CSE 344 System Programming

Midterm

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SUMMARY

In the midterm assignment we were given the task to simulate a vaccination clinic using a multi-process design. To solve synchronization and data sharing issues in the assignment I used 3 Semaphores, 3 shared memories and FIFOs for each citizen and vaccinator. These 3 group of semaphores and shared memories are,

file_shm: To make nurse processes cooperate while reading input file, program stores a program counter like integer to jump to the location the last nurse read the file at, using fseek function.

file_sem: The semaphore to synchronize read/write operations of its shared memory.

buffer_shm: The buffer as described in the assignment. It can have a size at least t*c + 1 as requested. It stores its values as chars. Nurses puts the read characters directly here without making any modifications.

buffer_sem: The semaphore to synchronize read/write operations of its shared memory.

records_shm: This memory acts as clinic database. It stores the minimum required information to organize vaccination order etc. It stores the pids of citizens and how many times have they been vaccinated. Using this memory, program can find the oldest process and give priority in vaccination queue.

records_sem: The semaphore to synchronize read/write operations of its shared memory.

As described above I implemented the bonus part. The program considers the age of the process and how many shots did the process get vaccinated. For instance, if program faces two processes with different amount of vaccinations it will take the one with less shots. If two processes have received same amount of shots it will get the one which is older. By this way always if a process is getting its nth vaccine, the other processes can get at most their (n-1)th vaccination.

I printed to stderr and error exited program in the exception situations as much as I could. I implemented a signal handler using SIGUSR1 to let children processes to signal mother process to SIGKILL all its children process and terminate the program safely in error situations if any child process faces.

