

3 Operating Systems (RMM)

Consider a simple operating system where live processes are either *running*, *ready* to run, or *blocked* on an event, before they *exit*.

- (a) State four conditions under which the operating system will try to schedule processes. [4 marks]
- (b) OS schedulers are said to be *pre-emptive* or *non-preemptive*. State the principal problem with non-preemptive schedulers. Explain how pre-emptive schedulers solve this problem. [2 marks]
- (c) Explain why pre-emptive schedulers are more complex to implement. [2 marks]
- (d) Consider four CPU-bound processes arriving to a Shortest Remaining Time First (SRTF) scheduler as follows:

Process	Arrival Time	Duration
P ₁	0	8
P ₂	3	3
P ₃	5	1
P ₄	9	4

- (i) Give a schedule computed by the SRTF scheduler, and compute the average waiting time across all four processes. Your answer should be explicit about the state of each process and the *ready* queue at all times. Clearly state any assumptions you make. [6 marks]
- (ii) Explain why SRTF is difficult to implement in practice, and propose how to address this difficulty. [2 marks]
- (iii) Assume that jobs are no longer CPU-bound but also perform blocking and non-blocking IO. Discuss how this can affect the effectiveness and fairness of the SRTF scheduler. [4 marks]