CSE 451
Section

Thursday, October 30

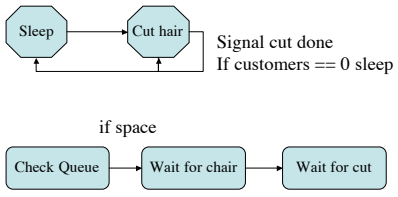
Questions from Lecture?

Questions from the Project?

Homeworks

- Barbershop Requirements:
  - Barber sleeps if no customers waiting
  - Customers leave if no chairs for waiting
  - Waiting customers can't leave until haircut done.
- Solution: we use semaphores
  - Mutex = 1
  - counting: barber_sleeping, customer_queue, cut_done

State Diagram



Barber Code

```
wait(mutex)
if (customers_waiting == 0) {
  signal(mutex);
  wait(barber_sleeping);
  wait(mutex);
}
customers_waiting--;
signal(mutex);
signal(customer_queue);
do_cut_hair();
signal(cut_done);
```

Customer Code

```
wait(mutex);
if (customers_waiting == n) {
   signal(mutex);
   return;
}
customers_waiting++;
if (customers_waiting == 1) {
  signal(barber_sleeping);
}
signal(mutex);
wait(customer_queue);
get_hair_cut();
wait(cut_done);
```

As a monitor

```
monitor barbershop {
  int num_waiting;
  condition get_cut;
  condition barber_asleep;
  condition in_chair;
  condition cut_done;
```

Barber routine

```
barber() {
    while (1);
      while (num_waiting == 0) {
        barber_asleep.wait();
      }
      customer_waiting.signal();
      in_chair.wait();
      give_hait_cut();
      cut_done.signal();
    }
```

Customer routine

```
 custome () {
   if (num_waiting == n) {
     return;
   }
   if (num_waiting == 0) {
     barber_asleep.signal();
   }
   customer_waiting.wait();
   in_char.signal();
   get_hair_cut();
   cut_done.wait();
 }
```

File access

- Requirements
  - Each file has a number N, and the sum of the PID's of the processes accessing the file must be <= N.
  - Processes wishing to access the file block until the file is available

File Monitor

```
monitor file_access {
  condition wake_up;
  int max_sum;
  int curr_sum
access(int pid) {
  while (curr_sum + pid > max_sum)
    wake_up.wait();
  curr_sum += pid;
  }
release(int pid) {
  curr_sum = curr_sum - pid;
  wake_up.broadcast();
}
```

What's wrong

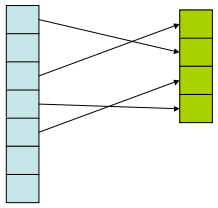
- How long can a process wait?
- What if the accesor doesn't want to wait?
- Do we need to wake everybody up every time?

Cigarette Smokers

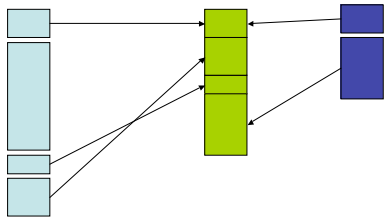
```
semaphore agent = 1;
sempahore tobacco_paper = 1;
sempahore paper_matches = 1;
sempahore matches_tobacco = 1;
agent() {
  while (1) {
    signal(paper_matches);
    wait(agent);
  }
}

tobacco_guy() {
  while(1) {
    wait(paper_matches);
    signal(agent);
  }
```

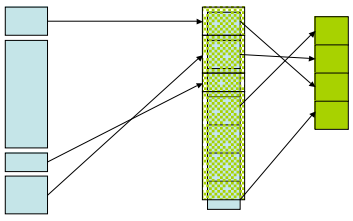
Memory Management - paging



Memory management - segments



Memory management - both



Why both?

Unixex bathroom (1)

```
monitor unisex_bathroom:
      int num_male_in;
      int num_female_in;
      condition male_wait;
      condition female_wait;
```

Men enter

```
male_enter() {
          while (num_female_in != 0) {
              male_wait.wait();
              }
              num_male_in++;
  }
male_exit() {
       num_male_in--;
       if (num_male_in == 0) {
          female_wait.broadcast();
      }
  }
```

Unixex bathroom (2)

```
monitor unisex_bathroom:
      int num_male_in;
      int num_female_in;
      int num_male_wait;
      int num_female_wait;
      condition male_wait;
      condition female_wait;
      boolean male_in;
```

Women

```
female_enter() {
  num_female_wait++;
  if (num_male_wait > 0)
    female_wait.wait();
  while (num_male_in != 0)
    female_wait.wait();
  num_female_wait--;
  num_female_in++;
  }
```