CSE 344
SYSTEM PROGRAMMING

HW 1 Report

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Introduction

In this homework I have created a student grade management system in C programming language. System works like terminal; user enters some predefined commands. Each command is handled in a child process. After operation is done, child process is terminated.

Commands Manual

```
--------------------------------------------------
COMMAND
        gtuStudentGrades "filename"

DESCRIPTION
        Create a file in given filename.

USAGE
        gtuStudentGrades grades.txt
--------------------------------------------------
COMMAND
        addStudentGrade "filename" "Name Surname" "Grade"

DESCRIPTION
        Append student name surname and grade to the end of the file.
        If student already exists in file, update his/her grade.

        Possible grades:
        'AA', 'BA', 'BB', 'CB', 'CC', 'DC', 'DD', 'FD', 'FF', 'VF', 'NA'

USAGE
        addStudentGrade grades.txt Emre Güven AA
--------------------------------------------------
COMMAND
        searchStudent "filename" "Name Surname"

DESCRIPTION
        Display student name surname and grade from given filename.

USAGE
        searchStudent grades.txt Emre Güven
--------------------------------------------------
COMMAND
        sortAll "filename" "sort option" "order option"

DESCRIPTION
        Display all entries by sorting according to options.
        sort option : n - g | n: name - g: grade
        order option: a - d | a: ascending - d: descending

USAGE
        sortAll grades.txt n a
        Displays all of the sorted entries in grades.txt, sorted by name in ascending order.
--------------------------------------------------
--------------------------------------------------
COMMAND
        showAll "filename"

DESCRIPTION
        Display all of the entries in the file.

USAGE
        showAll grades.txt
--------------------------------------------------
COMMAND
        listGrades "filename"

DESCRIPTION
        Display first 5 entries in the file.

USAGE
        listGrades grades.txt
--------------------------------------------------
COMMAND
        listSome "numofEntries" "pageNumber" "filename"

DESCRIPTION
        Display number of the entries in given page number in the file.

USAGE
        listSome 5 2 grades.txt
        Displays 5 entries in the 2nd page in the file, 6th-10th entries.
--------------------------------------------------
```

General System Design

System waits for an input after it runs. If user enters a valid command, operation is done. If command is invalid, user is warned, and system waits for a new command. "q" command terminates system.

When a command is entered in **execute_command()** function, it is parsed as command name, filename, and other arguments **parse_command(...)** function. Then, a child process is created for handling command by using **fork()** system call. In child process, **handle_command_process(...)** function is called. In this function, according to given command, related functions are called to make operations. If command is invalid, no operation is done. After doing related operation successfully, child process is terminated successfully. In all file operations, files are closed properly after operation is done. In all system calls, error checks are done.

Methods for Operations

void command_create_file(const char* filename): Create a file if file does not exist by using **open()** system call. If file exist, only warn user.

void command_display_commands(): Create a manual page text for commands and print it.

void command_add_grade(const char *filename, char *arguments): Check given file exists or not. If it exists, parse student name and grade in **parse_name_and_grade(...)** function. Then call **add_grade_to_file(...)** function to add student to end of the file or update its grade if it is already in the file.

void add_grade_to_file(const char *filename, const char *student_name, const char *student_grade): Open file by using **open()** system call. First search student name in file. Read some chunks from file to a buffer using **read()** system call, search student name in chunk. Iterate all file content until student is found. If it is found, update student grade, else append student name and grade information to the end of the file using **write()** system call.

void command_search_student(const char *filename, const char *student_name): Open file by using **open()** system call. First search student name in file. Read some chunks from file to a buffer using **read()** system call, search student name in chunk. Iterate all file content until student is found. If it is found, display student name and grade, else warn user to indicate not found student.

void command_sort_all(const char *filename):

void command_show_all(const char *filename): Check given file exists or not. If it exists, open file by using **open()** system call. Read all file content by using **read()** system call, and display them.

void command_list_grades(const char *filename): Check given file exists or not. If it exists, call **print_entries_page(...)** function to display first 5 entries in the file.

void command_list_some(const char *filename, char *arguments): Check given file exists or not. If it exists, parse arguments string to obtain page size and page number values. Then call **print_entries_page(...)** function to display entries given page in the file.

void print_entries_page(const char *filename, int page_size, int page_number): Open file by using **open()** system call. Then calculate the line numbers (or orders) of the wanted entries. For example, page size 5, page number 2 indicates 6th to 10th entries. Then, traverse lines until target lines. Display target lines using **write()** system call.

void parse_name_and_grade(char *arguments, char *student_name, char *student_grade): In given arguments, parses and returns student name and grade.

void parse_command(char *command, char *sub_command, char *filename, char *arguments): In given input command, parses and returns sub command (our system command), filename and arguments. In all our system commands, first argument is sub command, second argument is filename and remaining part is argumens of our system except listSome command. In listSome command, last argument is filename and middle part is argumens of our system.

int is_token_grade(const char *token): Check validity of grade input according to our grade options.

