Practice Midterm Questions

Questions are drawn from any concept that has been covered in the book, lecture, recitation, quiz, programming assignment, or problem set.

1. **Match given definitions to the given terms**
    a. **see spreadsheet already on Moodle for possible terms**

2. **Multiple Choice: Select all that are true for each question**

    a. **What are the benefits of using a Virtual Machine?**
        i. **fault isolation within the kernel**
        ii. **multiple OS running on host**
        iii. **support different hardware than host**
        iv. **keeps OS from accessing hardware**
        v. **support GUI vs command line**

    b. **Which are the benefits of Multitasking?**
        i. **efficient use of CPU**
        ii. **fault isolation**
        iii. **support interactive programs**
        iv. **keep CPU from being idle**
        v. **only use cooperative task switching**

    c. **Which of the following are utilities used to manage LKMs?**
        i. **insmod**
        ii. **rmmod**
        iii. **lsmod**
        iv. **mkmod**
        v. **skmod**
        vi. **cdmod**

    d. **Which of the following are TRUE for LKMs**
        i. **no recompile of kernel is required to add new module**
        ii. **must register module with a major number**
        iii. **are added to kernel via inmod call**
        iv. **modules are run in user space**
        v. **no need for kernel source to build module**

    e. **Critical Section is where a cooperative process:**
        i. **accesses shared data**
        ii. **must yield the CPU**
        iii. **disables interrupts**
        iv. **must not access any shared data**

f. **What can be found in the /proc directory?**
   i. **a view of the operating system status**
   ii. **set of device drivers**
   iii. **file hierarchy for all system files**
   iv. **process code and data**

Other possible questions, could you answer a multiple choice about each one?

A mobile device OS must also manage which additional resource?

What is an interrupt?

How does the hardware support two modes of operations?

What is the difference between multi-programming and multi-tasking?

Race Conditions occur when two processes:

What is found within file of /proc?

What is found in /dev directory?

Which method of IPC has the highest overhead?

What is the bounded buffer problem?

what is the producer-consumer problem?

what is the reader-writer problem?

what is the dining philosopher problem?

why do we need process/thread synchronization?

what is required to solve the producer-consumer problem?

How do some OS solve deadlock problem?

Deadlock occurs when:

Starvation occurs when:

Semaphores are accessed through two atomic operations called:

Name of situation where two or more threads manipulate the same data?

Threads share the following ...

4. **Compare and Contrast (pick a or b) Only use the available space provided. Means you must be concise in your descriptions.**

    a. CPU Bound vs I/O Bound

    b. Concurrency vs Parallelism

    <u>Place answer below for either (a) or (b) Please only use the space provided</u>

5. **Compare and Contrast (pick a or b)**

    a. Producer-Consumer problem vs Reader-Writer problem

    b. Preemptive vs Cooperative

    <u>Place answer below for either (a) or (b) Please only use the space provided</u>

---- any two related concepts could be used as a pair

a. P() vs V()
b. Busy Waiting vs Blocking
c. DMA vs CPU data transfer
d. Sync vs Async I/O
e. describe the different states that a process can exist in at any given time
f. FCFS vs Priority (or Multi-level)

6. ***Consider the system described below. Describe in detail if the system is in deadlock. Show which processes are in deadlock or show the list of all possible execution orders of the processes (show your work on how you decided)***

	Allocation			Still Need			Max			Avail		
process	R1	R2	R3	R1	R2	R3	R1	R2	R3	R1	R2	R3
p1	0	1	0				3	5	1	2	0	1
p2	2	1	0				3	2	2			
p3	1	0	0				1	0	1			

7. ***Consider the system described below. Is the following sequence of process execution <P2, P4, P5, P3, P1> safe? (show your work on how you decided)***

	Allocation			Still Need			Max			Avail		
process	R1	R2	R3	R1	R2	R3	R1	R2	R3	R1	R2	R3
p1	0	1	0				7	5	3	3	3	2
p2	2	0	0				3	2	2			
p3	3	0	2				9	0	2			
p4	2	1	1				2	2	2			
p5	0	0	2				4	3	3			

8. **Consider the following table showing execution parameters for four processes. Using this information, answer each of the questions below and be sure to show your calculations.**

Process	Original Priority	Arrival Time	Execution Pattern	Deadline
P1	3	10	70 <20> 30	150
P2	2	70	10 <40> 10 <20> 20	220
P3	5	20	50 <10> 10 <20> 10	120
P4	1	30	110	320

Substitute any scheduling algorithm and any measurement calculation in the following question:

Show the Gantt chart for execution if the ???? scheduling algorithm is used with a time slice of 40. Calculate the average ????? time.