TESTS

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user@ubuntu:~/Desktop/cse_344/midterm$ ./midterm -n 3 -v 3 -c 5 -t 3 -b 16 -i vactest
Welcome to the GTU 344 clinic. Number of citizens to vaccinate c = 5 with t = 3 doses.
Nurse pid = 19073 has brought vaccine 1: the clinic has 1 vaccine 1 and 0 vaccine 2
Nurse pid = 19073 has brought vaccine 1: the clinic has 2 vaccine 1 and 0 vaccine 2
Nurse pid = 19073 has brought vaccine 1: the clinic has 3 vaccine 1 and 0 vaccine 2
Nurse pid = 19073 has brought vaccine 1: the clinic has 4 vaccine 1 and 0 vaccine 2
Nurse pid = 19073 has brought vaccine 1: the clinic has 5 vaccine 1 and 0 vaccine 2
Nurse pid = 19073 has brought vaccine 2: the clinic has 5 vaccine 1 and 1 vaccine 2
Nurse pid = 19073 has brought vaccine 1: the clinic has 6 vaccine 1 and 1 vaccine 2
Nurse pid = 19073 has brought vaccine 2: the clinic has 6 vaccine 1 and 2 vaccine 2
Nurse pid = 19073 has brought vaccine 1: the clinic has 7 vaccine 1 and 2 vaccine 2
Nurse pid = 19073 has brought vaccine 2: the clinic has 7 vaccine 1 and 3 vaccine 2
Nurse pid = 19073 has brought vaccine 1: the clinic has 8 vaccine 1 and 3 vaccine 2
Nurse pid = 19074 has brought vaccine 1: the clinic has 9 vaccine 1 and 3 vaccine 2
Nurse pid = 19074 has brought vaccine 1: the clinic has 10 vaccine 1 and 3 vaccine 2
Nurse pid = 19074 has brought vaccine 1: the clinic has 11 vaccine 1 and 3 vaccine 2
Nurse pid = 19074 has brought vaccine 1: the clinic has 12 vaccine 1 and 3 vaccine 2
Nurse pid = 19074 has brought vaccine 2: the clinic has 12 vaccine 1 and 4 vaccine 2
Vaccinator pid = 19077 is inviting citizen pid = 19079 to the clinic.
Nurse pid = 19073 has brought vaccine 2: the clinic has 11 vaccine 1 and 4 vaccine 2
Nurse pid = 19073 has brought vaccine 2: the clinic has 11 vaccine 1 and 5 vaccine 2
Vaccinator pid = 19076 is inviting citizen pid = 19080 to the clinic.
Vaccinator pid = 19078 is inviting citizen pid = 19081 to the clinic.
Citizen pid = 19081 is vaccinated for the 1st time. The clinic has 9 vaccine 1 and 4 vaccine 2
Citizen pid = 19079 is vaccinated for the 1st time. The clinic has 9 vaccine 1 and 4 vaccine 2
Citizen pid = 19080 is vaccinated for the 1st time. The clinic has 9 vaccine 1 and 4 vaccine 2
Nurse pid = 19073 has brought vaccine 2: the clinic has 9 vaccine 1 and 4 vaccine 2
Nurse pid = 19073 has brought vaccine 2: the clinic has 9 vaccine 1 and 5 vaccine 2
Nurse pid = 19073 has brought vaccine 2: the clinic has 9 vaccine 1 and 6 vaccine 2
Nurse pid = 19073 has brought vaccine 1: the clinic has 10 vaccine 1 and 6 vaccine 2
Vaccinator pid = 19078 is inviting citizen pid = 19082 to the clinic.
Citizen pid = 19082 is vaccinated for the 1st time. The clinic has 9 vaccine 1 and 5 vaccine 2
Nurse pid = 19073 has brought vaccine 2: the clinic has 9 vaccine 1 and 6 vaccine 2
Nurse pid = 19073 has brought vaccine 2: the clinic has 9 vaccine 1 and 7 vaccine 2
Vaccinator pid = 19076 is inviting citizen pid = 19083 to the clinic.
Nurse pid = 19073 has brought vaccine 1: the clinic has 9 vaccine 1 and 6 vaccine 2
Nurse pid = 19073 has brought vaccine 2: the clinic has 9 vaccine 1 and 7 vaccine 2
Vaccinator pid = 19078 is inviting citizen pid = 19079 to the clinic.
Citizen pid = 19079 is vaccinated for the 2nd time. The clinic has 8 vaccine 1 and 6 vaccine 2
Vaccinator pid = 19078 is inviting citizen pid = 19080 to the clinic.
Citizen pid = 19080 is vaccinated for the 2nd time. The clinic has 7 vaccine 1 and 5 vaccine 2
Vaccinator pid = 19078 is inviting citizen pid = 19081 to the clinic.
Nurse pid = 19074 has brought vaccine 2: the clinic has 6 vaccine 1 and 5 vaccine 2
Nurse pid = 19074 has brought vaccine 2: the clinic has 6 vaccine 1 and 6 vaccine 2
Nurse pid = 19074 has brought vaccine 2: the clinic has 6 vaccine 1 and 7 vaccine 2
Nurse pid = 19074 has brought vaccine 1: the clinic has 7 vaccine 1 and 7 vaccine 2
Nurse pid = 19074 has carried all vaccines to the buffer. It is terminating
Vaccinator pid = 19077 is inviting citizen pid = 19082 to the clinic.
Citizen pid = 19081 is vaccinated for the 2nd time. The clinic has 6 vaccine 1 and 6 vaccine 2
Vaccinator pid = 19078 is inviting citizen pid = 19083 to the clinic.
Nurse pid = 19075 has carried all vaccines to the buffer. It is terminating
Citizen pid = 19082 is vaccinated for the 2nd time. The clinic has 5 vaccine 1 and 5 vaccine 2
Nurse pid = 19073 has carried all vaccines to the buffer. It is terminating
Vaccinator pid = 19077 is inviting citizen pid = 19079 to the clinic.
Citizen pid = 19079 is vaccinated for the 3rd time. The clinic has 4 vaccine 1 and 4 vaccine 2
Citizen pid = 19079 is leaving. Remaining citizens to vaccinate 1
Citizen pid = 19083 is vaccinated for the 1st time. The clinic has 4 vaccine 1 and 4 vaccine 2
Citizen pid = 19083 is vaccinated for the 2nd time. The clinic has 4 vaccine 1 and 4 vaccine 2
Vaccinator pid = 19076 is inviting citizen pid = 19080 to the clinic.
Vaccinator pid = 19077 is inviting citizen pid = 19081 to the clinic.
Vaccinator pid = 19078 is inviting citizen pid = 19082 to the clinic.
Citizen pid = 19081 is vaccinated for the 3rd time. The clinic has 1 vaccine 1 and 1 vaccine 2
Vaccinator pid = 19077 is inviting citizen pid = 19083 to the clinic.
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Citizen pid = 19083 is vaccinated for the 3rd time. The clinic has 0 vaccine 1 and 0 vaccine 2
Vaccinator pid = 19077 has vaccinated 10 doses. All citizens have been vaccinated. It is terminating
Citizen pid = 19083 is leaving. Remaining citizens to vaccinate 0
Citizen pid = 19081 is leaving. Remaining citizens to vaccinate 0
Citizen pid = 19080 is vaccinated for the 3rd time. The clinic has 0 vaccine 1 and 0 vaccine 2
Citizen pid = 19080 is leaving. Remaining citizens to vaccinate 0
Vaccinator pid = 19076 has vaccinated 6 doses. All citizens have been vaccinated. It is terminating
Citizen pid = 19082 is vaccinated for the 3rd time. The clinic has 0 vaccine 1 and 0 vaccine 2
Citizen pid = 19082 is leaving. Remaining citizens to vaccinate 0
Vaccinator pid = 19078 has vaccinated 14 doses. All citizens have been vaccinated. It is terminating
The clinic is now closed. Stay healthy.