Methods for Utility

void log_msg(const char *entry_1, const char *entry_2, const char *message): Create a child process for logging operation by using **fork()** system call. Open log file "log.txt" by using **open()** system call. Create a log message by concatenating current time, entry_1, entry_2 and message. Write log message to log file by using **write()** system call.

void print(const char *message): Print given message string to stdout by using **write()** system call.

void print_error(const char *message): Print given error message string to stderr by using **write()** system call.

void handle_no_exist_file(const char *filename): Warn user about given filename does not exist. Also log a message.

int is_file_exists(const char *filename): Checks existence of a file in given filename, by using **stat()** system call.

void close_fd(const char *filename, int fd): Close given file descriptor and log a message properly.

TESTS

I tried commands and get the results. Some tests, results and their log records is shown below.

Test1:

```
mrguven@mrguven:~/Desktop/cse344/hw1$ ls
grades_5mb.txt  grades.txt  gtu_grades.h  main.c  Makefile
mrguven@mrguven:~/Desktop/cse344/hw1$ make
gcc main.c -o main
mrguven@mrguven:~/Desktop/cse344/hw1$ ./main
~$ gtuStudentGrade grd.txt
'gtuStudentGrade' command not found.
~$ gtuStudentGrades grd.txt
~$ q
mrguven@mrguven:~/Desktop/cse344/hw1$ make
make: Nothing to be done for 'ALL'.
mrguven@mrguven:~/Desktop/cse344/hw1$ ls
grades_5mb.txt  grades.txt  grd.txt  gtu_grades.h  log.txt  main  main.c  Makefile
mrguven@mrguven:~/Desktop/cse344/hw1$ ./main
~$ addStudentGrade grd.tx Emre Güven BA
'grd.tx' file does not exist.
~$ addStudentGrade grd.txt Emre Güven BA
~$ ^C
mrguven@mrguven:~/Desktop/cse344/hw1$ ./main
~$ addStudentGrade grd.txt Joseph Lisa Thomas NA
~$ addStudentGrade grd.txt Matthew Harris AA
~$ addStudentGrade grd.txt Joseph Smith CC
~$ addStudentGrade grd.txt Lisa Patricia Moore FF
~$ addStudentGrade grd.txt Ali Aydın BA
~$ addStudentGrade grd.txt Joseph Lisa Thomas FF
~$ addStudentGrade grd.txt James Andre CC
~$ searchStudent grd.txt Emre Güven
Emre Güven - BA
~$ searchStudent grd.txt Joseph Lisa Thomas
Joseph Lisa Thomas - FF
~$ showAll grd.txt
Emre Güven, BA
Joseph Lisa Thomas, FF
Matthew Harris, AA
Joseph Smith, CC
Lisa Patricia Moore, FF
Ali Aydın, BA
James Andre, CC
~$ listGrades grd.tas
'grd.tas' file does not exist.
~$ listGrades grd.txt
Emre Güven, BA
Joseph Lisa Thomas, FF
Matthew Harris, AA
Joseph Smith, CC
Lisa Patricia Moore, FF
~$ listSome 3 1 grd.txt
Emre Güven, BA
Joseph Lisa Thomas, FF
Matthew Harris, AA
~$ listSome 3 3 grd.txt
James Andre, CC
~$ q
mrguven@mrguven:~/Desktop/cse344/hw1$
```

