[STUDENTIDS...] variables of -p and -c was given
nlog@nlog-vm-lsp:~/p2$ |
```

#### 4-8. -t 옵션

##### 4-8-1. 가변인자 입력

```
nlog@nlog-vm-lsp:~/p2$ ./ssu_score STD_DIR/ ANS_DIR/ -c -t 27 28 29
grading student's test papers..
20200001 is finished.. score : 65.00
20200002 is finished.. score : 65.00
20200003 is finished.. score : 63.00
20200004 is finished.. score : 65.00
20200005 is finished.. score : 67.00
20200006 is finished.. score : 72.00
20200007 is finished.. score : 76.00
20200008 is finished.. score : 75.00
20200009 is finished.. score : 75.00
20200010 is finished.. score : 70.00
Total average : 69.30
result saved.. (/home/nlog/p2/ANS_DIR/score.csv)
Runtime: 87:118516(sec:usec)
nlog@nlog-vm-lsp:~/p2$ |
```

#### 4-8-2. 가변인자 미입력

```
nlog@nlog-vm-lsp:~/p2$ ./ssu_score STD_DIR/ ANS_DIR/ -c -t
grading student's test papers..
20200001 is finished.. score : 65.00
20200002 is finished.. score : 65.00
20200003 is finished.. score : 63.00
20200004 is finished.. score : 65.00
20200005 is finished.. score : 67.00
20200006 is finished.. score : 72.00
20200007 is finished.. score : 76.00
20200008 is finished.. score : 75.00
20200009 is finished.. score : 75.00
20200010 is finished.. score : 70.00
Total average : 69.30
result saved.. (/home/nlog/p2/ANS_DIR/score.csv)
Runtime: 87:317166(sec:usec)
nlog@nlog-vm-lsp:~/p2$ |
```

#### 4-8-3. 가변인자 개수 초과

```
nlog@nlog-vm-lsp:~/p2$ ./ssu_score STD_DIR/ ANS_DIR/ -c -t 20 21 22 23 24 25 26 27 28
Maximum Number of Argument Exceeded. :: 25 26 27 28
grading student's test papers..
20200001 is finished.. score : 66.00
20200002 is finished.. score : 65.00
20200003 is finished.. score : 62.00
20200004 is finished.. score : 64.00
20200005 is finished.. score : 67.00
20200006 is finished.. score : 73.00
20200007 is finished.. score : 76.00
20200008 is finished.. score : 75.00
20200009 is finished.. score : 75.00
20200010 is finished.. score : 70.00
Total average : 69.30
result saved.. (/home/nlog/p2/ANS_DIR/score.csv)
Runtime: 87:103103(sec:usec)
nlog@nlog-vm-lsp:~/p2$ |
```

#### 4-9. -s 옵션

##### 4-9-1. stdid 1 (학번 오름차순)

```
nlog@nlog-vm-lsp:~/p2$ cat ANS_DIR/score.csv
,1-1.txt,1-2.txt,2-1.txt,2-2.txt,3-1.txt,4-1.
,7-7.txt,8-1.txt,8-2.txt,8-3.txt,8-4.txt,8-5.
xt,10-3.txt,10-4.txt,11-1.txt,11-2.txt,11-3.t
13-3.txt,13-4.txt,13-5.txt,14-1.txt,14-2.txt,
2.txt,17-3.txt,17-4.txt,17-5.txt,18-1.txt,18-
xt,20.c,21.c,22.c,23.c,24.c,25.c,26.c,27.c,28
20200001,1.00,1.00,0,1.00,0,1.00,1.00,1.00,1.
1.00,0,1.00,1.00,1.00,1.00,1.00,0,1.00,1.00,1
1.00,0,1.00,1.00,0,1.00,1.00,1.00,1.00,1.00,1
.00,65.00
20200002,0,1.00,1.00,1.00,0,1.00,1.00,1.00,1.
0,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.0
00,1.00,0,1.00,1.00,1.00,1.00,0,1.00,1.00,1.0
.00,65.00
20200003,0,0,1.00,1.00,1.00,1.00,0,0,1.00,0,1
00,1.00,1.00,1.00,1.00,0,1.00,1.00,1.00,1.00,
0,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.0
20200004,0,1.00,0,1.00,1.00,1.00,1.00,0,1.00,
0,0,1.00,1.00,1.00,1.00,1.00,1.00,0,1.00,0,1.
00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.
,64.00
20200005,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1
1.00,1.00,0,1.00,1.00,1.00,1.00,1.00,0,0,1.00
00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,0,
1.00,1.00,67.00
20200006,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1
```



