Managing Time is Part of the Exam!!

<table>
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<th>First Question</th>
<th>No. of Branches (1)</th>
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<td><strong>Q1 B1</strong></td>
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Choose the best Answer:

1) A deadlocked state occurs whenever _____.
   - a) a process is waiting for I/O to a device that does not exist
   - b) the system has no available free resources
   - c) every process in a set is waiting for an event that can only be caused by another process in the set
   - d) a process is unable to release its request for a resource after use

2) One necessary condition for deadlock is______, which states that a resource can be released only voluntarily by the process holding the resource:
   - a) hold and wait
   - b) mutual exclusion
   - c) circular wait
   - d) no preemption

3) A cycle in a resource-allocation graph is _____.
   - a) a necessary and sufficient condition for deadlock in the case that each resource has more than one instance
   - b) a necessary and sufficient condition for a deadlock in the case that each resource has exactly one instance
   - c) a sufficient condition for a deadlock in the case that each resource has more than one instance
   - d) neither necessary nor sufficient for indicating deadlock in the case that each resource has exactly one instance

4) 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.

5) 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?

<table>
<thead>
<tr>
<th>Process</th>
<th>Maximum Needs</th>
<th>Currently Owned</th>
</tr>
</thead>
<tbody>
<tr>
<td>P₀</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>P₁</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>P₂</td>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>
   - a) It is safe.
   - b) It is not safe.
   - c) The state cannot be determined.
   - d) It is an impossible state.
6) An address generated by a CPU is referred to as a ____:
   a) physical address
   b) logical address
   c) post relocation register address
   d) Memory-Management Unit (MMU) generated address

7) Suppose a program is operating with execution-time binding and the physical address
   generated is 300. The relocation register is set to 100. What is the corresponding logical
   address?
   a) 199
   b) 201
   c) 200
   d) 300

8) ____ is the dynamic storage-allocation algorithm which results in the smallest leftover
   hole in memory
   a) First fit
   b) Best fit
   c) Worst fit
   d) None of the above

9) Given the logical address 0xAEF9 (in hexadecimal) with a page size of 256 bytes, what is the
   page number?
   a) 0xAE
   b) 0xF9
   c) 0xA
   d) 0x00F9

10) Assume the value of the base and limit registers are 1200 and 350 respectively. Which of the
    following addresses is legal?
    a) 355
    b) 1200
    c) 1551
    d) all of the above

11) Which of the following is a benefit of allowing a program that is only partially in memory to
    execute?
    a) Programs can be written to use more memory than is available in physical memory.
    b) CPU utilization and throughput is increased.
    c) Less I/O is needed to load or swap each user program into memory.
    d) All of the above

12) Suppose we have the following page accesses: 1 2 3 4 2 3 4 1 2 1 1 3 1 4 and that there are
    three frames within our system. Using the FIFO replacement algorithm, what is the number
    of page faults for the given reference string?
    A) 14
    B) 8
    C) 13
    D) 10

13) Suppose we have the following page accesses: 1 2 3 4 2 3 4 1 2 1 1 3 1 4 and that there are
    three frames within our system. Using the LRU replacement algorithm, what is the
    number of page faults for the given reference string
    A) 14
    B) 8
    C) 13
    D) 10
14) Given the reference string of page accesses: 1 2 3 4 2 3 4 1 2 1 3 1 4 and a system with three page frames, what is the final configuration of the three frames after the LRU algorithm is applied? 
   a) 1, 3, 4 
   b) 3, 1, 4 
   c) 4, 1, 2 
   d) 1, 2, 3 

15) Belady's anomaly states that _____.
   a) giving more memory to a process will improve its performance
   b) as the number of allocated frames increases, the page-fault rate may decrease for all page replacement algorithms
   c) for some page replacement algorithms, the page-fault rate may decrease as the number of allocated frames increases
   d) for some page replacement algorithms, the page-fault rate may increase as the number of allocated frames increases