Log1:

```
≡ log.txt
 14    2024-03-22T23:00:31 | grd.txt | Matthew Harris, AA is added.
 15    2024-03-22T23:01:09 | addStudentGrade grd.txt Joseph Smith CC | command is entered.
 16    2024-03-22T23:01:09 | grd.txt | Joseph Smith, CC is added.
 17    2024-03-22T23:01:44 | addStudentGrade grd.txt Lisa Patricia Moore FF | command is entered.
 18    2024-03-22T23:01:44 | grd.txt | Lisa Patricia Moore, FF is added.
 19    2024-03-22T23:02:07 | addStudentGrade grd.txt Ali Aydın BA | command is entered.
 20    2024-03-22T23:02:07 | grd.txt | Ali Aydın, BA is added.
 21    2024-03-22T23:02:30 | addStudentGrade grd.txt Joseph Lisa Thomas FF | command is entered.
 22    2024-03-22T23:02:30 | grd.txt | grade is updated.
 23    2024-03-22T23:03:21 | addStudentGrade grd.txt James Andre CC | command is entered.
 24    2024-03-22T23:03:21 | grd.txt | James Andre, CC is added.
 25    2024-03-22T23:03:52 | searchStudent grd.txt Emre Güven | command is entered.
 26    2024-03-22T23:03:52 | grd.txt | Emre Güven - BA is displayed.
 27    2024-03-22T23:04:10 | searchStudent grd.txt Joseph Lisa Thomas | command is entered.
 28    2024-03-22T23:04:10 | grd.txt | Joseph Lisa Thomas - FF is displayed.
 29    2024-03-22T23:04:28 | showAll grd.txt | command is entered.
 30    2024-03-22T23:04:28 | grd.txt | all entries are displayed.
 31    2024-03-22T23:04:52 | listGrades grd.tas | command is entered.
 32    2024-03-22T23:04:52 | grd.tas | file does not exist.
 33    2024-03-22T23:05:03 | listGrades grd.txt | command is entered.
 34    2024-03-22T23:05:03 | grd.txt |  first 5 entries are displayed.
 35    2024-03-22T23:05:25 | listSome 3 1 grd.txt | command is entered.
 36    2024-03-22T23:05:25 | grd.txt |  some entries are displayed.
 37    2024-03-22T23:05:49 | listSome 3 3 grd.txt | command is entered.
 38    2024-03-22T23:05:49 | grd.txt |  some entries are displayed.
 39    2024-03-22T23:07:58 | q | command is entered.
 40    2024-03-22T23:07:58 | System terminated.
 41    |
```

Test2:

```
mrguven@mrguven:~/Desktop/cse344/hw1$ ./main
~$ showAll grades.txt
Matthew Williams, BB
Patricia Robinson, AA
Daniel Moore, VF
Anthony Clark, CB
Anthony Lewis, VF
Matthew Lee, FF
Anthony Gonzalez, NA
Betty Anderson, NA
Christopher Anderson, BA
Mary Perez, FF
Barbara Hernandez, VF
Robert Davis, BA
Matthew Brown, DD
Sarah Ramirez, BB
James Gonzalez, BB
Matthew Moore, CB
Barbara Garcia, BA
Joseph Rodriguez, DC
James Sanchez, DD
Karen Taylor, AA
Charles Ramirez, CC
Sarah Thompson, AA
Jessica Martin, CC
William Jones, BA
Mary Martinez, DD
Jessica Brown, VF
Barbara Martin, VF
Nancy Harris, VF
Michael Perez, CC
Joseph Jones, BA
Sarah Taylor, DC
Christopher Robinson, NA
Jessica Williams, AA
Sandra Perez, BB
Michael Jackson, BB
William Wilson, DD
Margaret Anderson, AA
Richard Thompson, AA
John Thomas, FF
Lisa Harris, BB
Lisa Jones, DC
Margaret Harris, NA
Karen Wilson, NA
Karen Lopez, FF
Daniel Brown, NA
Barbara Williams, NA
Jennifer Jackson, VF
John Gonzalez, AA
Patricia Clark, AA
Sarah Jackson, DC
Daniel Anderson, DC
Mark Martin, CC
James Anderson, CC
```

```
Jennifer Jackson, VF
John Gonzalez, AA
Patricia Clark, AA
Sarah Jackson, DC
Daniel Anderson, DC
Mark Martin, CC
James Anderson, CC
James Lewis, FF
Lisa Thomas, BA
John Lopez, CB
Joseph Robinson, CB
Barbara Lopez, DD
Patricia Martin, FF
Elizabeth Perez, CB
Mary Jackson, BB
Margaret Miller, AA
Christopher Hernandez, VF
James Lee, AA
Anthony Smith, BA
Christopher Brown, FF
John Davis, NA
Robert Lewis, CC
Barbara Brown, FF
Betty Davis, FF
Margaret Clark, VF
David Moore, BA
Nancy Sanchez, VF
Christopher Sanchez, DC
Christopher Martin, NA
Michael Davis, BA
Jessica Jackson, NA
Sandra Brown, FF
Mark Sanchez, AA
Joseph Brown, DC
Sarah Rodriguez, DD
Daniel Clark, DD
Richard Lewis, BB
John Wilson, CB
Daniel Wilson, CC
Anthony Wilson, NA
Christopher Rodriguez, CB
Richard Clark, NA
William Perez, FF
Michael Clark, FF
Betty Rodriguez, FF
James Miller, FF
Mark Lopez, VF
Richard Lopez, BA
Joseph Smith, DD
John Williams, BB
Nancy Lewis, CC
Mary Thomas, DD
Jennifer Lopez, VF
Susan Jones, NA
~$ listGrades grades.txt
```

```
James Miller, FF
Mark Lopez, VF
Richard Lopez, BA
Joseph Smith, DD
John Williams, BB
Nancy Lewis, CC
Mary Thomas, DD
Jennifer Lopez, VF
Susan Jones, NA
~$ listGrades grades.txt
Matthew Williams, BB
Patricia Robinson, AA
Daniel Moore, VF
Anthony Clark, CB
Anthony Lewis, VF
~$ listSome 5 20 grades.txt
John Williams, BB
Nancy Lewis, CC
Mary Thomas, DD
Jennifer Lopez, VF
Susan Jones, NA
~$ q
mrguven@mrguven:~/Desktop/cse344/hw1$
```

