

CSE 344 SYSTEM PROGRAMMING - HOMEWORK #03

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In the assignment, one parent process and four child processes are required to be created. Normally it was enough to create four pipes for this process. But a bi-directional transmission is desired. That's why eight pipes were made. 8 pairs of file descriptors were created to be used in these pipes.

Firstly, it is checked whether the user has entered the program arguments correctly. Then, it is checked that the specified input files are opened correctly. It is checked whether there are enough bytes in the files according to the n parameters entered by the user. If not, the files are closed and the program ends.

Pipes are created. If there is an error, the program ends. This process is applied for all pipes. After that, it is passed to the stage where child processes will occur.

In both child processes and parent processes, the correct ends of file descriptors are closed. There will be communication between them and there will be a one-way byte flow using pipes. Another pipe will be used for reverse communication.

In the parent process, the quarter matrix that will go to each child process is calculated and sent. Child processes take matrix values and call the calculate functions to calculate their values. These are 4 of them (calculate_C11, calculate_C12, calculate_C21, calculate_C22).

Parent then waits for all the children. After all the kids have finished they get the results and create a matrix_C. Then the singular values of this matrix_C are printed on the screen. The SIGCHLD signal is captured in the catcher function before these operations are performed. So this signal is captured when the child process is finished. Likewise, when the SIGINT signal is captured, all processes (to be the last parent) are terminated. After using each malloc, it is returned free.

