Operating Systems

Homework 3

Question 1

The process is inserted into the top queue, which has a time quantum of 2 units. This means that eventually the process will reach the head of the top queue and be executed for a duration of 2 units. The process now has 38 time units remaining. It is inserted into the second queue (with a time quantum of 7 units), and is eventually executed for another 7 time units. It then has 31 time units remaining. After exiting the third queue with a time quantum of 12 units, it will have 19 time units remaining. The fourth queue has a time quantum of 17 units, so after exiting that queue there will only be 2 time units remaining, so it will exit the fifth que and terminate.

All of the above is assuming that there are at least five queues in the scheduler. Otherwise it will remain in the bottom queue until it is finished.

Question 2

The Shortest Job First scheduling algorithm minimises the average waiting time, since the shorter processes are executed first, so most processes would not have to wait for a very long time.

However it also can cause starvation, since a long process will keep being pushed off if many short processes enter the system.

Question 3

- At the 0ms mark, process P0 begins since it is the only process in the system.
- At the 1ms mark, process P0 is paused and process P1 begins, since its burst time is smaller than P0's remaining time.
- At the 2ms mark, process P2 enters the system but it does not run, because P1 is shorter.
- At the 5ms mark, process P1 terminates. The waiting time for P1 is 0ms. P0 continues running, since it came in before P2.
- At the 13ms mark, process P0 terminates with a waiting time of 4ms. P2 begins since it is the only process remaining.
- At the 22ms mark, process P2 terminates. The waiting time for P2 is 11ms

The average waiting time is $(0 + 4 + 11)/3 = 15/3 = 5$ ms.

Question 4

- At 0ms, P1 begins.
- At 1ms, P2 enters and begins, and P1 is paused with 4ms remaining.
- At 2ms, P3 enters but does not begin, since P2 has less time remaining.
- At 4ms, P2 terminates with a turnaround time of 3ms. P4 also enters. P4 begins, since it has the shortest remaining time.
- At 5ms, P4 terminates with a turnaround time of 1ms. P3 begins since it has a smaller remaining time.
- At 8ms, P3 terminates with a turnaround time of 6ms. P1 continues.
- At 12ms, P1 terminates with a turnaround time of 12ms

The average turnaround time is $(3 + 1 + 6 + 12)/4 = 22/4 = 5.5$ ms

Question 5

At time 15, P2 enters the ready queue. P1 has only 5 units remaining, but P2 has 25 units. P1 takes precedence so it is not stopped. P2 waits for 5 units until time 20 when P1 terminates and then P2 begins executing. After 10 more units, at time 30, P3 enters with an execution time of 10 units, however P2 still has 15 units remaining, so P2 is paused and P3 begins. After 10 units, at time 40, P3 terminates. So far, P2 has been waiting 15 units. P2 now continues. After 5 more units, at time 45, P4 enters. P2 now has only 10 units remaining, but so does P4. P2 continues until it terminates. P2 has been waiting for a total of 15 units.