

**OPERATING SYSTEMS**  
**(INFO 3103)**

**Time Allotted : 2½ hrs**

**Full Marks : 60**

*Figures out of the right margin indicate full marks.*

*Candidates are required to answer Group A and  
any 4 (four) from Group B to E, taking one from each group.*

*Candidates are required to give answer in their own words as far as practicable.*

**Group – A**

1. Answer any twelve:

**12 × 1 = 12**

*Choose the correct alternative for the following*

- (i) A process is in blocked state waiting for some IO service. When the service is completed it goes to the
  - (a) Running state
  - (b) Ready state
  - (c) Terminated state
  - (d) none of the above.
- (ii) Which one of the following is not shared by threads?
  - (a) Program counter
  - (b) Stack
  - (c) Both program counter and stack
  - (d) None of the mentioned.
- (iii) Bankers algorithm in OS used for
  - (a) Deadlock detection
  - (b) Deadlock avoidance
  - (c) Recovery from deadlock
  - (d) None of the above.
- (iv) A process can be terminated due to
  - (a) Normal exit
  - (b) Fatal error
  - (c) Killed by another process
  - (d) All of the mentioned.
- (v) Which system call can be used by a parent process to determine the termination of child process?
  - (a) Wait
  - (b) Exit
  - (c) Fork
  - (d) Get.
- (vi) What is compaction?
  - (a) A technique for overcoming internal fragmentation
  - (b) A paging technique
  - (c) A technique for overcoming external fragmentation
  - (d) A technique for overcoming fatal error.
- (vii) Run time mapping from virtual to physical address is done by \_\_\_\_\_.
  - (a) Memory management unit
  - (b) CPU
  - (c) PCI
  - (d) None of the mentioned

- (viii) Which of the following page replacement algorithms suffers from Belady's anomaly?  
 (a) FIFO (b) LRU  
 (c) Optimal Page Replacement (d) Both LRU and FIFO.
- (ix) The first block of a file system is  
 (a) data block (b) address block  
 (c) boot block (d) inode block.
- (x) For system protection, a process should access \_\_\_\_\_  
 (a) all the resources  
 (b) only those resources for which it has authorization  
 (c) few resources but authorization is not required  
 (d) all of the mentioned.

*Fill in the blanks with the correct word*

- (xi) The hardware mechanism that allows a device to notify the CPU is called \_\_\_\_\_.
- (xii) The time taken for the desired sector to rotate to the disk head is called \_\_\_\_\_.
- (xiii) In the \_\_\_\_\_ algorithm, the disk arm starts at one end of the disk and moves toward the other end, servicing requests till the other end of the disk. At the other end, the direction is reversed and servicing continues.
- (xiv) Defective sectors on disks are often known as \_\_\_\_\_.
- (xv) If the page size increases, the internal fragmentation is also \_\_\_\_\_.

### Group - B

2. (a) Compare Zombie Process and Orphan Process with proper example. [[C03](Analyse/IOCQ)]  
 (b) Explain Cascaded Termination and when this is required? [[C03](Understand/LOCQ)]  
 (c) Compare the functionalities of fork() and vfork() system call. [[C03](Analyse/IOCQ)]  
 (d) Draw and explain process lifecycle which depicts all active and suspended states and transition paths. [[C03](Understand/LOCQ)]  

$$3 + (1 + 2) + 2 + 4 = 12$$
3. (a) Explain the relative advantages and disadvantages of user level thread and kernel level thread. [[C03](Understand/LOCQ)]  
 (b) State different condition for which a parent process forcefully terminates a child process. [[C01](Remember/LOCQ)]  
 (c) Differentiate between symmetric and asymmetric multiprocessor system. [[C01](Analyse/IOCQ)]  

$$5 + 4 + 3 = 12$$

### Group - C

4. (a) Write down four necessary condition of Deadlock. Differentiate between Deadlock Prevention and Deadlock Avoidance. [[C02](Analyse/HOCQ)]

