Report HW4
System Programming

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Problem Definition

While Reading a file with a thread, Doing some operations with other multiple threads, Cheating Student problem details in the homework pdf.

Design Decision

Since the thread mutexes are not allowed I used semaphores. And we have reader writer problem here. Such as adding elements to queue or deleting elements from queue when we do these operations we should protect the operations in case of deadlocks. In my main thread firstly I read all students form file and create the related threads until these operations are done main wait for it when it reaches end of the file for student path I post the semaphore and we can start by reading the homework from homework file for after that it starts to give jobs to threads

Beginning of the infinite loop first I check the available student number if there is not available student it waits until one of them available then it checks the number of homework and if there is no homework it waits to get one then it continues and takes beginning of the queue and delete that from queue then according to homework it choose a student from student array and takes its index then again in a protected area i do my operations make student busy and increase the quantity students money number of homework and update the cheater student money and then i post the semaphore of the chosen student so other threads wait until i post their semaphores, and homework money checks are they enough or all homework has done then it waits semaphore to cureent student post the information what homework he is doing

In the student-for-hired thread i send the students as argument so i keep hw information within the student, it waits post operation from main for the realted student then it prints the "...is solving homework .. for .. H has..." after that it post the semaphore so the statement has been printed and main can give a homework to next student then for that thread sleeps and when the sleeping operation done it makes its busy 0 so that student can get new homework and also post the total available students.

