Threads II: Synchronization

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1 Administrivia

Announcements

Assignment

Read Chapter 6.

From Last Time

Introduction to threads.

Outline

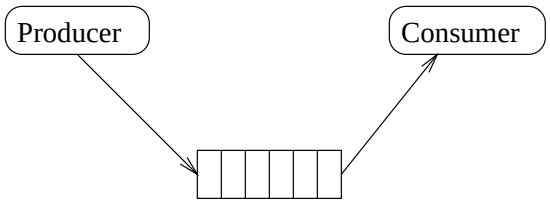
1. Thread Synchronization
2. Lab

Coming Up

Game2D case study.

2 Thread Synchronization

1. The Producer/Consumer problem:



   (a) Producer and Consumer work at different rates.

   (b) Fixed amount of buffering (queuing) between them.

   (c) With no synchronization, items can "disappear" or be multiply consumed.

2. A solution: the monitor.

   (a) Lock and condition variables.

   (b) A thread must secure the lock before executing within the monitor.

   (c) Once in the monitor, a thread checks its condition variables:

      i. Producer: queue full.

      ii. Consumer: queue empty.

      If the condition is false, the thread waits — exits the monitor and sleeps. When it awakes, it **must** recheck its condition.

   (d) Once a thread has modified state within the monitor, it will notify waiting threads, allowing them to recheck their conditions. (Must first re-obtain lock.)

3. Example:

```
class Queue
{
```

```
   private int val;
   private boolean full = false;
   private boolean empty = true;

   public Queue()
   {
      val = 0;
   }

   public synchronized void put(int v)
   {
      while (full)
         try
         {
            wait();
         }
         catch (Exception e)
         {
         }

      val = v;
      full = true;
      empty = false;
      notify();
   }

   public synchronized int get()
   {
      while (empty)
         try
         {
            wait();
         }
         catch (Exception e)
         {
         }

      full = false;
      empty = true;
      notify();
      return val;
   }
}
```

3 Lab