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

**Autonomous Institute Affiliated to VTU**

## September / October 2023 Supplementary Examinations

**Programme: B.E** **Semester: IV**
**Branch: Computer Science and Engineering** **Duration: 3 hrs.**
**Course Code: 19CS4PCOPS** **Max Marks: 100**
**Course: Operating Systems** **Date: 27.09.2023**

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





### UNIT - I

1 a) List five services provided by an operating system that are designed to make it more convenient for users to use the computer system. Explain each in detail. **6**

b) Differentiate between traps and interrupts. Illustrate how they are used to ensure proper execution of the operating system in different modes. **8**

c) Analyze the advantages and disadvantages of each of the following, considering both at the system level as well as at the user level. **6**
i. Synchronous and asynchronous communication
ii. Fixed-sized and variable-sized messages

### UNIT - II

2 a) Differentiate between short-term, medium-term, and long-term scheduling. Highlight where the above scheduling happens by depicting it in the general process state diagram. **6**

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

| Processes | CPU Burst | TimePriority |
|---|---|---|
| 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 $P_1$, $P_2$, $P_3$, $P_4$, $P_5$, all at time 0. With help of Gantt charts illustrating the execution of these processes using FCFS, SJF, a non-preemptive priority (a smaller priority number implies a higher priority), and RR (quantum = 1) scheduling, do the following.

i. Calculate the turn-around time of each process for each of the scheduling algorithms

ii. Calculate the waiting time of each process for each of the scheduling algorithms

iii. Which of the schedules results in the minimal average turn-around time and minimal waiting time?

c) Given that process P1 has a period of p1=60 and a CPU burst of t1= 30 and Process P2 has a period of p2= 90 and t2=40. Show with Gantt charts, how the processes are scheduled using Rate Monotonic Scheduling and Earliest-Deadline-First Scheduling. **4**

## UNIT - III

3 a) Design a solution to the Readers-Writers problem using binary semaphores. (Writers have exclusive access) Show the abstract definitions of producer and consumer functions. **10**

b) Given the following state for the Banker's Algorithm: **10**
6 processes: P0 through P5
4 resource types: A (15 instances); B (6 instances) C (9 instances); D (10 instances)
Snapshot at time T0:

| **Processes** | Allocation | | | | Max | | | | Available | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | A | B | C | D | A | B | C | D |
| $P_0$ | 2 | 0 | 2 | 1 | 9 | 5 | 5 | 5 | 6 | 3 | 5 | 4 |
| $P_1$ | 0 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | | | | |
| $P_2$ | 4 | 1 | 0 | 2 | 7 | 5 | 4 | 4 | | | | |
| $P_3$ | 1 | 0 | 0 | 1 | 3 | 3 | 3 | 2 | | | | |
| $P_4$ | 1 | 1 | 0 | 0 | 5 | 2 | 2 | 1 | | | | |
| $P_5$ | 1 | 0 | 1 | 1 | 4 | 4 | 4 | 4 | | | | |

i) Calculate the Need matrix.

ii) Show that the current state is safe, that is, show a safe sequence of processes. In addition, to the sequence, show how Available (working array) changes as each process terminates.

iii) Given the request (3,2,3,3) from Process P5. Should this request be granted? Why or why not?

## UNIT - IV

4 a) Given five memory partitions of 100 KB, 500 KB, 200 KB, 300 KB, and 600 KB (in order), illustrate how would each of the first-fit, best-fit, and worst-fit algorithms place processes of 212 KB, 417 KB, 112 KB, and 426 KB (in order). **6**

b) Consider a paging system with a page table stored in memory. **6**

i. If a memory reference takes 200 nanoseconds, how long does a paged reference take (reference is retrieved from page table in memory and

then program data is retrieved from memory) Assume all pages are in memory?

ii. If we add associative registers (TLB), and 75 percent of all page-table references are found in the associative registers, what is the effective memory reference time on average? (Assume that finding a page table entry in the associative registers takes 10 nanoseconds, if the entry is there.) Assume all pages are in memory.

c) Trashing results in performance problems. Illustrate the phenomena and deduce the two methods of handling the effects due to trashing. **8**

**OR**

5 a) What is the requirement of Translation Look-aside Buffer (TLB) in paging? Consider a system with 80% hit ratio, 50 nanoseconds to search the associative registers and 750 nanoseconds time to access memory. Find the time to access a page **6**

(i) When the page number is in associative memory (TLB).

(ii) When the page number is not in associative memory (TLB).

Find the effective memory access time

b) Consider reference string: 1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6 Find the number of page faults with respect to the following, when the number of frames in the memory is 3 and 4 (show the working diagram): **8**

i) LRU Page Replacement Algorithm

ii) Optimal Page Replacement Algorithm

c) In a virtual memory system, size of virtual address is 32-bit, size of physical address is 30-bit, page size is 4 Kbyte and size of each page table entry is 32-bit. The main memory is byte addressable. Deduce the maximum number of bits that can be used for storing protection and other information in each page table entry. **6**

**UNIT - V**

6 a) Describe the three major methods of allocating disk space. **10**

b) Suppose that a disk drive has 200 cylinders, numbered 0 to 199. The drive is currently serving a request at cylinder 50, and the previous request was at cylinder 25. The queue of pending requests, in FIFO order, is: 82,170,43,140,24,16,190. 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? **10**

i) FCFS ii) SSTF iii) SCAN iv) LOOK v) C-SCAN

**OR**

7 a) Assume that we are using variable size partitions and we have batch processes arriving in order, with the following requests for storage: 20k, 30k, 10k, 100k, 60k. Assume that we have five holes in memory of size: 50k, 30k, 200k, 16k and 30k, where would each of the First-fit and Worst-fit algorithms place the requested storage. **6**

b) Differentiate between Host-Attached Storage and Network-Attached Storage. **4**

c) Consider a system with four domains along with four objects (Files) and one printer. Design an Access Matrix for the following conditions / operations: **10**

i) Process in Domain D1 can perform read operation on files F1 and F2.
ii) Domain D4 contains file F1 with read permission and file F3 with read and write permissions.
iii) Domain D2 has printer access.
iv) Domain D3 contains file F2 with read and files F3 and F4 with execute permissions respectively.

Also depict the Global table, Access list and Capability list implementations for the Access Matrix designed above.

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