1)
Compute the response time and turnaround time when running three jobs of length 200 with the SJF and FIFO schedulers.

ARG policy SJF
ARG jobs 3
ARG maxlen 200
ARG seed 100

Here is the job list, with the run time of each job:
Job 0 (length = 30)
Job 1 (length = 91)
Job 2 (length = 155)

Let's calculate the response time first:
T_response = T_firstturn – T_arrival
T0 = 0 – 0 = 0
T1 = 30 – 0 = 30
T2 = 121 – 0 = 121
Average response time = (0 + 30 + 121) / 3 = 50.333

Next calculate the average turnaround time:
T_turnaround = T_completion – T_arrival
T0 = 30 – 0 = 30
T1 = 121 – 0 = 121
T2 = (121+155) - 0 = 276
Thus, average turnaround time= (30 + 121 + 276) / 3 = 142.33333

ARG policy FIFO
ARG jobs 3
ARG maxlen 200
ARG seed 100

Here is the job list, with the run time of each job:
Job 0 (length = 30)
Job 1 (length = 91)
Job 2 (length = 155)

Let's calculate the response time first:
T_response = T_firstturn – T_arrival
T0 = 0 – 0 = 0
T1 = 30 – 0 = 30
T2 = 121 – 0 = 121

Average response time = (0 + 30 + 121) / 3 = 50.333

Next calculate the average turnaround time:
T_turnaround = T_completion – T_arrival
T0 = 30 – 0 = 30
T1 = 121 – 0 = 121
T2 = (121+155) - 0 = 276
Thus, average turnaround time= (30 + 121 + 276) / 3 = 142.33333

2)
Now do the same but with jobs of different lengths: 100, 200, and 300.

ARG policy SJF
ARG jlist 100,200,300

Here is the job list, with the run time of each job:
Job 0 (length = 100.0)
Job 1 (length = 200.0)
Job 2 (length = 300.0)

Let's calculate the response time first:
T_response = T_firstturn – T_arrival
T0 = 0 – 0 = 0
T1 = 100 – 0 = 100
T2 = 300 – 0 = 300
Average response time = (0 + 100 + 300) / 3 = 133.33333

Next calculate the average turnaround time:
T_turnaround = T_completion – T_arrival
T0 = 100 – 0 = 100
T1 = 300 – 0 = 300
T2 = 600 - 0 = 600
Thus, average turnaround time= (100 + 300 + 600) / 3 = 333.33333

ARG policy FIFO
ARG jlist 100,200,300

Here is the job list, with the run time of each job:
Job 0 (length = 100.0)
Job 1 (length = 200.0)
Job 2 (length = 300.0)

Let's calculate the response time first:
T_response = T_firstturn – T_arrival
T0 = 0 – 0 = 0
T1 = 100 – 0 = 100
T2 = 300 – 0 = 300
Average response time = (0 + 100 + 300) / 3 = 133.33333

Next calculate the average turnaround time:
T_turnaround = T_completion – T_arrival
T0 = 100 – 0 = 100
T1 = 300 – 0 = 300
T2 = 600 - 0 = 600
Thus, average turnaround time= (100 + 300 + 600) / 3 = 333.33333

3)
Now do the same, but also with the RR scheduler and a time-slice of 1.

Let's calculate the response time first:
T_response = T_firstturn – T_arrival
T0 = 0 – 0 = 0
T1 = 1 – 0 = 1
T2 = 2 – 0 = 2
Average response time = (0 + 1 + 2) / 3 = 1

Next calculate the average turnaround time:
T_turnaround = T_completion – T_arrival
T0 = 298 - 0 = 100
first time arrival at time 0, then in order to make one execution have to wait 3 seconds, thus completion time should at 300 seconds, we double counted the first and last instruction. Then it should be down at time 298.

T1 = 499 – 0 = 499
first time arrival at time 0, then in order to make one execution have to wait 3 seconds. At time 298 when job 0 finished(job 1 also completed 100 instructions)Then, start here each instruction cost 2 seconds to finish. Thus, at time 499 will finish the job 1

T2 = 600 - 0 = 600
At time 499, both job 0 and job 1 completed. Moreover job 2 complted 200 instructions. The rest 100 instructions will cost 100 seconds to be done. Thus, job 2 will completed at time 600.

Thus, average turnaround time= (298 + 499 + 600) / 3 = 465.66666

4)
For what types of workloads does SJF deliver the same turnaround times as FIFO?

When job0's length is < then job1's length < job2'length, and job0 arrive first, job1 arrive second, and job2 arrive last. Then, both SJF and FIFO will arrange job0 execute first, job1 execute second, and job2 execute last as same sequence. Then they will have same turnaround times.

5)
For what types of workloads and quantum lengths does SJF deliver the same response times as RR?

When workload's length and quantum length are the same. For example, we have 3 jobs each job have workload of 1 and quantum length as well. They will have same response time.

6)
What happens to response time with SJF as job lengths increase? Can you use the simulator to demonstrate the trend?
Response time will also increase because the time between each job is increase. For example if we use below command:

python3 scheduler.py -p SJF -j 3 -l 10,20,30 -c
The response time is 13.33

And when we increase the each job's length by 2 times:
python3 scheduler.py -p SJF -j 3 -l 20,40,60 -c
we got new response time: 26.67.
Notice the response time also double.

7)

What happens to response time with RR as quantum lengths increase? Can you write an equation that gives the worst-case response time, given N jobs?

When quantum lengths increase the response time also increase.

First, we define quantum lengths as q, and we have N jobs.
Notice the first job response time is 0, the second job response time is q, the third one 2q, the fourth one is 3q. Then the total response time as follow:

$$\sum_{i=1}^{N} q(i-1)$$

Is the same thing as follow:

$$q\sum_{i=1}^{N} i-1$$

Next, we apply arithmetic series formula we got:

$$Total\ response\ time\ = q(\frac{(0+N-1)*N}{2})$$

$$Total\ response\ time\ = q(\frac{N^2-N}{2})$$

New, if we want to find out average response time by using Total response time divide by N we got:

$$Average\ response\ time\ = q(\frac{N^2-N}{2})/N$$

$$= q(\frac{N-1}{2})$$