Log2:

```
≡ log.txt
14    2024-03-22T23:00:31 | grd.txt | Matthew Harris, AA is added.
15    2024-03-22T23:01:09 | addStudentGrade grd.txt Joseph Smith CC | command is entered.
16    2024-03-22T23:01:09 | grd.txt | Joseph Smith, CC is added.
17    2024-03-22T23:01:44 | addStudentGrade grd.txt Lisa Patricia Moore FF | command is entered.
18    2024-03-22T23:01:44 | grd.txt | Lisa Patricia Moore, FF is added.
19    2024-03-22T23:02:07 | addStudentGrade grd.txt Ali Aydın BA | command is entered.
20    2024-03-22T23:02:07 | grd.txt | Ali Aydın, BA is added.
21    2024-03-22T23:02:30 | addStudentGrade grd.txt Joseph Lisa Thomas FF | command is entered.
22    2024-03-22T23:02:30 | grd.txt | grade is updated.
23    2024-03-22T23:03:21 | addStudentGrade grd.txt James Andre CC | command is entered.
24    2024-03-22T23:03:21 | grd.txt | James Andre, CC is added.
25    2024-03-22T23:03:52 | searchStudent grd.txt Emre Güven | command is entered.
26    2024-03-22T23:03:52 | grd.txt | Emre Güven - BA is displayed.
27    2024-03-22T23:04:10 | searchStudent grd.txt Joseph Lisa Thomas | command is entered.
28    2024-03-22T23:04:10 | grd.txt | Joseph Lisa Thomas - FF is displayed.
29    2024-03-22T23:04:28 | showAll grd.txt | command is entered.
30    2024-03-22T23:04:28 | grd.txt | all entries are displayed.
31    2024-03-22T23:04:52 | listGrades grd.tas | command is entered.
32    2024-03-22T23:04:52 | grd.tas | file does not exist.
33    2024-03-22T23:05:03 | listGrades grd.txt | command is entered.
34    2024-03-22T23:05:03 | grd.txt |  first 5 entries are displayed.
35    2024-03-22T23:05:25 | listSome 3 1 grd.txt | command is entered.
36    2024-03-22T23:05:25 | grd.txt |  some entries are displayed.
37    2024-03-22T23:05:49 | listSome 3 3 grd.txt | command is entered.
38    2024-03-22T23:05:49 | grd.txt |  some entries are displayed.
39    2024-03-22T23:07:58 | q | command is entered.
40    2024-03-22T23:07:58 | System terminated.
41    2024-03-22T23:20:26 | showAll grades.txt | command is entered.
42    2024-03-22T23:20:26 | grades.txt | all entries are displayed.
43    2024-03-22T23:21:03 | listGrades grades.txt | command is entered.
44    2024-03-22T23:22:11 | listSome 5 20 grades.txt | command is entered.
45    2024-03-22T23:22:34 | q | command is entered.
46    2024-03-22T23:22:34 | System terminated.
47
```