You can see the outputs below

For all homework done, for insufficient money, for termination signal, for valgrind leak check

```
[anonxx@eXmachina hw4]$ ./a.out homeworkFilePath studentsFilePath 10000
5 students-for-hire threads have been created.
Name Q S C
bogazicili 4 5 1000
odtulu 5 3 900
itulu 4 4 800
ytulu 3 4 650
sakaryali 1 2 150
bogazicili is waiting for a homework
odtulu 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 9850TL
H has a new homework Q; remaining money is 9850TL
H has a new homework C; remaining money is 9850TL
H has a new homework S; remaining money is 9850TL
H has no other homeworks, terminating.
sakaryali is solving homework C for 150, H has 9850 left.
bogazicili is solving homework S for 1000, H has 8850 left.
odtulu is solving homework Q for 900, H has 7950 left.
ytulu is solving homework C for 650, H has 7300 left.
itulu is solving homework S for 800, H has 6500 left.
No more homeworks left or coming in, closing.


Homeworks solved and money made by students:
bogazicili 1 1000
odtulu 1 900
itulu 1 800
ytulu 1 650
sakaryali 1 150
Total cost for 5 homeworks 3500TL
Money left at G's account: 6500TL
[anonxx@eXmachina hw4]$
```

```
H has a new homework C; remaining money is 850TL
H has a new homework Q; remaining money is 850TL
H has a new homework C; remaining money is 850TL
H has a new homework Q; remaining money is 850TL
H has a new homework Q; remaining money is 850TL
H has a new homework Q; remaining money is 850TL
H has a new homework S; remaining money is 850TL
H has a new homework C; remaining money is 850TL
H has a new homework S; remaining money is 850TL
H has a new homework C; remaining money is 850TL
H has a new homework S; remaining money is 850TL
H has a new homework S; remaining money is 850TL
H has a new homework C; remaining money is 850TL
H has a new homework S; remaining money is 850TL
H has a new homework C; remaining money is 850TL
sakaryali is solving homework C for 150, H has 850 left.
H has a new homework S; remaining money is 850TL
H has a new homework C; remaining money is 850TL
H has a new homework C; remaining money is 850TL
H has a new homework S; remaining money is 850TL
H has a new homework C; remaining money is 850TL
H has a new homework C; remaining money is 850TL
H has no more money for homeworks, terminating.
H has no other homeworks, terminating.


Homeworks solved and money made by students:
bogazicili 0 0
odtulu 0 0
itulu 0 0
ytulu 0 0
sakaryali 1 150
Total cost for 1 homeworks 150TL
Money left at G's account: 850TL
[anonxx@eXmachina hw4]$
```

```
H has a new homework C; remaining money is 9850TL
sakaryali is solving homework C for 150, H has 9850 left.
H has a new homework Q; remaining money is 9850TL
H has a new homework Q; remaining money is 9850TL
H has a new homework Q; remaining money is 8850TL
H has a new homework S; remaining money is 8850TL
H has a new homework C; remaining money is 8850TL
H has a new homework S; remaining money is 8850TL
H has a new homework C; remaining money is 8850TL
H has a new homework S; remaining money is 8850TL
H has a new homework S; remaining money is 8850TL
H has a new homework C; remaining money is 8850TL
H has a new homework S; remaining money is 8850TL
H has a new homework C; remaining money is 8850TL
H has a new homework S; remaining money is 8850TL
H has a new homework C; remaining money is 8850TL
H has a new homework C; remaining money is 8850TL
H has a new homework S; remaining money is 8850TL
H has a new homework C; remaining money is 8850TL
H has a new homework C; remaining money is 8850TL
H has no other homeworks, terminating.
bogazicili is solving homework S for 1000, H has 8850 left.
odtulu is solving homework Q for 900, H has 7950 left.
ytulu is solving homework C for 650, H has 7300 left.
itulu is solving homework S for 800, H has 6500 left.
bogazicili is waiting for a homework
bogazicili is solving homework Q for 1000, H has 5500 left.
ytulu is waiting for a homework
itulu is waiting for a homework
ytulu is solving homework C for 650, H has 4850 left.
bogazicili is waiting for a homework
itulu is solving homework S for 800, H has 4050 left.
bogazicili is solving homework Q for 1000, H has 3050 left.
odtulu is waiting for a homework
odtulu is solving homework C for 900, H has 2150 left.
bogazicili is waiting for a homework
bogazicili is solving homework S for 1000, H has 1150 left.
^CTermination signal received, closing.
[anonxx@eXmachina hw4]$ 
```

```
itulu is solving homework Q for 800, H has 5200 left.
bogazicili is waiting for a homework
bogazicili is solving homework S for 1000, H has 4200 left.
bogazicili is waiting for a homework
bogazicili is solving homework C for 1000, H has 3200 left.
sakaryali is waiting for a homework
sakaryali is solving homework Q for 150, H has 3050 left.
ytulu is waiting for a homework
ytulu is solving homework C for 650, H has 2400 left.
itulu is waiting for a homework
itulu is solving homework Q for 800, H has 1600 left.
bogazicili is waiting for a homework
bogazicili is solving homework Q for 1000, H has 600 left.
odtulu is waiting for a homework
H has no more money for homeworks, terminating.


Homeworks solved and money made by students:
bogazicili 9 9000
odtulu 3 2700
itulu 5 4000
ytulu 5 3250
sakaryali 3 450
Total cost for 25 homeworks 19400TL
Money left at G's account: 600TL
==44470==
==44470== HEAP SUMMARY:
==44470==     in use at exit: 0 bytes in 0 blocks
==44470==   total heap usage: 53 allocs, 53 frees, 12,464 bytes allocated
==44470==
==44470== All heap blocks were freed -- no leaks are possible
==44470==
==44470== For lists of detected and suppressed errors, rerun with: -s
==44470== ERROR SUMMARY: 0 errors from 0 contexts (suppressed: 0 from 0)
```

The Requirements I have achieved

It provides all requirements I tried the rules below and they worked properly on my computer

1. No compilation error

2. No compilation warning

3. *Makefile*

4. *Report in Latex format*

5. Printed usage information in case of missing or invalid argument

6. Program did not crashed

7. No memory leaks

8. No zombie process

9. No deadlock

10. No poor synchronization

11. Submitted on time

12. Informed user in case of system errors

The Requirements I have failed

None