Exercise 3

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Ex.1

A CPU scheduling algorithm determines an order for the execution of its scheduled processes. Given 5 processes to be scheduled on one processor, how many possible different schedules are there?

5

Ex.2.

Consider the following set of processes, with the length of the CPU-burst time given in milliseconds:

Process	Burst Time	Priority
P1	**4**	**4**
P2	**1**	**2**
P3	**7**	**2**
P4	**3**	**1**
P5	**5**	**3**

All the processes are assumed to have arrived in the order P1, P2, P3, P4, P5, at time 0.

a) Draw four Gantt charts illustrating the execution of these processes using FCFS (first-come first-served), SJF (shortest-job-first), a non-preemptive priority (a smaller priority number implies a higher priority), and RR (round-robin, quantum = 1) scheduling.

Time

Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
FCFS	p1	p1	p1	P1	p2	p3	p3	p3	p3	p3	p3	p3	p4	p4	p4	p5	p5	p5	p5	p5	
SJF	p2	p4	p4	p4	p1	p1	p1	p1	p5	p5	p5	p5	p5	p3	p3	p3	p3	p3	p3	p3	
Priority	p4	p4	p4	p2	p3	p3	p3	p3	p3	p3	p3	p5	p5	p5	p5	p5	p1	p1	p1	p1	
RR	p1	p2	p3	p4	p5	p1	p3	p4	p5	p1	p3	p4	p5	p1	p3	p5	p3	p5	p3	p3	

b) What is the turnaround time of each process for each of the scheduling algorithms in the case a)?

Turnaround time

	P1	P2	P3	P4	P5
FCFS	4	5	12	15	20
SJF	8	1	20	4	13
Priority	20	4	11	3	16
RR	14	2	20	12	18

c) What is the waiting time of each process for each of the scheduling algorithms in the case a)?

Waiting time

	P1	P2	P3	P4	P5
FCFS	0	4	5	12	15
SJF	4	0	13	1	8
Priority	16	3	4	0	11
RR	10	1	13	9	13

d) What is the <u>average</u> waiting time (over all processes)?

FCFS: 7.2

SJF: 5.2

Priority: 6.8

RR:9.2

Ex.3.

Suppose that the following processes arrive for execution at the time indicated. Each process will run the listed amount of burst time. Fill the Gannt chart for each of the following cases and answer to the questions. In answering the questions, use <u>non-preemptive</u> scheduling and base all decisions on the information you have at the time the decision is made.

Process	Arrival Time	Burst Time
P1	0	7

P2	**1**	**3**
P3	**2**	**1**

a) What is the average turnaround time for these processes with the FCFS scheduling algorithm?

Time	1	2	3	4	5	6	7	8	9	10	11	12	13
FCFS	P1	p1	p1	p1	p1	p1	p1	p2	p2	p2	p3		

Average Turnaround Time = _3.7_____.

b) What is the average turnaround time for these processes with the SJF scheduling algorithm?

Time	1	2	3	4	5	6	7	8	9	10	11	12	13
SJF	p3	p2	p2	p2	p1	p1	p1	p1	p1	p1	p1		

Average Turnaround Time = ___3.7_____.

c) The SJF algorithm is supposed to improve the performance but notice that we choose to run process P1 at time 0 because we did not know that two shorter processes would arrive soon. Compute what the average turnaround time will be if the CPU is left idle for <u>the first 2 units</u> and then SJF scheduling is used. Remember that processes P1 and P2 are waiting during this idle time, so their waiting time may increase. This algorithm could be known as future-knowledge scheduling. What is the average turnaround time for these processes with this scheduling algorithm?

Time	1	2	3	4	5	6	7	8	9	10	11	12	13
Future-knowledge SJF	p1	p1	p3	p2	p2	p2	p1	p1	p1	p1	p1		

Average Turnaround Time = __3.7_____.