Show your calculation. You do not need to resolve to a single value. The following is a correct result:

(100 + 40 + 70 + 110)/ 4

- **Show Gantt chart for execution if the FCFS algorithm is used. Ignore priority, deadline, and the IO for this case. Calculate the average turnaround time.**

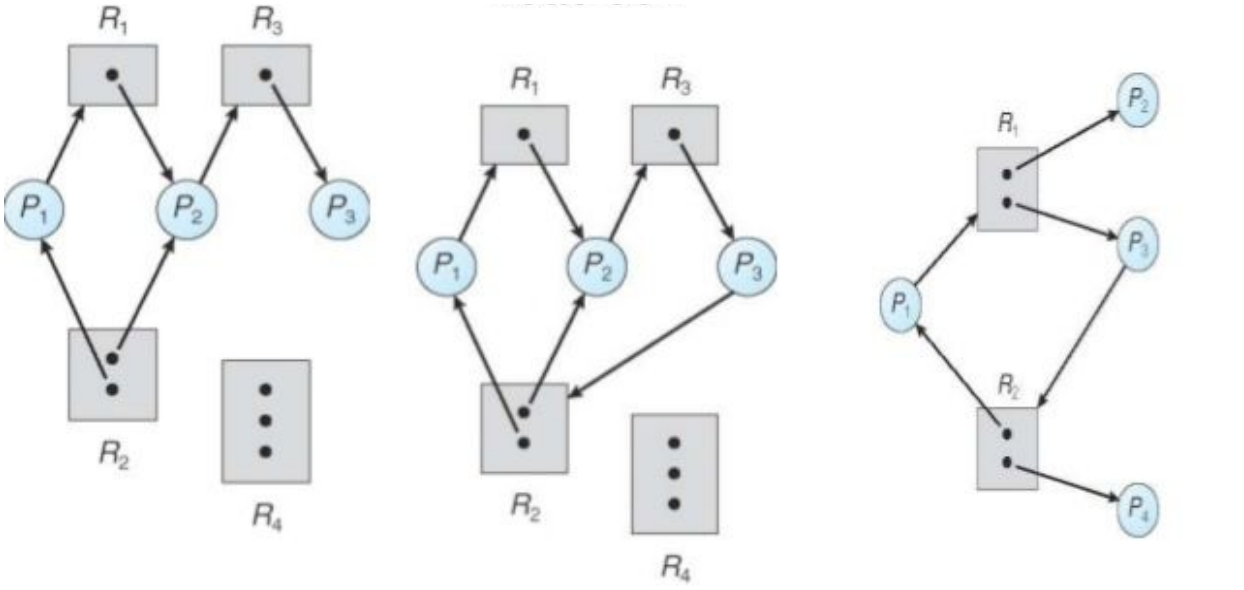
- **Show the Gantt chart for execution if the SJF (with preemption for shortest remaining time) algorithm is used. Again ignore priority, deadline, and the IO for this case. Calculate the average wait time.**

- **Show the Gantt chart for execution if the EDF (with preemption for earliest deadline) algorithm is used. Ignore priority and the IO for this case. Do each of the processes meet their deadline?**

- **Show the Gantt chart for execution if the RR algorithm is used with a time slice of 30. Ignore priority, deadline, and the IO for this case. Calculate the average response time.**

- **Show the Gantt chart for execution if the multi-level feedback queue scheduling algorithm is used with a time slice of 30. Ignore deadline for this case. Calculate the average response time.**

9. ***Is each of the graphs in a safe state?***



RESOURCE ALLOCATION GRAP

10. ***Suppose processes P0 and P1 share variable V1, and processes P1 and P2 share variable V2, while processes P0, P1 and P2 share V3. Operations on V1 are limited to increment() and decrement(). Operations on V2 are limited to square() and squareroot(). Operations on V3 are limited to sin() and cos(). Design a monitor-based solution that synchronizes access to and manipulation of these variables between the three processes so that race conditions are eliminated.***

11. ***Suppose we have 5 dining philosophers and 5 shared chopsticks, and that the philosophers are circularly deadlocked. Assume also that there are two serving spoons, one allocated to philosopher 1, and the other available. Assume that philosopher 4 wants a serving spoon. Show how this situation can be modeled according to the various data structures, e.g. Allocation and Request matrices, used in the Deadlock detection algorithm. Run the Deadlock detection algorithm on your model to prove that the dining philosophers are in deadlock.***