

**OPERATING SYSTEM WITH LINUX  
(CSEN 3107)**

**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) What is the degree of multiprogramming?
  - (a) Number of processes executed per unit time
  - (b) Number of processes in the ready queue
  - (c) Number of processes in the I/O queue
  - (d) Number of processes in memory.
- (ii) A Process Control Block (PCB) does not contain which of the following?
  - (a) Code      (b) Stack      (c) Bootstrap program      (d) Process id.
- (iii) Which scheduling algorithm is inherently pre-emptive?
  - (a) FCFS      (b) SJF      (c) RR      (d) All of (a), (b) & (c).
- (iv) The time spent by a process in the ready queue is called?
  - (a) Waiting Time      (b) Turnaround Time
  - (c) Throughput      (d) None of (a), (b) & (c).
- (v) A critical section is a program segment
  - (a) Which must be enclosed by a pair of semaphore operations, Signal and Wait
  - (b) Where shared resources are accessed
  - (c) Which avoids deadlocks
  - (d) Which should run in a certain specified amount of time.
- (vi) If time quantum is too short in RR scheduling, then it suffers from?
  - (a) High waiting time      (b) High turn-around time
  - (c) High context switch time      (d) High response time.
- (vii) When a process does not get access to the resource, it loops continuously for the resource and wastes CPU cycles. It is known as
  - (a) Deadlock      (b) Livelock      (c) Spinlock      (d) None of (a), (b) & (c).

- (viii) Scheduling a process from ready queue to CPU is done by?  
 (a) Short term scheduler (b) Middle term scheduler  
 (c) Long term scheduler (d) Dispatcher.
- (ix) Why is CPU scheduling done?  
 (a) Decrease CPU Utilization (b) Increase CPU Utilization  
 (c) Increase Cost (d) None of (a), (b) & (c).
- (x) The two types of semaphores are?  
 (a) Counting and Binary (b) Octal and Hexadecimal  
 (c) Zero and One (d) None of (a), (b) & (c).

*Fill in the blanks with the correct word*

- (xi) At a particular time, the value of a Counting Semaphore is 10. It will become 7 after \_\_\_\_\_ signal and \_\_\_\_\_ wait operations.
- (xii) External, non-volatile memory is also referred to as \_\_\_\_\_ or auxiliary memory.
- (xiii) The interval from the time of submission of a process to the time of completion is termed as \_\_\_\_\_.
- (xiv) A register that contains the address of the next instruction to be fetched is called the \_\_\_\_\_.
- (xv) If time quantum is too large in RR scheduling, it becomes \_\_\_\_\_ scheduling.

### Group - B

2. (a) Explain the architecture of microkernel-based OS with diagram. What are the good features of hybrid-based architecture? [[CO5](Analyse/LOCQ)]
- (b) What do you mean by time sharing system? What is the difference between general purpose OS and RTOS. [[CO2](Understand/LOCQ)]
- (c) Write any 4 different options which are used in grep command. Give proper example.  
 How should we identify which shell you are using? How should you sort entries in a text file in ascending order? [[CO5](Apply/IOCQ)]  
**(3 + 3) + (1 + 2) + 3 = 12**
3. (a) How system call is executed? Explain with an example. [[CO1](Remember/LOCQ)]
- (b) Draw and explain the architecture of Virtual machine? [[CO5](Remember/IOCQ)]
- (c) Write some features of Linux operating system. Write the name of some shell available in Linux. [[CO5](Apply/LOCQ)]  
**(2 + 2) + 3 + (3 + 2) = 12**

### Group - C

4. (a) What do you mean by pre-emptive and non pre-emptive scheduling? [[CO2](Remember/LOCQ)]

- (b) Draw the gantt chart for the execution of the processes using SRTF scheduling. Calculate waiting time, average waiting time, turn-around time, average turn-around time and response time for the system with the following data.

