THE OPEN UNIVERSITY OF SRI LANKA
B.Sc. (IT) DEGREE PROGRAMME – 2024/2025
DEPARTMENT OF COMPUTER SCIENCE
COU4302 - OPERATING SYSTEMS
FINAL EXAMINATION
DURATION: **TWO HOURS ONLY** (2 HOURS)

Date: 19.06.2025 **Time: 09.30 a.m. – 11.30 a.m.**

ANSWER **FOUR (04) QUESTIONS** ONLY.

QUESTION 01

1.1 Explain the function of the Kernel in an operating system.

1.2 List down **five (5)** activities of an operating system in regard to file management.

1.3 Draw a diagram which indicate the state transition of process in execution. Describe **four (4)** possible state transitions.

1.4 What is the process descriptor and explain **three** (3) fields that might be included in a process descriptor.

QUESTION 02

2.1 Describe **three (3)** types of CPU schedulers.

2.2 List **three (3)** factors that affect the selection of a scheduling algorithm.

2.3 Consider a system with **one (1)** CPU and **five (5)** jobs with arrival times and burst times given below.

Job	Arrival Time (ms)	Burst Time (ms)
A	0	6
B	3	2
C	5	8
D	8	4
E	12	5

i. Draw separate Gantt charts illustrating the execution order of the jobs using Non-Preemptive Shortest Job First Scheduling Algorithm and Preemptive Shortest Job First Scheduling Algorithm.

ii. Calculate average waiting time, average turnaround time and average response time using the preemptive Shortest Job First Scheduling Algorithm.

iii. Draw Gantt chart illustrating the execution order of the jobs using Round-Robin algorithm by considering time quantum = 3ms.

2.4 What is the major problem associated with a priority scheduling algorithm?

QUESTION 03

3.1 Explain the *producer and consumer problem* based on bounded buffer.

3.2 Explain the *race condition* and *critical section* using a suitable example.

3.3 What are the **two (2)** types of threads? Explain those **two (2)** types of threads using diagrams.

3.4 Explain *circular wait condition* using a suitable example.

3.5 Program X's memory is allocated from memory address 1200 to 1899.

i. Identify the LBR and UBR of it.

ii. That program tries to access address 1989. Will this be allowed? Justify your answer.

iii. What is the necessity of a memory protection function?

QUESTION 04

4.1 What is main responsibility of the hardware unit known as Memory Management Unit (MMU)?

4.2 Describe the technique of storage compaction by coalescing holes. Write down **two (2)** drawbacks in the compaction.

4.3 Suppose you have the following page reference string and the frames (0, 1, 2, 3).

Reference	1	2	5	2	1	1	4	3	1	6	2	4	1	3	2	6
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 4096 KB of memory, which begins at address 0.

- A: Request 225KB
- B: Request 123KB
- C: Request 300KB
- D: Request 287KB
- 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 two (2) types of directory implementation?

5.2 A 36-bit address is divided into a 12-bit segment number, a 10-bit page number, and a 14-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 10 units of resource R1, 4 units of resource R2, and 9 units of resource **R3**. The system is in the following state (S0):

Process	Max			Allocation		
	R1	R2	R3	R1	R2	R3
P0	4	2	3	3	0	1
P1	5	2	2	1	1	1
P2	3	3	3	2	1	2
P3	4	2	2	1	1	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, 1, 0) when the system is in state S0. Is it possible to grant the request by P1? Provide the process sequence and explain whether the request leads the system to a safe or unsafe state.

QUESTION 06

6.1 Permission numbers of the files *alice.txt* and *bob.txt* are given as 725 and 367, 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?

6.2 Describe the Indexed Allocation of a Disk Space using an example. Write down **two (2)** advantages in Indexed Allocation of a Disk Space.

6.3 What is the RAID? Explain **level one** RAID scheme.

6.4 Draw diagrams to describe the functionality of the following disk access scheduling schemes in a disk having 0-799 cylinders. Previous and current head positions are 100 and 130, respectively. The read request sequence is 170, 350, 180, 85, 420, 550, 780. Then calculate the distance traveled by the disk head in each of the following scheduling algorithms:

- SCAN
- C-SCAN
- LOOK
- SSTF