USAGE :

```
gokhan@has: ~/Desktop/CSE344-SYSTEMS-PROGRAMMING/HW-03
gokhan@has:~/Desktop/CSE344-SYSTEMS-PROGRAMMING/HW-03$ ls
161044067.c  inputA  inputB  makefile  'Untitled 1.odt'
gokhan@has:~/Desktop/CSE344-SYSTEMS-PROGRAMMING/HW-03$ make
gcc 161044067.c -o program -lm
gokhan@has:~/Desktop/CSE344-SYSTEMS-PROGRAMMING/HW-03$ ls
161044067.c  inputA  inputB  makefile  program  'Untitled 1.odt'
gokhan@has:~/Desktop/CSE344-SYSTEMS-PROGRAMMING/HW-03$ ./program
Parent process started ...

ERROR : Input/output error

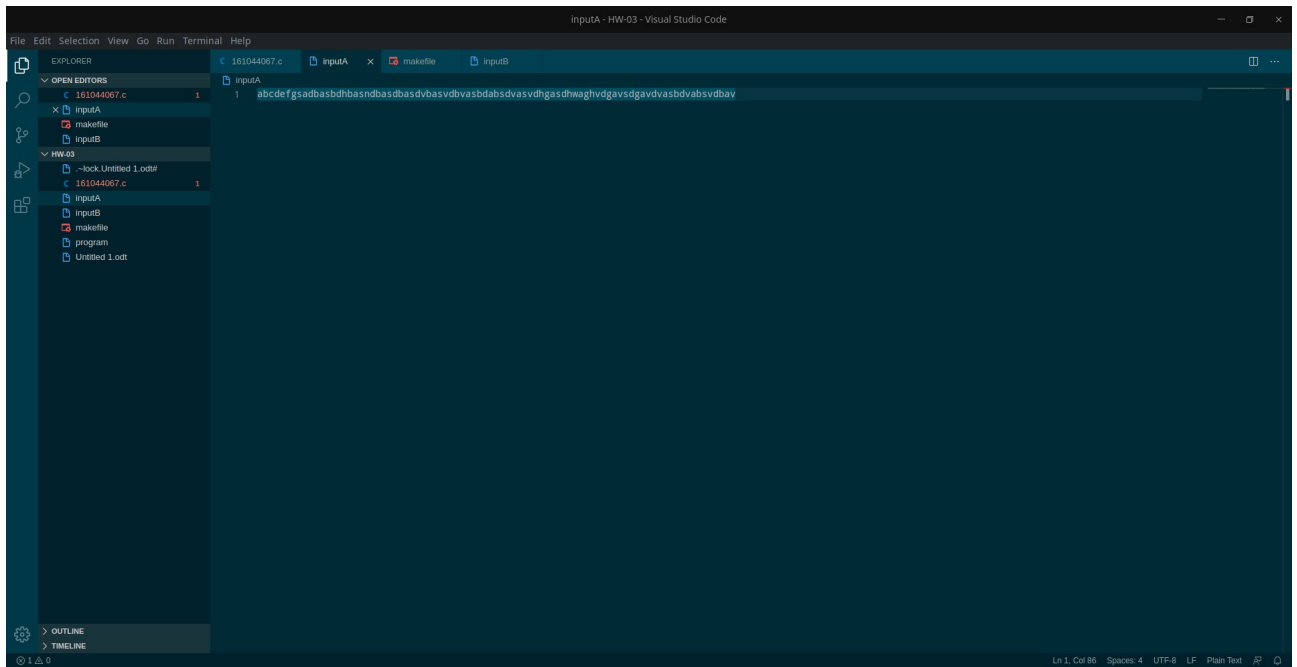
##### PROGRAM USAGE #####
# Programs argument is -i -j and -n #
# -i : read the contents of the file denoted by inputPathA #
# -j : read the contents of the file denoted by inputPathB #
# -n : 2^n x 2^n positive integer n #
#####

gokhan@has:~/Desktop/CSE344-SYSTEMS-PROGRAMMING/HW-03$ ./program -i input -o
Parent process started ...

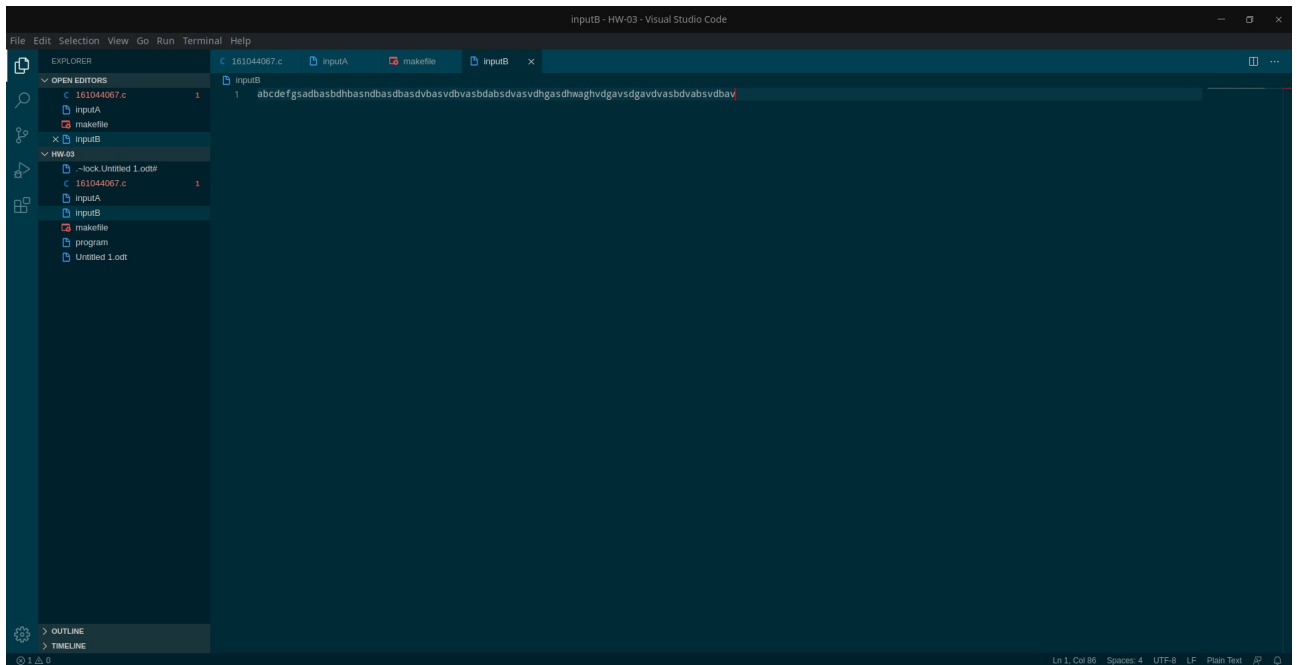
./program: invalid option -- 'o'
ERROR : Input/output error

##### PROGRAM USAGE #####
# Programs argument is -i -j and -n #
# -i : read the contents of the file denoted by inputPathA #
# -j : read the contents of the file denoted by inputPathB #
# -n : 2^n x 2^n positive integer n #
#####

gokhan@has:~/Desktop/CSE344-SYSTEMS-PROGRAMMING/HW-03$
```



inputA



inputB

```

gokhan@has: ~/Desktop/CSE344-SYSTEMS-PROGRAMMING/HW-03
Parent process started ...

ERROR (-n) : Invalid argument
gokhan@has:~/Desktop/CSE344-SYSTEMS-PROGRAMMING/HW-03$ ./program -i inputA -j inputB -n -150
Parent process started ...

ERROR (-n) : Invalid argument
gokhan@has:~/Desktop/CSE344-SYSTEMS-PROGRAMMING/HW-03$ ./program -i inputA -j inputB -n 1
Parent process started ...

MATRIX A :
97 98
99 100

MATRIX B :
97 98
99 100

Child process 1 started ...
Child process 2 started ...
Child process 3 started ...
Child process 4 started ...
SIGCHLD is caught
SIGCHLD is caught
SIGCHLD is caught
SIGCHLD is caught

MATRIX C :
19111 19306
19503 19702

SINGULAR VALUES :
0.000 38813.500
gokhan@has:~/Desktop/CSE344-SYSTEMS-PROGRAMMING/HW-03$