```

nlog@nlog-vm-lsp:~/p2$ cat ANS_DIR/score.csv
,1-1.txt,1-2.txt,2-1.txt,2-2.txt,3-1.txt,4-1.
,7-7.txt,8-1.txt,8-2.txt,8-3.txt,8-4.txt,8-5.
xt,10-3.txt,10-4.txt,11-1.txt,11-2.txt,11-3.t
13-3.txt,13-4.txt,13-5.txt,14-1.txt,14-2.txt
2.txt,17-3.txt,17-4.txt,17-5.txt,18-1.txt,18-
xt,20.c,21.c,22.c,23.c,24.c,25.c,26.c,27.c,28
20200010,1.00,1.00,1.00,1.00,1.00,0,1.00,1.00
00,0,1.00,1.00,0,1.00,1.00,1.00,1.00,1.00,1.00
00,1.00,1.00,1.00,1.00,1.00,1.00,0,1.00,1.00,
0,1.00,1.00,1.00,1.00,71.00
20200009,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00
,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00
00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00
00,0,0,1.00,0,1.00,1.00,1.00,1.00,1.00,75.00
20200008,1.00,1.00,1.00,1.00,0,1.00,1.00,1.00,
,1.00,1.00,0,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00
1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00
1.00,1.00,1.00,1.00,1.00,1.00,1.00,0,76.00
20200007,1.00,0,1.00,1.00,1.00,1.00,0,1.00,1.00,1.00,1.00,1.00
00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00
00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00
00,0,1.00,1.00,1.00,1.00,1.00,1.00,0,76.00
20200006,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00
,1.00,0,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00
,1.00,1.00,1.00,1.00,1.00,0,1.00,1.00,1.00,1.00,1.00,1.00
1.00,1.00,1.00,1.00,1.00,72.00

```

```

nlog@nlog-vm-lsp:~/p2$ cat ANS_DIR/score.csv
,1-1.txt,1-2.txt,2-1.txt,2-2.txt,2-3.txt,3-1.txt,4-1.txt,
,7-7.txt,8-1.txt,8-2.txt,8-3.txt,8-4.txt,8-5.txt,
xt,10-3.txt,10-4.txt,11-1.txt,11-2.txt,11-3.txt,
13-3.txt,13-4.txt,13-5.txt,14-1.txt,14-2.txt,1
2.txt,17-3.txt,17-4.txt,17-5.txt,18-1.txt,18-
xt,20.c,21.c,22.c,23.c,24.c,25.c,26.c,27.c,28
20200003,0,0,1.00,1.00,1.00,1.00,0,0,1.00,0,1
00,1.00,1.00,1.00,1.00,0,1.00,1.00,1.00,1.00,1
0,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00
20200004,0,1.00,0,1.00,1.00,1.00,1.00,0,1.00,1
0,0,1.00,1.00,1.00,1.00,1.00,1.00,0,1.00,0,1.0
00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.0
,64.00
20200001,1.00,1.00,0,1.00,0,1.00,1.00,1.00,1.0
1.00,0,1.00,1.00,1.00,1.00,1.00,0,1.00,1.00,1
1.00,0,1.00,1.00,0,1.00,1.00,1.00,1.00,1.00,1
.00,65.00
20200002,0,1.00,1.00,1.00,0,1.00,1.00,1.00,1.0
0,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.0
00,1.00,0,1.00,1.00,1.00,1.00,0,1.00,1.00,1.0
0,1.00,66.00
20200005,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1
1.00,1.00,0,1.00,1.00,1.00,1.00,1.00,0,0,1.00
00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,0,0
1.00,1.00,67.00
20200010,1.00,1.00,1.00,1.00,1.00,1.00,0,1.00,1.00

```

#### 4-9-4. score -1 (점수 내림차순)

```
nlog@nlog-vm-lsp:~/p2$ cat ANS_DIR/score.csv
,1-1.txt,1-2.txt,2-1.txt,2-2.txt,3-1.txt,4-1.txt,5-1.txt,
,7-7.txt,8-1.txt,8-2.txt,8-3.txt,8-4.txt,8-5.txt,8-6.txt,
xt,10-3.txt,10-4.txt,11-1.txt,11-2.txt,11-3.txt,11-4.txt,
13-3.txt,13-4.txt,13-5.txt,14-1.txt,14-2.txt,14-3.txt,15-
2.txt,17-3.txt,17-4.txt,17-5.txt,18-1.txt,18-2.txt,18-3.t
xt,20.c,21.c,22.c,23.c,24.c,25.c,26.c,27.c,28.c,29.c,sum
20200007,1.00,0,1.00,1.00,1.00,1.00,1.00,0,1.00,1.00,1.00,1.00
00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00
00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00
00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,0,77.00
20200008,1.00,1.00,1.00,1.00,1.00,0,1.00,1.00,1.00,1.00,1.00,1
,1.00,1.00,0,1.00,1.00,1.00,1.00,1.00,1.00,1.00,0,1.00,1.
1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.
1.00,1.00,1.00,1.00,1.00,1.00,1.00,0,76.00
20200009,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00
,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1
00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00
00,1.00,0,1.00,0,1.00,1.00,1.00,1.00,76.00
20200006,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00
,1.00,0,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00
,1.00,1.00,1.00,1.00,1.00,0,1.00,1.00,1.00,1.00,1.00,1.00
1.00,1.00,1.00,1.00,1.00,72.00
20200010,1.00,1.00,1.00,1.00,1.00,1.00,0,1.00,1.00,1.00,1.00,1.00,1
00,0,1.00,1.00,0,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,
00,1.00,1.00,1.00,1.00,1.00,1.00,0,1.00,1.00,1.00,1.00,1.00,1.
0,1.00,1.00,1.00,1.00,71.00
20200005,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,1.00,0,0
```

#### 4-9-5. 인자에 다른 입력 들어오는 경우

