

YUSUF AKGÜL

CSE 344

Homework 4

1 Requirements

I have successfully implemented all the desired features in this homework. There is no warning that comes from -Wall flag or memory leak showed by valgrind including CTRL-C interruption signal.

2 Design Decisions

- a.) In this assignment I used unnamed semaphores to synchronization.
- b.) Since thread h read file one by one, there is a relationship between main thread and thread h, producer/consumer paradigm.
- c.) I used 3 unnamed semaphore in order to synchronization queue, sem full, sem empty and sem queue semaphores for producer/consumer paradigm.
- d.) I used 2 more unnamed semaphore(sem money and sem all students).I used the sem money semaphore to create a critical section while reading and changing money.I used sem all students semaphore to wait for main thread while all students are busy.
- e.) I created struct named student, in this struct, every student has her own special semaphore.I used this semaphore to wait while the student is not doing homework.
- f.) I created the int volatile style global variable. I am changing this variable when the ctrl-c signal arrives. I use this signal where necessary, and do the desired action. When CTRL-C is pressed, the program leaves whatever it is doing, and frees the memory created by returning to the machine as soon as possible.When the control c signal arrives, if some students doing homework that time, it waits for the students finish homework then terminate.

g.) I set the size of the queue as 4 (define SIZE 4).I started the SEM EMPTY semaphore with this number.But you can change it to whatever you want.
I set the size of the student array as 512 (define MAX STUDENT SIZE 512).But you can change it to whatever you want.
I have defined the length of student names to be a maximum of 256 characters.

3 Algorithms

Queue,H-Students-Main threads

I started the assignment by creating a queue.To show that reading from the file is finished, I put F, which means finish, to the queue.While the main thread is reading the queue, when F arrives, main thread understands that there are no more homework or no more coming homework.

I have created a student struct to keep students in this struct.This struct keeps the name of the student, the name of the student's school, the student's price, the student's speed, and the student's quality, how many homework the student has done and there is the available variable to check if it is available. If this variable is 1, the student is available. If 0, he is currently dealing with another homework.Also, I keep a semaphore to wait while there is no homework.

I created 3 arrays to sort them according to their properties, I kept the indexes in these arrays sorted according to the students' properties. While doing this I did not copy or change the places of the students. I just made the index order.

If all the students are full, I use a semaphore to wait for the main thread, sem student starts with the number of students and each student decreases by 1 when they are busy and increases when they are done, if the semaphore is 0, it is waiting for one of the students to available.

4 Input Outputs

I tried it with many different input files. The output below is the output given by the inputs given in homework pdf.

```
./main input1 input2 10000
5 students-for-hire threads have been created.
Name Q S C
odtulu 5 3 900
bogazicili 4 5 1000
itulu 4 4 800
ytulu 3 4 650
sakaryali 1 2 150
odtulu is waiting for a homework
itulu is waiting for a homework
bogazicili is waiting for a homework
ytulu is waiting for a homework
sakaryali is waiting for a homework
H has a new homework C; remaining money is 10000TL
H has a new homework S; remaining money is 10000TL
H has a new homework Q; remaining money is 10000TL
H has a new homework C; remaining money is 10000TL
sakaryali is solving homework C for 150, H has 9850TL left.
H has a new homework S; remaining money is 9850TL
bogazicili is solving homework S for 1000, H has 8850TL left.
H has a new homework Q; remaining money is 8850TL
odtulu is solving homework Q for 900, H has 7950TL left.
H has a new homework C; remaining money is 7950TL
ytulu is solving homework C for 650, H has 7300TL left.
H has a new homework S; remaining money is 7300TL
itulu is solving homework S for 800, H has 6500TL left.
H has a new homework Q; remaining money is 6500TL
H has a new homework C; remaining money is 6500TL
bogazicili is waiting for a homework
bogazicili is solving homework Q for 1000, H has 5500TL left.
H has a new homework S; remaining money is 5500TL
ytulu is waiting for a homework
ytulu is solving homework C for 650, H has 4850TL left.
bogazicili is waiting for a homework
itulu is waiting for a homework
bogazicili is solving homework S for 1000, H has 3850TL left.
H has a new homework C; remaining money is 3850TL
H has a new homework Q; remaining money is 3850TL
itulu is solving homework Q for 800, H has 3050TL left.
H has a new homework S; remaining money is 3050TL
odtulu is waiting for a homework
odtulu is solving homework C for 900, H has 2150TL left.
H has a new homework C; remaining money is 2150TL
bogazicili is waiting for a homework
bogazicili is solving homework S for 1000, H has 1150TL left.
H has a new homework S; remaining money is 1150TL
sakaryali is waiting for a homework
sakaryali is solving homework C for 150, H has 1000TL left.
H has a new homework S; remaining money is 1000TL
ytulu is waiting for a homework
ytulu is solving homework Q for 650, H has 350TL left.
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H has a new homework C; remaining money is 350TL
itulu is waiting for a homework
There is not enough money for available students, closing.
H has no enough money for homeworks, terminating.
Homeworks solved and money made by the students:
odtulu 2 1800
bogazicili 4 4000
itulu 2 1600
ytulu 3 1950
sakaryali 2 300
Total cost for 13 homeworks 9650TL
Money left at G's account: 350TL

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Testing control c signal.

