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# B.M.S. College of Engineering, Bengaluru-560019

**Autonomous Institute Affiliated to VTU**

## January / February 2025 Semester End Main Examinations

**Programme: B.E.** **Semester: III**
**Branch: Artificial Intelligence and Machine Learning** **Duration: 3 hrs.**
**Course Code: 20AM3PCOPS** **Max Marks: 100**
**Course: Operating System**

**Instructions**: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.



**Important Note:** Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

| | | | CO | PO | Marks |
|---|---|---|---|---|---|
| | | **UNIT - I** | | | |
| 1 | a) | Define Operating System. List and explain different types of OS. | CO1 | PO1 | **6** |
| | b) | Elaborate the steps involved in making the system call read (fd, buffer, nbyte) with a neat diagram and list the system call with its description used for file management. | CO2 | PO1 | **8** |
| | c) | Explain the roles and interactions between kernel and user mode in an operating system with a neat sketch. | CO2 | PO1 | **6** |
| | | **OR** | | | |
| 2 | a) | The services and functions provided by an operating system can be viewed in two perspectives. Briefly describe them with a neat diagram. | CO1 | PO1 | **6** |
| | b) | Describe the implementation of threads in user and kernel space, highlighting their advantages and disadvantages. | CO2 | PO1 | **6** |
| | c) | Illustrate the use of fork and exec system calls. | CO1 | PO1 | **8** |
| | | **UNIT - II** | | | |
| 3 | a) | How to create a process in an operating system? With a neat state diagram, describe the four transitions of process states. | CO2 | PO2 | **5** |
| | b) | Define race conditions. Elaborate the solution how to avoid race conditions? | CO2 | PO1 | **5** |
| | c) | Consider the set of 6 processes whose arrival time and burst time are given below- | CO3 | PO3 | **10** |

| Process Id | Arrival time | Burst time |
|---|---|---|
| P1 | 0 | 7 |
| P2 | 1 | 5 |
| P3 | 2 | 3 |
| P4 | 3 | 1 |
| P5 | 4 | 2 |
| P6 | 5 | 1 |

Draw Gantt charts illustrating the execution of these processes using shortest remaining time first (SRTF) scheduling algorithm and calculate the average waiting time and average turnaround time.

**OR**

4 a) i) Define Dining Philosophers problem? Discuss the solution for Dining Philosopher’s problem using semaphores.
ii) If each user requires 400kb of memory (350kb code + 50kb data). How much memory is required for 50 users? Shared pages allow “**multiple users to share the same memory pages for code**” that is identical among them, so how much memory required for 50 users with considering shared pages? — *CO2* *PO4* **10**

b) Consider the following set of processes, with the length of the CPU-burst time given in milliseconds: — *CO3* *PO2* **10**

| Process | Burst Time | Priority |
|---|---|---|
| P1 | 10 | 3 |
| P2 | 1 | 1 |
| P3 | 2 | 3 |
| P4 | 1 | 4 |
| P5 | 5 | 2 |

The processes are assumed to have arrived in the order P1,P2,P3,P4,P5, all at time 0.

i. Draw two Gantt charts illustrating the execution of these processes using non preemptive priority (a smaller priority number implies a higher priority), and Round Robin (quantum=1) scheduling.
ii. What is the turnaround time and waiting time of each process for each of the scheduling algorithms in part i?

Which of the scheduling algorithm in part i results in the minimal average waiting time?

**UNIT - III**

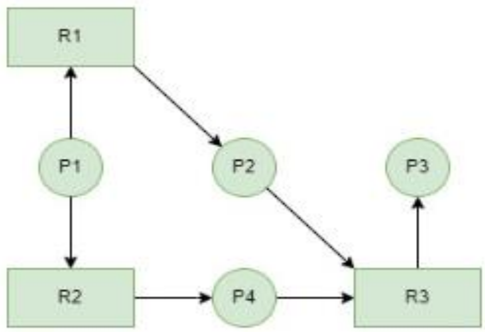
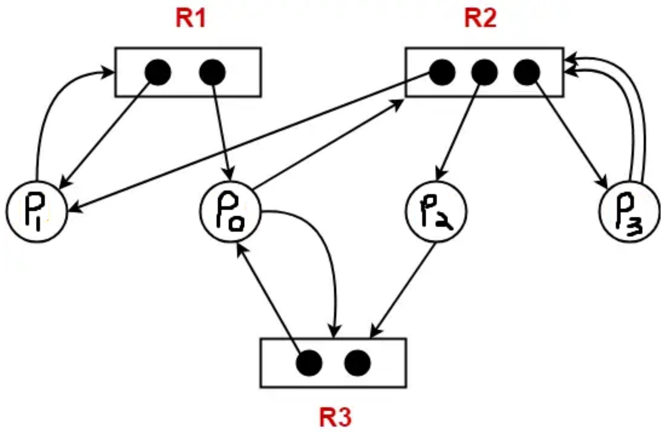
5 a) Define deadlock. What are the necessary conditions for the deadlock to occur? Describe briefly. — *CO1* *PO1* **6**

b) Consider the following snapshot of a system: — *CO3* *PO3* **10**

| Process | Allocation | | | | Max | | | | Available | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | A | B | C | D | A | B | C | D |
| P0 | 2 | 0 | 0 | 1 | 4 | 2 | 1 | 2 | 3 | 3 | 2 | 1 |
| P1 | 3 | 1 | 2 | 1 | 5 | 2 | 5 | 2 | | | | |
| P2 | 2 | 1 | 0 | 3 | 2 | 3 | 1 | 6 | | | | |
| P3 | 1 | 3 | 1 | 2 | 1 | 4 | 2 | 4 | | | | |
| P4 | 1 | 4 | 3 | 2 | 3 | 6 | 6 | 5 | | | | |

Apply Banker’s algorithm to find:

i) Is the system being safe? If so, give the safe sequence.

