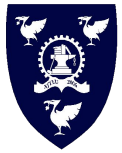

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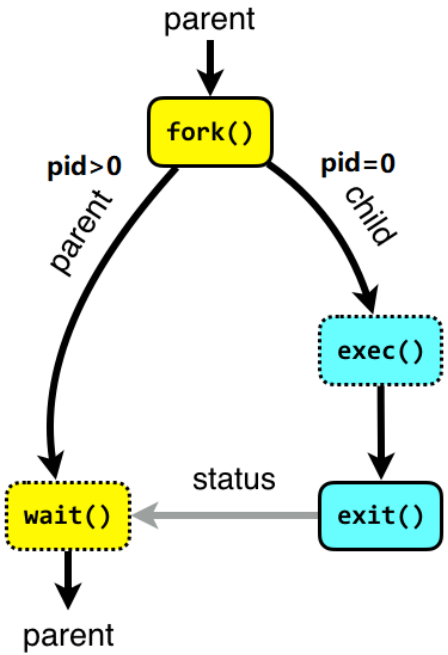
CPT104 Operating System Concepts

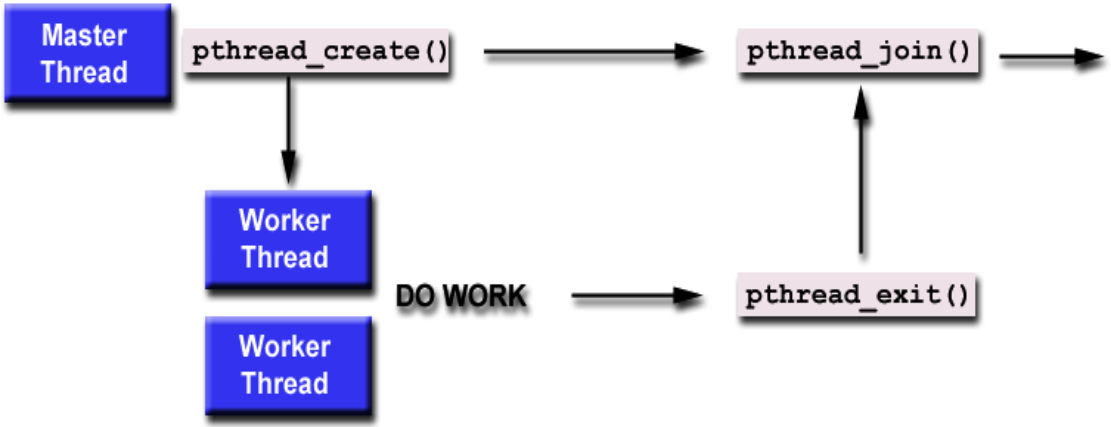
Review of OS API programming

Contents

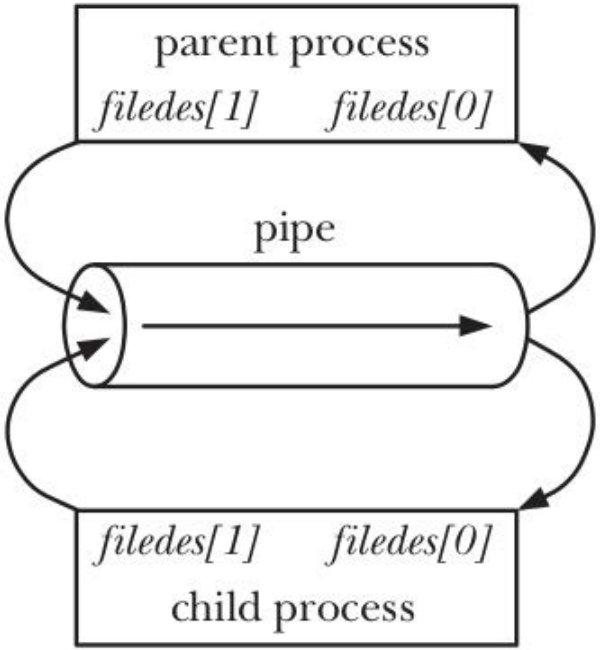
- Process/thread Management
- Inter Process Communication- Pipe
- POSIX semaphores
- Process scheduling
- Memory management
- Q&A

