

## Homework 1

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### **1. What is the difference between an operating system and middleware?**

Operating systems uses features from, and is dependent on, the hardware. The middleware is the software that sits in between application programs and operating systems and is therefore dependent on features from the operating system to provide services to an application.

### **2. What is the relationship between threads and processes?**

A thread is defined as any singular sequence of programmed actions and is a basic unit of concurrency. While running a program, you create a process. A process consists of multiple threads and prevents unrelated threads from interfering with the current program that you are running.

### **3. Of all the topics previewed in chapter one of the textbook, which one are you most looking forward to learning about? Why?**

The topic that is most interesting to us is security. We had no idea that improper use/protection of threads causes security concerns. The book briefly mentions that when unrelated threads interact with each other, they end up causing security concerns. For example, multiple threads trying to access parts of storage that are confidential. Also, Denial of service hacks (for ex. Ransomware) are the result of thread switching (scheduling). During denial of service hacks, hackers run multiple threads to

compete with existing threads by using up resources. The way to combat this is by building independent resource containers.

4.

- a. Suppose the processor and disk work purely on thread A until its completion, and then the processor switches to thread B and runs all of that thread. What will the total elapsed time be?

Thread A = 11 milliseconds \* 100 iterations = 1100

milliseconds

Switch(A,B) = 1 millisecond

Thread B = 1000 milliseconds

Total: 1100 + 1 + 1000 = **2101 milliseconds or 2.101**

**seconds**

- b. Suppose the processor starts out working on thread A, but every time thread A performs a disk operation, the processor switches to B during the operation and then back to A upon the disk operation's completion. What will the total elapsed time be?

For loop (100x) {

THREAD A:

Function Performed	COST (milliseconds)
Switch(A,B)	1
Sleep();	10
Switch(B,A)	1
Execute command();	1

<b>TOTAL MILLISECONDS</b>	<b>13</b>
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}

THREAD B: Runs while thread A is sleeping.

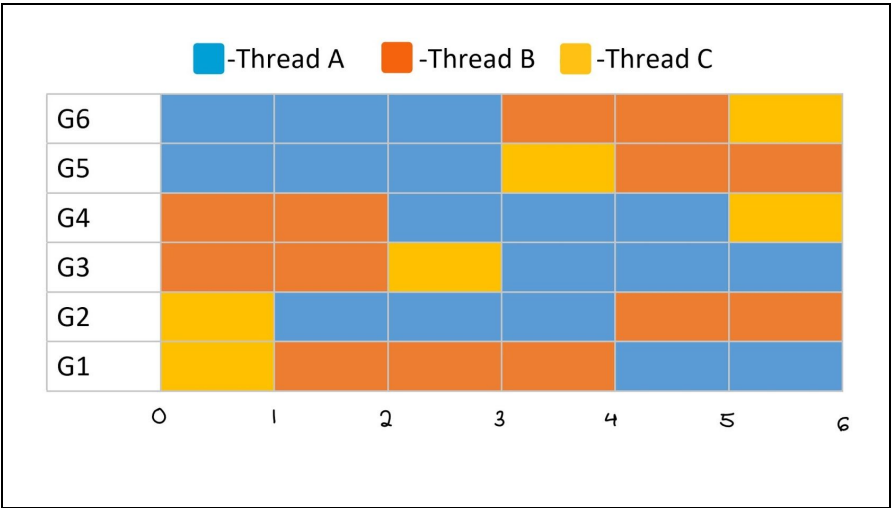
Function Performed	COST (milliseconds)
ThreadBRun()	10
<b>TOTAL MILLISECONDS</b>	<b>10</b>

100\*(10 + 1 +1 +1) = 1300 ms

c. In your opinion, which do you think is more efficient, and why?

In our opinion, the performance of B is more efficient. The processor was making use of Thread A's sleep period by switching to thread B.

6.



a. Average turnaround time for each thread and order:

	T1 Turnaround Time (s)	T2 Turnaround Time (s)	T3 Turnaround Time (s)	Average Turnaround Time (s)

G6 (3, 2, 1)	6	5	3	<b>4.67</b>
G5 (3, 1, 2)	4	6	3	<b>4.33</b>
G4 (2, 3, 1)	6	2	5	<b>4.33</b>
G3 (2, 1, 3)	3	2	6	<b>3.67</b>
G2 (1, 3, 2)	1	6	4	<b>3.67</b>
G1 (1, 2, 3)	1	3	6	<b>3.33</b>

b. G1 has the shortest turnaround time

c. Fixed priority scheduling- rate metabolic assignment