```
nlog@nlog-vm-lsp:~/p2$ ./ssu_score STD_DIR/ ANS_DIR/ -s score 0
Unknown option 0
nlog@nlog-vm-lsp:~/p2$ ./ssu_score STD_DIR/ ANS_DIR/ -s stddd -1
Unknown option stddd
nlog@nlog-vm-lsp:~/p2$ ./ssu_score STD_DIR/ ANS_DIR/ -s stdid
Need <1|-1>
nlog@nlog-vm-lsp:~/p2$ |
```

#### 4-10. -e 옵션

##### 4-10-1. 동작 확인

```
nlog@nlog-vm-lsp:~/p2$ ./ssu_score STD_DIR/ ANS_DIR/ -e error
grading student's test papers..
20200001 is finished..
20200002 is finished..
20200003 is finished..
20200004 is finished..
20200005 is finished..
20200006 is finished..
20200007 is finished..
20200008 is finished..
20200009 is finished..
20200010 is finished..
result saved.. (/home/nlog/p2/ANS_DIR/score.csv)
Runtime: 87:520606(sec:usec)
nlog@nlog-vm-lsp:~/p2$ ls error/
20200001 20200002 20200003 20200004 20200005 20200009 20200010
nlog@nlog-vm-lsp:~/p2$ ls error/20200010/
23_error.txt
nlog@nlog-vm-lsp:~/p2$ cat error/20200010/23_error.txt
/home/nlog/p2/STD_DIR/20200010/23.c: In function 'main':
/home/nlog/p2/STD_DIR/20200010/23.c:11:22: error: expected ';' before 'char'
   11 |         char buf[128]
       |         ^
       |         ;
   12 |         char pattern[4] = "bcd";
       |         ~~~~~
/home/nlog/p2/STD_DIR/20200010/23.c:13:20: error: 'buf' undeclared (first use in this function)
   13 |         char *pos1=buf, *pos2=buf;
       |         ^~~~~
/home/nlog/p2/STD_DIR/20200010/23.c:13:20: note: each undeclared identifier is reported only once for each function it appears in
nlog@nlog-vm-lsp:~/p2$
```

#### 4-10-2. 기존 내용 삭제

```
nlog@nlog-vm-lsp:~/p2$ touch error/dummy.txt
nlog@nlog-vm-lsp:~/p2$ touch error/20200010/dummy.txt
nlog@nlog-vm-lsp:~/p2$ ./ssu_score STD_DIR/ ANS_DIR/ -e error
grading student's test papers..
20200001 is finished..
20200002 is finished..
20200003 is finished..
20200004 is finished..
20200005 is finished..
20200006 is finished..
20200007 is finished..
20200008 is finished..
20200009 is finished..
20200010 is finished..
result saved.. (/home/nlog/p2/ANS_DIR/score.csv)
Runtime: 86:925106(sec:usec)
nlog@nlog-vm-lsp:~/p2$ ls error/
20200001 20200002 20200003 20200004 20200005 20200009 20200010
nlog@nlog-vm-lsp:~/p2$ ls error/20200010/
23_error.txt
nlog@nlog-vm-lsp:~/p2$ |
```

#### 4-10-3. 경로 예외처리/오류 파일 생성 중 오류 발생 처리

```
nlog@nlog-vm-lsp:~/p2$ ./ssu_score STD_DIR/ ANS_DIR/ -e /error
grading student's test papers..
moving error file('/home/nlog/p2/STD_DIR/20200001/20_error.txt' -> '/error/20200001/20_error.txt') failed.
nlog@nlog-vm-lsp:~/p2$
```

#### 4-11. -h 옵션

```
nlog@nlog-vm-lsp:~/p2$ ./ssu_score STD_DIR/ ANS_DIR/ -h
Usage : ssu_score <STD_DIR> <ANS_DIR> [OPTION]
Option :
-n <CSVFILENAME>
-m
-c [STUDENTIDS ...]
-p [STUDENTIDS ...]
-t [Q NAMES ...]
-s <CATEGORY> <1|-1>
-e <DIRNAME>
-h
nlog@nlog-vm-lsp:~/p2$ ./ssu_score -h
Usage : ssu_score <STD_DIR> <ANS_DIR> [OPTION]
Option :
-n <CSVFILENAME>
-m
-c [STUDENTIDS ...]
-p [STUDENTIDS ...]
-t [Q NAMES ...]
-s <CATEGORY> <1|-1>
-e <DIRNAME>
-h
nlog@nlog-vm-lsp:~/p2$ |
```

#### 4-8. Makefile

##### 4-8-1. build

```
nlog@nlog-vm-lsp:~/p2$ make  
Build complete  
nlog@nlog-vm-lsp:~/p2$ |
```

##### 4-8-2. clean

```
nlog@nlog-vm-lsp:~/p2$ make clean  
rm -f ssu_backup test_* *.o  
nlog@nlog-vm-lsp:~/p2$ |
```