<table>
<tr><td></td><td></td><td></td><td>If process P2 requests (0, 1, 1, 3) resources can it be granted immediately?</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td>c)</td><td>i. For the given Resource Allocation Graph, write the wait-for-graph.<br>ii. Justify whether there is any deadlock occurrence.<br>
</td><td>CO2</td><td>PO2</td><td>4</td></tr>
<tr><td></td><td></td><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td></td><td>6</td><td>a)</td><td>Consider the resource allocation graph given below. Find if the system is in a deadlock state otherwise find a safe sequence.<br>
</td><td>CO2</td><td>PO2</td><td>6</td></tr>
<tr><td></td><td></td><td>b)</td><td>Consider four process A, B, C, and D, each of them has been granted a certain number of resource units as shown in resource allocation states (a) to (c). Identify the safe, unsafe state and justify the answer to serve the request.<br>
<table><tr><th></th><th>Has</th><th>Max</th></tr><tr><td>A</td><td>0</td><td>6</td></tr><tr><td>B</td><td>0</td><td>5</td></tr><tr><td>C</td><td>0</td><td>4</td></tr><tr><td>D</td><td>0</td><td>7</td></tr></table>
Free: 10<br>(a)<br>
<table><tr><th></th><th>Has</th><th>Max</th></tr><tr><td>A</td><td>1</td><td>6</td></tr><tr><td>B</td><td>1</td><td>5</td></tr><tr><td>C</td><td>2</td><td>4</td></tr><tr><td>D</td><td>4</td><td>7</td></tr></table>
Free: 2<br>(b)<br>
<table><tr><th></th><th>Has</th><th>Max</th></tr><tr><td>A</td><td>1</td><td>6</td></tr><tr><td>B</td><td>2</td><td>5</td></tr><tr><td>C</td><td>2</td><td>4</td></tr><tr><td>D</td><td>4</td><td>7</td></tr></table>
Free: 1<br>(c)</td><td>CO3</td><td>PO2</td><td>8</td></tr>
<tr><td></td><td></td><td>c)</td><td>Analyze the pros and cons of resource preemption and process termination as strategies for deadlock recovery. Provide examples to support your explanation.</td><td>CO2</td><td>PO2</td><td>6</td></tr>
<tr><td></td><td></td><td></td><td>UNIT - IV</td><td></td><td></td><td></td></tr>
<tr><td></td><td>7</td><td>a)</td><td>Illustrate swapping in memory management with a neat sketch.</td><td>CO1</td><td>PO1</td><td>5</td></tr>
<tr><td></td><td></td><td>b)</td><td>Discuss the working principle of Working set page replacement algorithm. Apply the same algorithm for a given page reference</td><td>CO3</td><td>PO3</td><td>10</td></tr>
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| | | | | | | |
|---|---|---|---|---|---|---|
| | | | string: 2,6,1,5,7,7,7,5,1,6,2,3,4,1,2,3,4,4,4 with window size(W)=5. Calculate the number of page faults, page hits, hit ratio, and miss ratio. | | | |
| | | c) | How virtual addresses can be converted to physical addresses using MMU. Describe with an example. | *CO1* | *PO2* | **5** |
| | | | **OR** | | | |
| | 8 | a) | When a memory is assigned dynamically, the operating system must manage it. Describe the two ways to keep track of memory usage. | *CO1* | *PO1* | **5** |
| | | b) | How Second chance page replacement algorithm differ from FIFO page replacement algorithm.<br>Apply second chance page replacement algorithm for a given page reference string: 2,3,2,1,5,2,4,5,3,2,3,5 with 3-page frames. Calculate the number of page faults, page hits, page hit ratio, and page miss ratio. | *CO3* | *PO3* | **10** |
| | | c) | If the blocks are allocated to the file in such a way that all the logical blocks of the file get the contiguous physical block in the hard disk. With an example, illustrate the advantages and disadvantages of contiguous allocation. | *CO1* | *PO2* | **5** |
| | | | **UNIT - V** | | | |
| | 9 | a) | Given memory partitions of 100K, 500K, 200K, 300K, and 600K (in order), how would each of the First-fit, Best-fit, and Worst-fit algorithms place processes of 212K, 417K, 112K, and 426K (in order)? Which algorithm makes the most efficient use of memory? | *CO3* | *PO2* | **8** |
| | | b) | Describe the structure of a page table entry with a neat diagram. | *CO1* | *PO1* | **6** |
| | | c) | Illustrate the relation between virtual addresses and physical memory addresses using page table. | *CO2* | *PO1* | **6** |
| | | | **OR** | | | |
| | 10 | a) | Assume we have a hard disk with the following characteristics:<br>i) Number of platters: 2<br>ii) Number of surfaces per platter: 2 (upper and lower)<br>iii) Number of tracks per surface: 200<br>iv) Number of sectors per track: 50<br>v) Size of each sector: 512 bytes<br>Find the disk size in terms of KB, MB, and GB? | *CO3* | *PO4* | **5** |
| | | b) | A disk drive has 5000 cylinders, numbered 0 to 4999. The drive is currently Serving a request at cylinder 143. The queue of pending requests in FIFO order is 86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130. Starting from current head position, what is a total distance travelled (in cylinders) that the Disk arm to satisfy the requests using FCFS, SSTF, SCAN, LOOK and C-LOOK algorithms. | *CO3* | *PO4* | **9** |
| | | c) | Discuss direct and sequential access methods in file operations with suitable examples for each. | *CO2* | *PO1* | **6** |

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