(b) Consider the following snapshot of a system.

| Process | Allocation<br>A B C D | MAX<br>A B C D | Available<br>A B C D |
|---------|-----------------------|----------------|----------------------|
| P0      | 0 0 1 2               | 0 0 1 2        | 1 5 2 0              |
| P1      | 1 0 0 0               | 1 7 5 0        |                      |
| P2      | 1 3 5 4               | 2 3 5 6        |                      |
| P3      | 0 6 3 2               | 0 6 5 2        |                      |
| P4      | 0 0 1 4               | 0 6 5 6        |                      |

(i) Is the system in Safe state?

(ii) If a request from process P1 arrives for (0 4 2 0) can the request be granted immediately?

[[CO2](Analyse/HOCQ)]

$$(2 + 2) + (4 + 4) = 12$$

5. (a) What is convoy effect?

[[CO3](Remember/LOCQ)]

(b) "Selection of the length of quantum can change the characteristics of Round Robin Scheduling" – Justify this statement.

[[CO3](Evaluate/HOCQ)]

(c) What are the advantages of introducing multilevel feedback queue in process scheduling?

[[CO3](Remember/LOCQ)]

(d) Consider three CPU-intensive processes, which require 10, 20 and 30 time units and arrive at times 0, 2 and 6, respectively. How many context switches are needed if the operating system implements a shortest remaining time first scheduling algorithm? Do not count the context switches at time zero and at the end. Find out the average waiting time and average turnaround time.

[[CO3](Analyse/HOCQ)]

$$2 + 3 + 3 + 4 = 12$$

### Group - D

6. (a) How the use of TLB improves the performance of system? Explain with diagram.

[[CO4](Understand/LOCQ)]

(b) Differentiate between paging and segmentation.

[[CO4](Analyse/IOCQ)]

(c) How page faults are handled?

[[CO4](Understand/LOCQ)]

(d) If the primary memory is divided into 4 pages and the request sequence of pages is 3 1 3 4 2 4 1 2 3 1 2 4 2 3 1 3 1 1 4 4; then using LRU page replacement algorithm, what will be the rate of page hit and page miss?

[[CO4](Apply/IOCQ)]

$$3 + 2 + (2 + 2) + 3 = 12$$

7. (a) Suppose a disk drive has 300 cylinders numbered 0 to 299. The current head position of disk is at 90. The queue of pending request in FIFO order is 36,79,15,120,199,270,89,170. Design the head movements and calculate average cylinder movements for the following.

(i) SSTF (ii) C-Scan.

[[CO4](Create/HOCQ)]

(b) Given memory partitions of a hard disk 100kb, 600kb, 200kb, 500kb, 300kb, 150kb (in order). How would each algorithm of first fit best fit and worst fit will accommodate the processes requiring 132kb, 376kb, 212kb, 478kb, 50kb (in order)? Which algorithm will give best result?

[[CO4](Create/HOCQ)]

$$(4 + 4) + 4 = 12$$

## Group - E

8. (a) Briefly explain the advantages and disadvantages of linked file allocation method. *[[CO5](Understand/LOCQ)]*
- (b) How does Indexed file allocation technique overcome the disadvantages of linked file allocation method-Explain briefly. *[[CO5](Understand/LOCQ)]*
- (c) Differentiate between sequential access and direct access method. *[[CO5](Analyze/IOCQ)]*  
**5 + 4 + 3 = 12**
9. (a) Differentiate between bit vector method and linked list method for free space management. *[[CO5](Analyze/IOCQ)]*
- (b) Explain the working principle of Polling with diagram. *[[CO5](Understand/LOCQ)]*
- (c) Differentiate between blocking IO and NON Blocking IO. *[[CO5](Analyze/IOCQ)]*  
**4 + 4 + 4 = 12**
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| Cognition Level         | LOCQ  | IOCQ  | HOCQ |
|-------------------------|-------|-------|------|
| Percentage distribution | 42.71 | 32.29 | 25   |