Process/thread Management

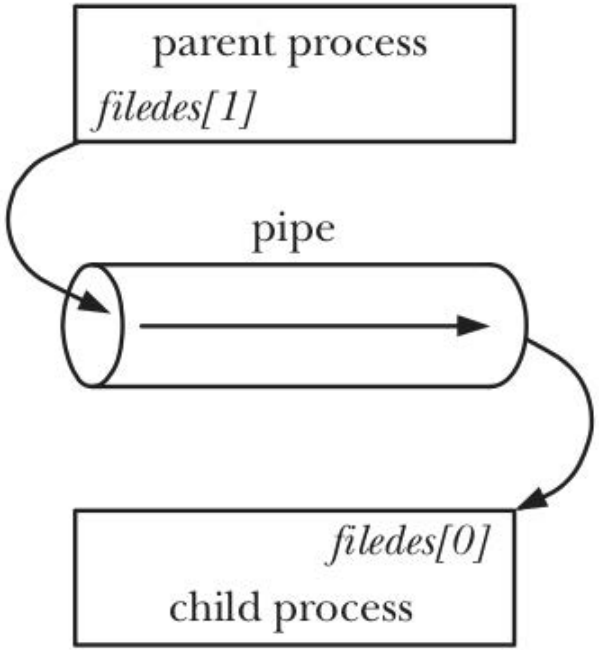




➢ Inter Process Communication- Pipe



a) After *fork()*



b) After closing unused descriptors

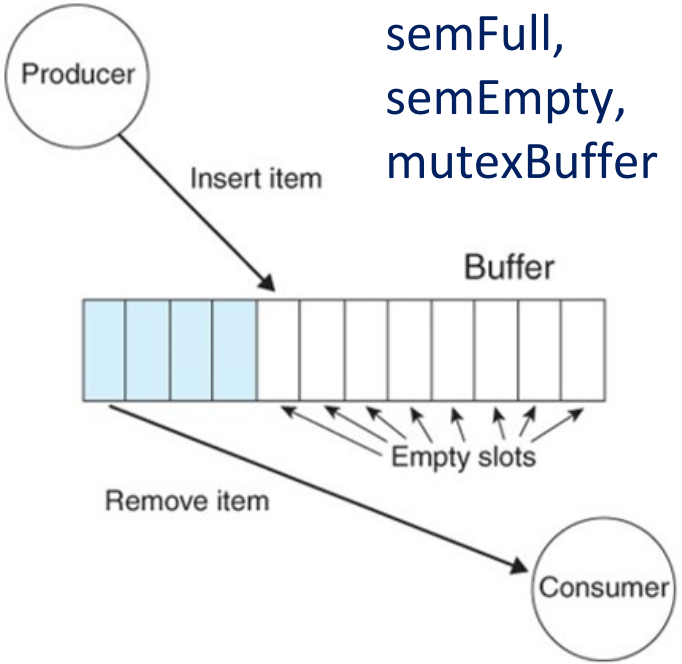
https://www.hitchhikersguidetolearning.com/2023/04/09/inter-process-communication-using-pipes-in-linux-user-space/

Inter Process Communication- Semaphores (1)

Process P

```
// Some code
P(s);
 // critical section
V(s);
 // remainder section
```

Mutual Exclusion
Critical section

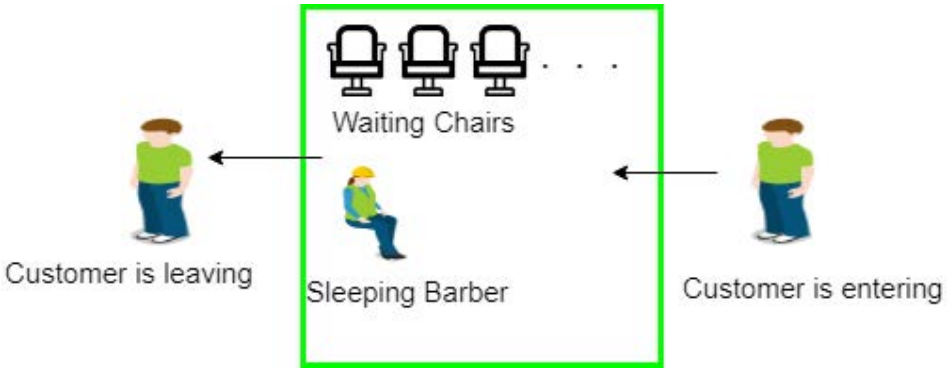


semFull,
semEmpty,
mutexBuffer

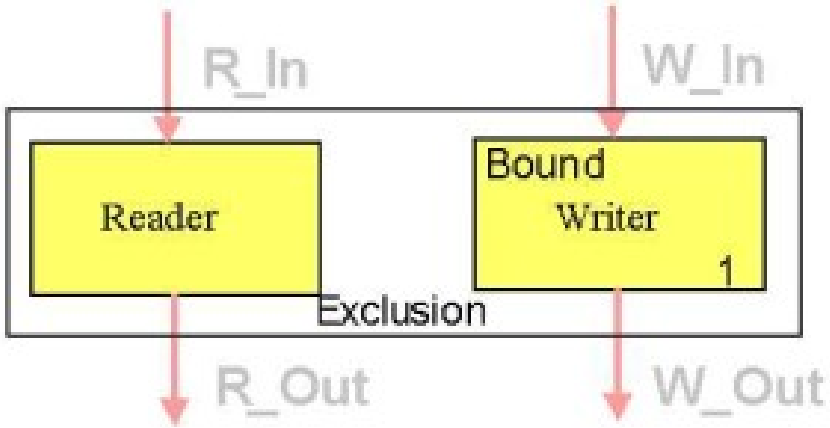
Produce-consumer problem

Inter Process Communication- Semaphores (2)

