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Department of Computer Science

Level: 2nd year Bachelor in CS

Course: Operating System 1

13/05/2025

Final Exam (duration : 1h30')

NB. Any answer out of our lectures will be considered false.

Questions (6 points)

1. The offset in a logical address can be greater than the offset in a physical address. True or false? Explain. 0.5
2. The page table is unique in an OS. True or false? Explain. 0.5
3. The process table is unique in an OS. True or false? Explain. 0.5
4. How to define a starvation (famine) in OS? 0.5 Give examples for:
   (a) CPU, and 0.5
   (b) Memory. 0.5
5. The size of logical memory can be greater than physical memory. True or false? Explain. 1
6. In a single-processor computer, tell which process state possibilities are true and which are false in the table below.

#	Ready	Running	Waiting
1	1	0	0
2	0	1	0
3	0	0	4
4	2	1	0
5	3	0	3
6	0	2	1
7	3	3	3
8	0	2	0

0.25 each

Exercise 1. (7 points) Consider the execution of the following processes/jobs on a single-processor machine.

Process/ job	Arrival date	Execution time	Priority	I/O request relative to job start	I/O duration
A	0.0000	5	4	2	1
B	2.0001	4	2	1	3
C	2.0001	2	6	1	2
D	4.0001	4	3	3	3
E	3.0000	3	1	1	1

NB. A small value of priority indicates a higher priority.

1. Considering only the non-grayed part of the table, give the process/job execution diagrams using:
   (a) the SRT, 1
   (b) RR (quantum=1) scheduling, and 1
   (c) the preemptive priority scheduling algorithm. 1
2. Now we consider the whole data of table, draw the execution diagram for a RR scheduling (Quantum=2)? 2.5
3. For the last case, calculate the following parameters for each process/job:
   (a) CPU usage, 0.5
   (b) response time, and 0.5
   (c) waiting time. 0.5

Exercise 2. (7 points) Let the central memory of a computer be 2^{10} address units. We assume that this memory is managed in multiprogramming in 5 fixed partitions with the k counter technique. The partitions have the following sizes: 50, 200, 40, 300, 150 memory words. The rest of the memory is occupied by the OS. Let consider also k=2.

At first, partitions are occupied, they are freed at times 4, 0.2, 4.1, 0.5, 2. The processes come to memory following the table below.

Process	Size	Arrival date	Stay time in memory
A	20	2.3	1
B	120	3.5	2
C	35	0	0.6
D	110	4	2
E	40	2.1	4.5
F	290	1	4

1. Draw the memory diagram, knowing that the OS occupies the lower addresses. 0.5
2. What would be the content of the queue at time 2.4? 3
3. What is the total amount of internal fragmentation at time 6? 1

   If we manage this memory using variable partitions and the Worst Fit placement strategy.
4. Provide a diagram showing the contents of the memory at time 4? 1.5
5. What is the amount of external fragmentation at time 4.2? 0.5
6. Is there internal fragmentation? If so, how size is it? 0.5