pthreads and the Dangers of Threading

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pthreads

• pthreads (POSIX threads) is a library for doing threading
• Can transparently be used under User or Kernel threads

POSIX

• Portable Operating System Interface
• Standard to unify the programs and system calls that many different OSes provide.

pthreads

#include <stdio.h>
#include <pthread.h>

void *do_stuff(void *p) {
    printf("Hello from thread %d\n", *(int *)p);
}

int main() {
    pthread_t thread;
    int id, arg1, arg2;
    arg1 = 1;
    id = pthread_create(&thread, NULL, do_stuff, (void *)&arg1);
    arg2 = 2;
    do_stuff((void *)&arg2);
    return 0;
}

Output
Hello from thread 2

Yield!

#include <stdio.h>
#include <pthread.h>

void *do_stuff(void *p) {
    printf("Hello from thread %d\n", *(int *)p);
}

int main() {
    pthread_t thread;
    int id, arg1, arg2;
    arg1 = 1;
    id = pthread_create(&thread, NULL, do_stuff, (void *)&arg1);
    pthread_yield();
    arg2 = 2;
    do_stuff((void *)&arg2);
    return 0;
}
Output

Hello from thread 1
Hello from thread 2

Hello from thread 2
Hello from thread 1

Compile

- Need the -pthread option to gcc
- Links in the library

```
gcc -o threadtest threadtest.c -pthread
```
Java Threads

class TestThread implements Runnable {
    private int x;
    public static void main(String[] args) {
        Thread t1 = new Thread(new TestThread(1));
        Thread t2 = new Thread(new TestThread(2));
        t1.start();
        t2.start();
    }
    public void run() {
        System.out.println("Hello from thread " + x);
    }
    public TestThread(int y) { x = y; }
}

Output

Hello from thread 1
Hello from thread 2

Race Condition

Shared Data:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>tail</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Enqueue:

- A[tail] = 20;
- tail++;
- A[tail] = 9;
- tail++;

Thread 0

Thread 1

Critical Regions

Synchronization

- Scheduling can be random and preemption can happen at any time
- Need some way to make critical regions “atomic”