

THE OPEN UNIVERSITY OF SRI LANKA
 B.Sc. (IT) DEGREE PROGRAMME
 DEPARTMENT OF COMPUTER SCIENCE
 LEVEL 04
 COU4302 - OPERATING SYSTEMS
 FINAL EXAMINATION: 2026/2027
 DURATION: TWO HOURS ONLY (2 HOURS)



Date: 22.06.2026

Time: 09.30 a.m. – 11.30 a.m.

ANSWER ONLY **FOUR (04)** QUESTIONS. ALL QUESTIONS CARRY EQUAL MARKS

QUESTION 01

- 1.1. What is an Operating System?
- 1.2. List **two (2)** types of processes.
- 1.3. List **five (5)** system components managed by the operating system.
- 1.4. Explain why an operating system hides hardware details by creating abstractions.
- 1.5. An operating system provides services for both programmer's purposes (programmer's view) and the system itself (system's view). Briefly describe **two (2)** services provided by the operating system for programmer's purposes and **two (2)** services provided by the operating system for the system itself.

QUESTION 02

- 2.1. Define a system call?
- 2.2. What are the factors that affect the creation of a new process?
- 2.3. Consider a system with one CPU and five jobs. Each job has arrival time and burst time as given below.

Job	Arrival Time (ms)	Burst Time (ms)
P1	0	6
P2	3	2
P3	5	8
P4	8	4
P5	12	5

- i. Draw separate Gantt charts illustrating the execution order of the jobs using First Come First Served and Preemptive Shortest Job First Scheduling Algorithm. Calculate the average waiting time, average turnaround time, and average response time using **only** the Preemptive Shortest Job First Scheduling Algorithm.
- ii. Draw Gantt chart illustrating the execution order of the jobs using Round-Robin algorithm by considering time quantum = 5ms.

QUESTION 03

- 3.1. What is meant by context switching?
- 3.2. What is the critical section problem? Briefly describe how it can be avoided.
- 3.3. Program called X allocated from memory address 1500 to 1999.
 - i. Identify the LBR and UBR of it.
 - ii. That program tries to access address 1989. Will this be allowed? Justify your answer.
- 3.4. Write **two (2)** differences between dynamic memory allocation and static memory allocation.
- 3.5. A deadlock is said to occur when **four (4)** conditions are simultaneously satisfied. Explain each condition briefly.

QUESTION 04

- 4.1. List **two (2)** types of free memory management techniques.
- 4.2. What is meant by fragmentation? Briefly describe **two (2)** types of fragmentations.
- 4.3. Suppose you have the following page reference string and the frames (0, 1, 2, 3).

Reference	2	3	4	2	6	3	7	4	6	3	2	3	4	8	2	4	6	3
Frame 0																		
Frame 1																		
Frame 2																		
Frame 3																		

Use the table above to show frame allocation using the **Belady's Optimal Algorithm**. Draw the table above into your answer sheet and fill it with the page references, marking page faults with (*).

Write down the total number of **page faults** and **page hits**.

4.4. Assume that the operating system on your computer uses the Buddy System for memory management. Initially, the system has 2048 KB of memory, which begins at address 0.

- A: Request 225KB
 - B: Request 133KB
 - C: Request 123KB
 - D: Request 110KB
 - Release A
 - E: Request 180KB
 - Release B
 - Release C
 - Release D
 - Release E
- i. Show the result of each request/release given below via successive figures.
- ii. How much internal fragmentation exists **after the E's** request?

QUESTION 05

- 5.1. What are the **three (3)** types of file allocation methods?
- 5.2. A 48-bit address is divided into a 14-bit segment number, a 12-bit page number, and a 22-bit displacement.
- i. How many pages can a segment have?
 - ii. What is the page size?
 - iii. How many segments can be addressed?
- 5.3. In a system, there is a total of **9 units of resource R1, 5 units of resource R2, and 10 units of resource R3**. The system is in the following state (S0):

Process	Max			Allocation		
	R1	R2	R3	R1	R2	R3
P0	5	3	4	2	1	1
P1	4	2	3	1	1	1
P2	6	3	5	3	1	2
P3	3	2	4	1	0	2

Where:

- **Max** indicates the maximum resources each process may need.
- **Allocation** indicates the resources already allocated to each process.
 - i. Is the system in a safe state? Use the Banker's algorithm to show that the system is in a safe state. Provide the complete sequence of jobs (processes) that allows the system to proceed without deadlock.
 - ii. Process P3 requests **additional resource allocation** (R1, R2, R3) equivalent to units (0, 0, 1) when the system is in state S0. Is it possible to grant the request by P3? Provide the process sequence and explain whether the request leads the system to a safe or unsafe state.

QUESTION 06

- 6.1. Write **two (2)** operations that can be performed on directories.
- 6.2. List **three (3)** file attributes.
- 6.3. Briefly describe RAID Level 01 using a diagram.
- 6.4. Permission numbers of the files project.txt and report.txt are given as 654 and 471, respectively.
 - i. Explain the permissions of those files in terms of owner, group, and other.
 - ii. Which file has the most permissions for the owner?
- 6.5. Draw diagrams to describe the functionality of the following disk access scheduling schemes in a disk having 0–699 cylinders. Previous and current head positions are 90 and 120, respectively. The read request sequence is 160, 300, 175, 70, 410, 520, 690. Then calculate the distance traveled by the disk head in each of the following scheduling algorithms:
 - SSTF
 - SCAN
 - LOOK
 - C-LOOK

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