```

./main input1 input2 10000
5 students-for-hire threads have been created.
Name Q S C
odtulu 5 3 900
bogazicili 4 5 1000
itulu 4 4 800
ytulu 3 4 650
sakaryali 1 2 150
odtulu is waiting for a homework
bogazicili is waiting for a homework
itulu is waiting for a homework
ytulu is waiting for a homework
sakaryali is waiting for a homework
H has a new homework C; remaining money is 10000TL
H has a new homework S; remaining money is 10000TL
H has a new homework Q; remaining money is 10000TL
H has a new homework C; remaining money is 10000TL
sakaryali is solving homework C for 150, H has 9850TL left.
H has a new homework S; remaining money is 9850TL
bogazicili is solving homework S for 1000, H has 8850TL left.
H has a new homework Q; remaining money is 8850TL
odtulu is solving homework Q for 900, H has 7950TL left.
ytulu is solving homework C for 650, H has 7300TL left.
H has a new homework C; remaining money is 7300TL
H has a new homework S; remaining money is 7300TL
itulu is solving homework S for 800, H has 6500TL left.
H has a new homework Q; remaining money is 6500TL
H has a new homework C; remaining money is 6500TL
bogazicili is waiting for a homework
bogazicili is solving homework Q for 1000, H has 5500TL left.
H has a new homework S; remaining money is 5500TL
itulu is waiting for a homework
ytulu is waiting for a homework
ytulu is solving homework C for 650, H has 4850TL left.
bogazicili is waiting for a homework
bogazicili is solving homework S for 1000, H has 3850TL left.
H has a new homework C; remaining money is 3850TL
itulu is solving homework Q for 800, H has 3050TL left.
H has a new homework Q; remaining money is 3050TL
H has a new homework S; remaining money is 3050TL
^CTermination signal received, closing.
Homeworks solved and money made by the students:

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odtulu 1 900
bogazicili 3 3000
itulu 2 1600
ytulu 2 1300
sakaryali 1 150
Total cost for 9 homeworks 6950TL
Money left at G's account: 3050TL

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Testing the performance of all homework. (100000 money)

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./main input1 input2 100000
5 students-for-hire threads have been created.
Name Q S C
odtulu 5 3 900
bogazicili 4 5 1000
itulu 4 4 800
ytulu 3 4 650
sakaryali 1 2 150
odtulu is waiting for a homework
bogazicili is waiting for a homework
ytulu is waiting for a homework
sakaryali is waiting for a homework
H has a new homework C; remaining money is 100000TL
itulu is waiting for a homework
H has a new homework S; remaining money is 100000TL
H has a new homework Q; remaining money is 100000TL
sakaryali is solving homework C for 150, H has 99850TL left.
H has a new homework C; remaining money is 99850TL
H has a new homework S; remaining money is 99850TL
H has a new homework Q; remaining money is 99850TL
bogazicili is solving homework S for 1000, H has 98850TL left.
odtulu is solving homework Q for 900, H has 97950TL left.
H has a new homework C; remaining money is 97950TL
ytulu is solving homework C for 650, H has 97300TL left.
H has a new homework S; remaining money is 97300TL
itulu is solving homework S for 800, H has 96500TL left.
H has a new homework Q; remaining money is 96500TL
H has a new homework C; remaining money is 96500TL
bogazicili is waiting for a homework
bogazicili is solving homework Q for 1000, H has 95500TL left.
H has a new homework S; remaining money is 95500TL
ytulu is waiting for a homework
ytulu is solving homework C for 650, H has 94850TL left.
H has a new homework C; remaining money is 94850TL
itulu is waiting for a homework
bogazicili is solving homework S for 1000, H has 93850TL left.
bogazicili is waiting for a homework
itulu is solving homework Q for 800, H has 93050TL left.
H has a new homework Q; remaining money is 93050TL
H has a new homework S; remaining money is 93050TL
odtulu is waiting for a homework
odtulu is solving homework C for 900, H has 92150TL left.
H has a new homework C; remaining money is 92150TL
bogazicili is waiting for a homework
bogazicili is solving homework S for 1000, H has 91150TL left.
H has a new homework S; remaining money is 91150TL
sakaryali is waiting for a homework

