CSE 344 System Programming Midterm

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1 Problem Solving

The problem was basically mixed of producer consumer problem and dining philosophers problem. I take advantage of the solutions of these problems.

1.1 Accessing Shared Memories

Accessing to shared memories via nurse and vaccinators, done in critical regions.

1.2 Filling Shared Memories

Vaccinators and citizens need wait for the parent saves theirs pids to shared memories. After parent set shared memories, it allows vaccinators to start by increasing relevant semaphore.

1.3 Reading File Sequentially

Nurses read file sequentially by file lock.

1.4 Call Citizens By Age

Citizen invitations by age is done with signals. Citizens wait signal with sigsuspend, and vaccinators invite citizens by sending them a SIGUSR1 signal.

1.5 Buffer Overflow

Buffer overflow is handled by semaphore which indicates empty spaces.

1.6 2 Different Vaccines

For preventing the deadlock caused by one vaccinator pick vaccine1 and other pick vaccine2, this situation is handled by three semaphore; 1 for vaccinators that block other vaccinators also try to get vaccines, others for vaccines.

1.7 Parent Waits Vaccinations Done

Waiting of parent for all vaccinations complete is handled with one semaphores in loop. Every vaccinator check citizens before try to get vaccines, if all citizens are vaccinated then vaccinator increase this semaphore and exits.

2 Design Decisions

I used 3 POSIX shared memory, 7 POSIX named semaphore and 1 signal for controlling synchronization of processes.

2.1 Shared Memories

- buffer : it is used for hold vaccines.
- citizenBuffer : it is used for hold pid's of citizens and the last dose taken by citizens.
- vaccinatorBuffer : it is used for hold pid's of vaccinator and the amount of vacinated dose by vaccinator.

2.2 Semaphores

- empty : it is used for preventing to overflow of clinic buffer.
- memLock : it is used for create critical region for buffer.
- ready1 : it is used for tracking are there any vaccine1 dose.
- ready2 : it is used for tracking are there any vaccine2 dose.
- vaccinLock : it is used for preventing deadlock caused by one vaccinator take ready1 and the other vaccinator take ready2.
- citizenMemLock : it is used for create critical region for citizenBuffer.
- vaccinateDone : it is used for tracking the all vaccinations are done.

2.3 Signals

- SIGUSR1: it is used for call citizens.

3 Achieved Requirements

- Buffer is protected against underflow and overflow.
- Race conditions are prevented.
- Multiple processes can read the input file sequentially.

- Both shots be ready before invite citizens to buffer.
- Citizens are vaccinated according to their ages.
- 7 semaphores are used.
- In case of CTRL-C all processes terminates.