COMPUTER SCIENCE TRIPOS Part IA – 2023 – Paper 2

4 Operating Systems (ek264)

(*a*) What is a process's *context* and what are the main steps involved in *context switching*? [4 marks]

(*b*) The following three processes arrive simultaneously and are to be scheduled on a single CPU for the specified burst length, measured in abstract time units. Assume that no process does any I/O, that the overhead of a context switch is one time unit, and that the idle process will always be run when there are no other processes scheduled.

Process ID	CPU burst length
P1	10
P2	20
P3	30

(*i*) Calculate the total turnaround time of the three processes when scheduled using Round Robin (RR) assuming a time quantum of two time units. [2 marks]

(*ii*) Calculate the total turnaround time of the three processes when scheduled using Shortest Job First (SJF). [2 marks]

(*iii*) Unfortunately, the CPU burst length of a process is not actually known when it arrives. Assume that it takes the SJF scheduler 10 time units to estimate the CPU burst length of a process before its execution. Recalculate the total turnaround time using SJF. [2 marks]

(*iv*) Compare your results for RR (*b*)(*i*) against those for SJF when the burst lengths are known (*b*)(*ii*) and unknown (*b*)(*iii*). When does the total turnaround time for SJF exceed that for RR? Which parameter has the most affect on the relative performance of these two schedulers, and why? [4 marks]

(*c*) Assuming a single-core system using SJF, design a mechanism to predict the CPU bursts of newly arrived processes. Describe the main components of this mechanism and how it might work in conjunction with the SJF scheduler. Discuss any memory and CPU performance considerations. Clearly state any assumptions that you make. Ignore any I/O bursts. [6 marks]