16) ____ allows the parent and child processes to initially share the same pages, but when either process modifies a page, a copy of the shared page is created 
   a) copy-on-write 
   b) zero-fill-on-demand 
   c) memory-mapped 
   d) virtual memory fork 

17) ____ occurs when a process spends more time paging than executing.
   A) Thrashing 
   B) Memory-mapping 
   C) Demand paging 
   D) Swapping

18) Which of the following disk head scheduling algorithms does not take into account the current position of the disk head?
   A) FCFS 
   B) SSTF 
   C) SCAN 
   D) LOOK 

19) What are the two components of positioning time?
   a) seek time + rotational latency 
   b) transfer time + transfer rate 
   c) effective transfer rate - transfer rate 
   d) cylinder positioning time + disk arm positioning time

<table>
<thead>
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<td>Q2 B1</td>
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**Short Essay (Solve questions 1-5 and then choose 2 of the rest)**

1) Describe the four conditions that must hold simultaneously in a system if a deadlock is to occur? **(3 Marks)**

2) What is the difference between deadlock prevention and deadlock avoidance? **(2 Marks)**

3) Distinguish in details between internal and external fragmentation? How can they be solved? **(2 Marks)**
4) Briefly describe the segmentation memory management scheme. How does it differ from the paging memory management scheme in terms of the user's view of memory? (2 Marks)

5) If you were creating an operating system to handle files, what would be the six basic file operations that you should implement? (2 Marks)

6) Describe two methods for eliminating deadlocks by aborting a process? (2 Marks)

7) Explain the sequence of events that happens when a page-fault occurs? (2 Marks)

8) Explain how copy-on-write operates (2 Marks)

9) Explain the usefulness of a modify bit? (2 Marks)

10) What are common attributes that an operating system keeps track of and associates with a file? (2 Marks)

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#### Third Question

**Q3 B1**

Consider the following snapshot of a system:

<table>
<thead>
<tr>
<th>Allocation</th>
<th>Max</th>
<th>Available</th>
</tr>
</thead>
<tbody>
<tr>
<td>A B C D</td>
<td>A B C D</td>
<td>A B C D</td>
</tr>
<tr>
<td>P0: 2 0 0 1</td>
<td>4 2 1 2</td>
<td>3 3 2 1</td>
</tr>
<tr>
<td>P1: 3 1 2 1</td>
<td>5 2 5 2</td>
<td></td>
</tr>
<tr>
<td>P2: 2 1 0 3</td>
<td>2 3 1 6</td>
<td></td>
</tr>
<tr>
<td>P3: 1 3 1 2</td>
<td>1 4 2 4</td>
<td></td>
</tr>
<tr>
<td>P4: 1 4 3 2</td>
<td>3 6 6 5</td>
<td></td>
</tr>
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</table>

Answer the following questions using the banker’s algorithm:

- a) Illustrate that the system is in a safe state by demonstrating an order in which the processes may complete.

- b) If a request from process P1 arrives for (1, 1, 0, 0), can the request be granted immediately?

- c) If a request from process P4 arrives for (0, 0, 2, 0), can the request be granted immediately?

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#### Fourth Question

**Q4 B1**

Given six memory partitions of 300 KB, 600 KB, 350 KB, 200 KB, 750 KB, and 125 KB (in order), how would the first-fit, best-fit, and worst-fit algorithms place processes of size 115 KB, 500 KB, 358 KB, 200 KB, and 375 KB (in order)? Rank the algorithms in terms of how efficiently they use memory.
Suppose that a disk drive has 5,000 cylinders, numbered 0 to 4,999. The drive is currently serving a request at cylinder 2,150, and the previous request was at cylinder 1,805. The queue of pending requests, in FIFO order, is:

2, 069, 1, 212, 2, 296, 2, 800, 544, 1, 618, 356, 1, 523, 4, 965, 3681.

Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests for each of the following disk-scheduling algorithms?

a. FCFS
b. SSTF
c. SCAN
d. C-LOOK