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sakaryali is solving homework C for 150, H has 91000TL left.
 H has a new homework S; remaining money is 91000TL
 ytulu is waiting for a homework
 ytulu is solving homework Q for 650, H has 90350TL left.
 H has a new homework C; remaining money is 90350TL
 itulu is waiting for a homework
 itulu is solving homework S for 800, H has 89550TL left.
 bogazicili is waiting for a homework
 bogazicili is solving homework C for 1000, H has 88550TL left.
 H has a new homework Q; remaining money is 88550TL
 H has a new homework S; remaining money is 88550TL
 bogazicili is waiting for a homework
 bogazicili is solving homework S for 1000, H has 87550TL left.
 H has a new homework C; remaining money is 87550TL
 odtulu is waiting for a homework
 odtulu is solving homework S for 900, H has 86650TL left.
 H has a new homework Q; remaining money is 86650TL
 ytulu is waiting for a homework
 ytulu is solving homework C for 650, H has 86000TL left.
 H has a new homework C; remaining money is 86000TL
 itulu is waiting for a homework
 itulu is solving homework Q for 800, H has 85200TL left.
 H has a new homework Q; remaining money is 85200TL
 bogazicili is waiting for a homework
 bogazicili is solving homework S for 1000, H has 84200TL left.
 H has a new homework Q; remaining money is 84200TL
 bogazicili is waiting for a homework
 bogazicili is solving homework C for 1000, H has 83200TL left.
 H has a new homework Q; remaining money is 83200TL
 sakaryali is waiting for a homework
 sakaryali is solving homework Q for 150, H has 83050TL left.
 H has a new homework S; remaining money is 83050TL
 ytulu is waiting for a homework
 ytulu is solving homework C for 650, H has 82400TL left.
 H has a new homework C; remaining money is 82400TL
 itulu is waiting for a homework
 itulu is solving homework Q for 800, H has 81600TL left.
 H has a new homework S; remaining money is 81600TL
 bogazicili is waiting for a homework
 bogazicili is solving homework Q for 1000, H has 80600TL left.
 H has a new homework C; remaining money is 80600TL
 odtulu is waiting for a homework
 odtulu is solving homework Q for 900, H has 79700TL left.
 H has a new homework S; remaining money is 79700TL
 bogazicili is waiting for a homework
 bogazicili is solving homework S for 1000, H has 78700TL left.
 H has a new homework S; remaining money is 78700TL
 ytulu is waiting for a homework
 ytulu is solving homework C for 650, H has 78050TL left.
 H has a new homework C; remaining money is 78050TL
 itulu is waiting for a homework
 itulu is solving homework S for 800, H has 77250TL left.
 H has a new homework S; remaining money is 77250TL
 bogazicili is waiting for a homework
 bogazicili is solving homework C for 1000, H has 76250TL left.
 H has a new homework C; remaining money is 76250TL
 bogazicili is waiting for a homework

bogazicili is solving homework S for 1000, H has 75250TL left.
 H has a new homework S; remaining money is 75250TL
 sakaryali is waiting for a homework
 sakaryali is solving homework S for 150, H has 75100TL left.
 H has a new homework C; remaining money is 75100TL
 odtulu is waiting for a homework
 odtulu is solving homework C for 900, H has 74200TL left.
 H has a new homework C; remaining money is 74200TL
 ytulu is waiting for a homework
 ytulu is solving homework S for 650, H has 73550TL left.
 H has a new homework S; remaining money is 73550TL
 itulu is waiting for a homework
 itulu is solving homework C for 800, H has 72750TL left.
 H has a new homework C; remaining money is 72750TL
 bogazicili is waiting for a homework
 bogazicili is solving homework S for 1000, H has 71750TL left.
 H has a new homework C; remaining money is 71750TL
 bogazicili is waiting for a homework
 bogazicili is solving homework C for 1000, H has 70750TL left.
 H has no other homeworks, terminating.
 ytulu is waiting for a homework
 ytulu is solving homework C for 650, H has 70100TL left.
 itulu is waiting for a homework
 itulu is solving homework S for 800, H has 69300TL left.
 bogazicili is waiting for a homework
 bogazicili is solving homework C for 1000, H has 68300TL left.
 odtulu is waiting for a homework
 odtulu is solving homework C for 900, H has 67400TL left.
 bogazicili is waiting for a homework
 No more homeworks left or coming in, closing.
 Homeworks solved and money made by the students:
 odtulu 6 5400
 bogazicili 15 15000
 itulu 8 6400
 ytulu 8 5200
 sakaryali 4 600
 Total cost for 41 homeworks 32600TL
 Money left at G's account: 67400TL