```

n is 1 example

```

gokhan@has: ~/Desktop/CSE344-SYSTEMS-PROGRAMMING/HW-03
0.000 38813.500
gokhan@has:~/Desktop/CSE344-SYSTEMS-PROGRAMMING/HW-03$ ./program -i inputA -j inputB -n 2
Parent process started ...

MATRIX A :
97 98 99 100
101 102 103 115
97 100 98 97
115 98 100 104

MATRIX B :
97 98 99 100
101 102 103 115
97 100 98 97
115 98 100 104

Child process 1 started ...
Child process 2 started ...
Child process 3 started ...
SIGCHLD is caught
Child process 4 started ...
SIGCHLD is caught
SIGCHLD is caught
SIGCHLD is caught

MATRIX C :
40410 39202 39399 40973
43315 41872 42099 43781
40170 39012 39207 40794
42713 41458 41679 43286

SINGULAR VALUES :
164955.321 124.824 3.527 43.734
gokhan@has:~/Desktop/CSE344-SYSTEMS-PROGRAMMING/HW-03$

```

n is 2 example

```
gokhan@has: ~/Desktop/CSE344-SYSTEMS-PROGRAMMING/HW-03
gokhan@has:~/Desktop/CSE344-SYSTEMS-PROGRAMMING/HW-03$ ./program -i inputA -j inputB -n 3
Parent process started ...

MATRIX A :
97 98 99 100 101 102 103 115
97 100 98 97 115 98 100 104
98 97 115 110 100 98 97 115
100 98 97 115 100 118 98 97
115 118 100 98 118 97 115 98
100 97 98 115 100 118 97 115
118 100 104 103 97 115 100 104
119 97 103 104 118 100 103 97

MATRIX B :
97 98 99 100 101 102 103 115
97 100 98 97 115 98 100 104
98 97 115 110 100 98 97 115
100 98 97 115 100 118 98 97
115 118 100 98 118 97 115 98
100 97 98 115 100 118 97 115
118 100 104 103 97 115 100 104
119 97 103 104 118 100 103 97

Child process 1 started ...
Child process 2 started ...
Child process 3 started ...
SIGCHLD is caught
SIGCHLD is caught
SIGCHLD is caught
SIGCHLD is caught
Child process 4 started ...
SIGCHLD is caught

MATRIX C :
86271 81976 82945 85793 86646 86178 82848 85927
85614 81682 82298 84991 86139 85363 82446 85262
87616 83400 84640 87530 88132 87671 84280 87566
86619 82734 83561 86953 87122 87474 83516 86973
90703 86713 87315 89972 91328 90575 87522 90688
88644 84377 85328 88735 89134 89159 85267 88626
88469 84435 85515 88632 89036 89061 85358 89140
88713 84878 85523 88360 89235 88801 85701 88891

SINGULAR VALUES :
693007.981 1239.739 610.674 410.385 194.884 21.132 88.484 69.750
gokhan@has:~/Desktop/CSE344-SYSTEMS-PROGRAMMING/HW-03$
gokhan@has:~/Desktop/CSE344-SYSTEMS-PROGRAMMING/HW-03$
gokhan@has:~/Desktop/CSE344-SYSTEMS-PROGRAMMING/HW-03$
gokhan@has:~/Desktop/CSE344-SYSTEMS-PROGRAMMING/HW-03$
gokhan@has:~/Desktop/CSE344-SYSTEMS-PROGRAMMING/HW-03$
gokhan@has:~/Desktop/CSE344-SYSTEMS-PROGRAMMING/HW-03$
```

n is 3 example

```
gokhan@has: ~/Desktop/CSE344-SYSTEMS-PROGRAMMING/HW-03
gokhan@has:~/Desktop/CSE344-SYSTEMS-PROGRAMMING/HW-03$
gokhan@has:~/Desktop/CSE344-SYSTEMS-PROGRAMMING/HW-03$
gokhan@has:~/Desktop/CSE344-SYSTEMS-PROGRAMMING/HW-03$ ./program -i inputA -j inputB -n 4
Parent process started ...

ERROR ! There is not enough bytes in inputPathA : Input/output error
gokhan@has:~/Desktop/CSE344-SYSTEMS-PROGRAMMING/HW-03$
```

n is 4 example

They was sent in a separate folder to make the screenshots look better.