COMPUTER SCIENCE TRIPOS Part IA – 2021 – Paper 2

4 Operating Systems (ek264)

(*a*) Consider the following four processes to run in a single CPU. What is the average waiting time when scheduling these processes according to FCFS, SJF, and SRTF? [5 marks]

Process	Arrival Time	Burst Time
P1	0	8
P2	3	3
P3	5	4
P4	6	6

(*b*) Assume n processes in the READY queue. Discuss which scheduling algorithm(s) from FCFS, SJF, SRTF, and RR give(s) the minimum context switches for these n processes. Ignore any I/O burst. Explain your answer and clearly state your assumptions. [3 marks]

(*c*) Consider a computer with a CPU scheduler that implements the RR scheduling algorithm using a fixed time quantum that cannot be changed.

(*i*) Explain why RR provides a fair CPU allocation. [1 mark]

(*ii*) You need to give certain critical processes a greater share of the CPU without changing the scheduler. Describe how you could do so, and how your solution achieves this goal. [4 marks]

(*d*) Assume a Unix system with three users named `user1`, `user2`, and `user3`, and three groups named `group1`, `group2`, and `group3`. Assume `group1` has members `(user1, user2)`, `group2` has members `(user2, user3)`, and `group3` has members `(user3, user1)`. Consider three files with the following permissions:

```
rw-rw---- user1 group1 file1
rw-r--r-- user2 group3 file2
rwxr----- user3 group2 file3
```

(*i*) Which files can `user1` read? Which files can `user2` write? Which users can read `file3`? [3 marks]

(*ii*) `user2` cannot execute `file3`. What permissions does `file3` need so that all of its previous permissions are retained and `user2` can further execute this file? What permissions does `file3` need so that all of its previous permissions are retained and `user2` can further execute this file as `user3`? [4 marks]