

3. In a multithreaded process, what information needs to be private to a thread? What can be shared?

4. What are the major benefits of multithreading?

5. Explain concurrency and parallelism.

6. Describe how non-deterministic ordering can present problems in a multithreaded program.

7. In the example below, what are the possible outputs? What are the impossible outputs? What are these two threads sharing?

Thread 1
Print ABC

Thread 2
Print 123

8. In the example below, what are the possible results, assuming y is initially 10? What are these threads sharing?

Thread 1
 $x = y + 1$

Thread 2
 $y = y * 2$

9. In the example below, what are the possible results, assuming x is initially 0?

Thread 1
 $x = 0$
 $x++$

Thread 2
 $x = 0$
 $x--$

10. Explain what an atomic operation is.

11. In the example below, which thread finishes first? Is the winner guaranteed to print first?
What's required to ensure that one thread actually does finish first?

Thread A

```
i = 0
while (i < 10)
    i++
print "A done"
```

Thread B

```
i = 0
while (i > -10)
    i++
print "B done"
```

12. Explain why synchronization is necessary.