Process	Arrival time	Execution time
P1	0	9
P2	1	5
P3	2	3
P4	3	4

[[CO2](Understand/IOCQ)]

- (c) How next CPU burst is predicted in SRTF algorithm using exponential average technique? What is  $\epsilon_5$ , if  $\alpha=0.5$  and  $\epsilon_1=5$  for the following data: [[CO2](Apply/HOCQ)]

Process	Actual Burst Time
P1	4
P2	8
P3	5
P4	6

$$2 + (2 + 1 + 1 + 1 + 1 + 1) + (1 + 2) = 12$$

5. (a) Show the 7-state process model with the help of a diagram. Explain briefly about the function of each state. [[CO2](Illustrate, Explain/LOCQ)]
- (b) Discuss the contents of the Process Control Block with the help of a diagram. How does it help in Context Switch? [[CO2](Organize, Analyze/IOCQ)]
- (c) How is Parallelism achieved using Threads?  
How much Speedup can be achieved for a 60% serial, 40% parallel process by shifting from single to four cores? [[CO2](Identify, Analyze/IOCQ)]

$$5 + 3 + 4 = 12$$

### Group - D

6. (a) Compare and contrast Peterson's Synchronization algorithm and Dekker's Synchronization algorithm in terms of: (i) Mutual Exclusion (ii) Bounded Wait. Write the section(s) of the pseudocode from both the algorithms that ensure the above criterion(s) and comment on/justify how the two algorithms are similar/different. Which algorithm do you think is more "cooperative" and why? [[CO3](Compare, Evaluate/HOCQ)]
- (b) Explain the four necessary conditions for Deadlock. [[CO4](Explain/LOCQ)]

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

7. (a) Consider the following snapshot of a system shown in Table:2

Process	Allocation				Max				Available			
	R1	R2	R3	R4	R1	R2	R3	R4	R1	R2	R3	R4
P1	0	0	1	2	0	0	1	2	2	1	0	0
P2	2	0	0	0	2	7	5	0				
P3	0	0	3	4	6	6	5	6				
P4	2	3	5	4	4	3	5	6				
P5	0	3	3	2	0	6	5	2				

Table:2

- (i) What is the content of Need matrix? Is the system in a safe state? Justify your answer.
- (ii) If a request from process P3 arrives for (0,1,0,0), can it be granted immediately. Clearly show your working to justify your claim.

[[CO4](Apply,Solve/IOCQ)]

- (b) Write an algorithm to solve Reader-Writer problem using semaphore. Your algorithm should ensure writers have priority.

[[CO3](Apply,Solve/IOCQ)]

**(4 + 4) + 4 = 12**

### Group - E

8. (a) What is spoofing? Explain various types of spoofing. [[CO6](Remember/LOCQ)]
- (b) What is Denial-of-Service attack? Explain it. [[CO6](Remember/LOCQ)]
- (c) Describe 2 inside system attack techniques and 2 outside system attack techniques. [[CO6](Remember/LOCQ)]

**(1 + 3) + 2 + (3 + 3) = 12**

9. (a) What is Access matrix? What type of operation can be done on it? [[CO6](Analyse/LOCQ)]
- (b) What are the 3 components of Access control model? Describe each of them. [[CO6](Remember/LOCQ)]
- (c)

Domain/Object	File A	File B	File C	Printer
Domain 1	read control		write	print
Domain 2	read, write		read*	
Domain 3		read, write, execute	read	print

For this above access matrix reduce it to access list and capability list. Among these three which is most efficient from implementation view point?

[[CO6](Understand/HOCQ)]

**(2 + 2) + 3 + (2 + 2 + 1) = 12**

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	50	33.33	16.67

#### Course Outcome (CO):

After the completion of the course students will be able to

1. Develop knowledge about the importance of computer system resources and the role of Linux operating system in their management policies and algorithms.
2. Understand processes and its management policies and scheduling of processes by CPU.
3. Acquire an understanding of the need of process synchronization, evaluate the requirement for process synchronization and coordination handled by operating system.
4. Understand deadlock, prevention and avoidance algorithms.
5. Understand the structure and functions of Linux operating systems along with their components, types and working.
6. Gain familiarity with protection and security in Linux Operating System.

\*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question.