Philadelphia University Faculty of Engineering Department of Computer Engineering		Date:- 13/05/2015 Allowed time:- 60 minutes

Operating Systems (630422) Second Exam

Student Name: - ……………………………………………….................. ID: - ……………………………

Question 1: choose the correct answer of the following: 10 points

1. ____ is the number of processes that are completed per time unit.
   A) CPU utilization B) Response time C) Turnaround time D) Throughput

2. ______ allows a thread to run on only one processor.
   A) Processor affinity B) Processor set C) NUMA D) Load balancing

3. __________ involves the decision of which kernel thread to schedule onto which CPU.
   A) Process-contention scope B) System-contention scope
   C) Dispatcher D) Round-robin scheduling

4. A significant problem with priority scheduling algorithms is _____.
   A) complexity B) determining the length of the next CPU burst
   C) starvation D) determining the length of the time quantum

5. The two general approaches to load balancing are __________ and ____________.
   A) soft affinity, hard affinity B) coarse grained, fine grained
   C) soft real-time, hard real-time D) push migration, pull migration

6. An instruction that executes atomically ____.
   A) must consist of only one machine instruction B) executes as a single, uninterruptible unit
   C) cannot be used to solve the critical section problem D) All of the above

7. A mutex lock ____.
   A) is exactly like a counting semaphore B) is essentially a boolean variable
   C) is not guaranteed to be atomic D) can be used to eliminate busy waiting

8. ____________ occurs when a higher-priority process needs to access a data structure that is currently being accessed by a lower-priority process.
   A) Priority inversion B) Deadlock C) A race condition D) A critical section

9. Which of the following statements is true?
   A) A safe state is a deadlocked state.
   B) A safe state may lead to a deadlocked state.
   C) An unsafe state is necessarily, and by definition, always a deadlocked state.
   D) An unsafe state may lead to a deadlocked state.

10. Suppose that there are ten resources available to three processes. At time 0, the following data is collected. The table indicates the process, the maximum number of resources needed by the process, and the number of resources currently owned by each process. Which of the following correctly characterizes this state?

Process	Maximum Needs	Currently Owned
P_0	10	4
P_1	3	1
P_2	6	4

A) It is safe. B) It is not safe. C) The state cannot be determined. D) It is an impossible state.

Question 2: Explain the difference between response time and turnaround time. 2 points

1. **Turnaround time** – amount of time to execute a particular process
2. **Response time** – amount of time it takes from when a request was submitted until the first response is produced, not output (for time-sharing environment)

Question 3: Explain the process of starvation and how it can be solved. **2 points**

Starvation is a situation where a process with low priority cannot be executed because some higher priority process keep coming and executed before

Starvation can be solved using AGING where the process priority increase over time.

Question 4: What are the three conditions must be satisfied in order to solve the critical section problem? **2 points**

1. **Mutual Exclusion - If process P_i is executing in its critical section, then no other processes can be executing in their critical sections**
2. **Progress - If no process is executing in its critical section and there exist some processes that wish to enter their critical section, then the selection of the processes that will enter the critical section next cannot be postponed indefinitely**
3. **Bounded Waiting - A bound must exist on the number of times that other processes are allowed to enter their critical sections after a process has made a request to enter its critical section and before that request is granted**

Question 5: What are the four conditions that must all hold simultaneously to have a deadlock situation. **2 points**

1. **Mutual exclusion: only one process at a time can use a resource**
2. **Hold and wait: a process holding at least one resource is waiting to acquire additional resources held by other processes**
3. **No preemption: a resource can be released only voluntarily by the process holding it, after that process has completed its task**
4. **Circular wait: there exists a set $\{P_0, P_1, \ldots, P_n\}$ of waiting processes such that P_0 is waiting for a resource that is held by P_1, P_1 is waiting for a resource that is held by P_2, …, P_{n-1} is waiting for a resource that is held by P_n, and P_n is waiting for a resource that is held by P_0.**

Question 6: Suppose you have three resource types A (10 instances), B (5instances), and C (7 instances) And at a particular point of time we have the following allocation data. Use banker algorithm to determine wither the system is in safe state or not. **2 points**

	Allocation	Max	Available	need	work	
	A B C	A B C	A B C	A B C	A B C	1. Process p1 can be served so work become 5 3 2
P_0	0 1 0	7 5 3	3 3 2	7 4 3	3 3 2	2- Process p3 can be served so work become 7 4 3
P_1	2 0 0	3 2 2		1 2 2		3- Process p0 can be served so work become 7 5 3
P_2	1 0 2	9 0 2		8 0 0		4 process p2 cannot be served.
P_3	2 1 1	2 2 2		0 1 1		**so system is in unsafe state.**