Semaphores:
customers , barbers , Seats



Sleeping Barber problem



readers-writers problem

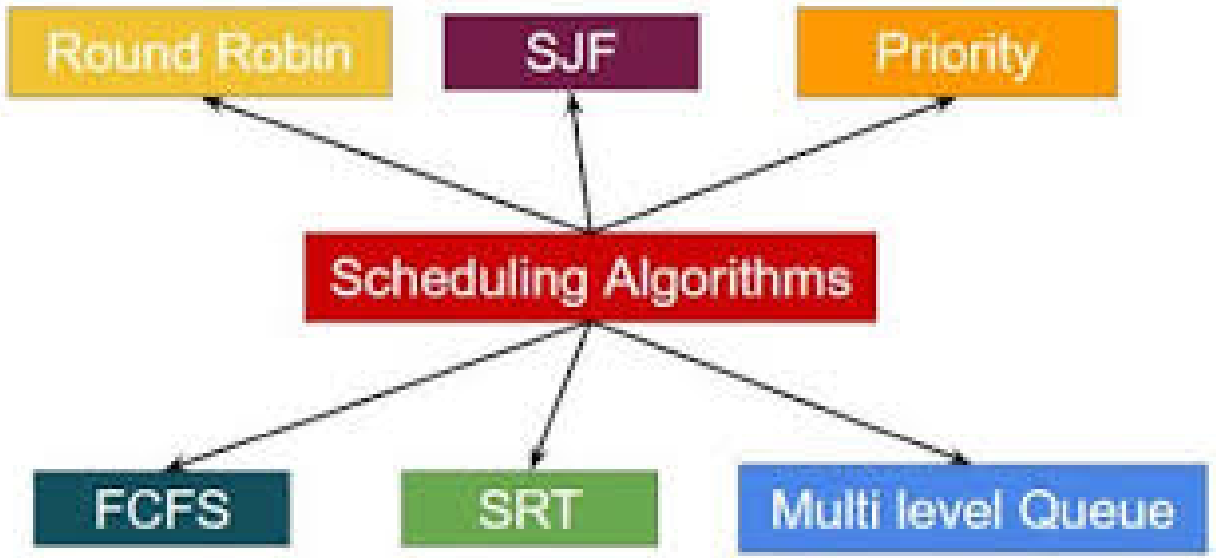
https://en.wikipedia.org/wiki/Sleeping_barber_problem

Inter Process Communication- Synchronization mechanisms

- **Semaphores:** used to control access to a shared resource by multiple processes or threads.
- **Mutexes:** These are used to protect shared resources by allowing only one thread to access the resource at a time.
- **Condition Variables:** Typically used with mutexes, allow threads to wait for a certain condition to become true before proceeding.
- **Spinlocks:** These are a type of lock that causes a thread trying to acquire it to simply wait in a loop ("spin") while repeatedly checking if the lock is available.

(reference book **chapter 11.6**)

Process scheduling



Memory management (1)

Contiguous memory allocation algorithms

- ✓ First-fit: Allocate the first hole that is big enough
- ✓ Best-fit: Allocate the smallest hole that is big enough; must search entire list
- ✓ Worst-fit: Allocate the largest hole; must also search entire list

- ❖ First-fit and best-fit better than worst-fit in terms of speed and storage utilization

Memory management (2)

Page replacement algorithms

- ✓ FIFO: oldest page in the front of the queue will be removed first
- ✓ LRU: the page that has been unused for the longest time will be removed.

Q&A

Q1: In the final exam do we have the same type c language problem as the past exam paper about process synchronization?

Ans: Same question type. Focus on IPC including pipe and semaphores.

Q2: what kinds of questions related to lab will appear in the final exam? Do we need to write code by hand on paper or in the final will only test concepts mentioned in the lab?

Ans: Refer to Q1. Basically, you are not required to write specific codes, questions are mainly about applications and understanding of OS principles, e.g. IPC.

Q&A

Tips on reviews and codes practice:

- ✓ Link the codes with corresponding OS principles
- ✓ Understand the purpose of defining variables, e.g. semaphores and mutex;
- ✓ Modify existing codes and consider consequences, e.g. initial value, changing code sequence, etc.

Office Hour: Monday afternoon, 4:00pm-6:00pm