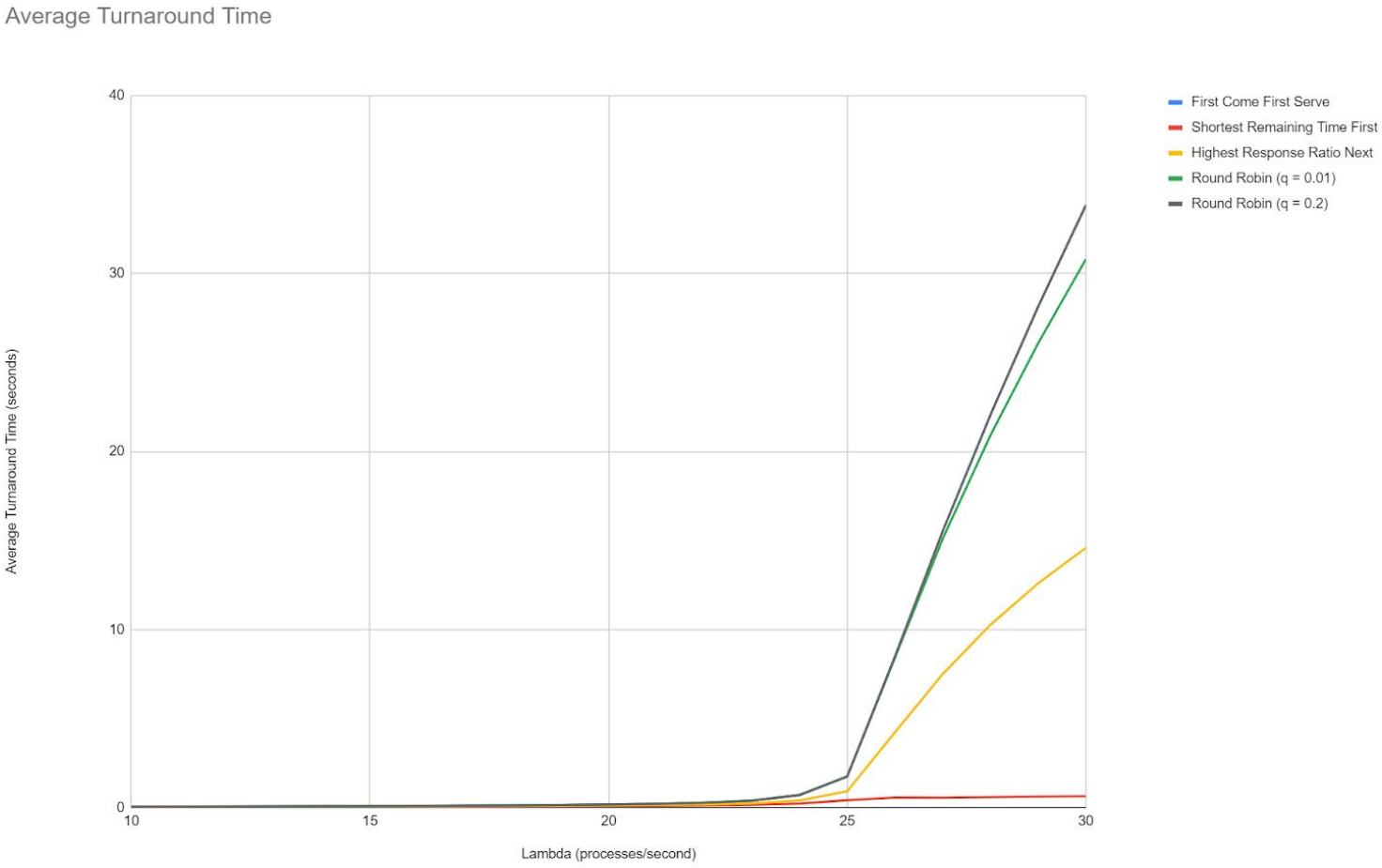
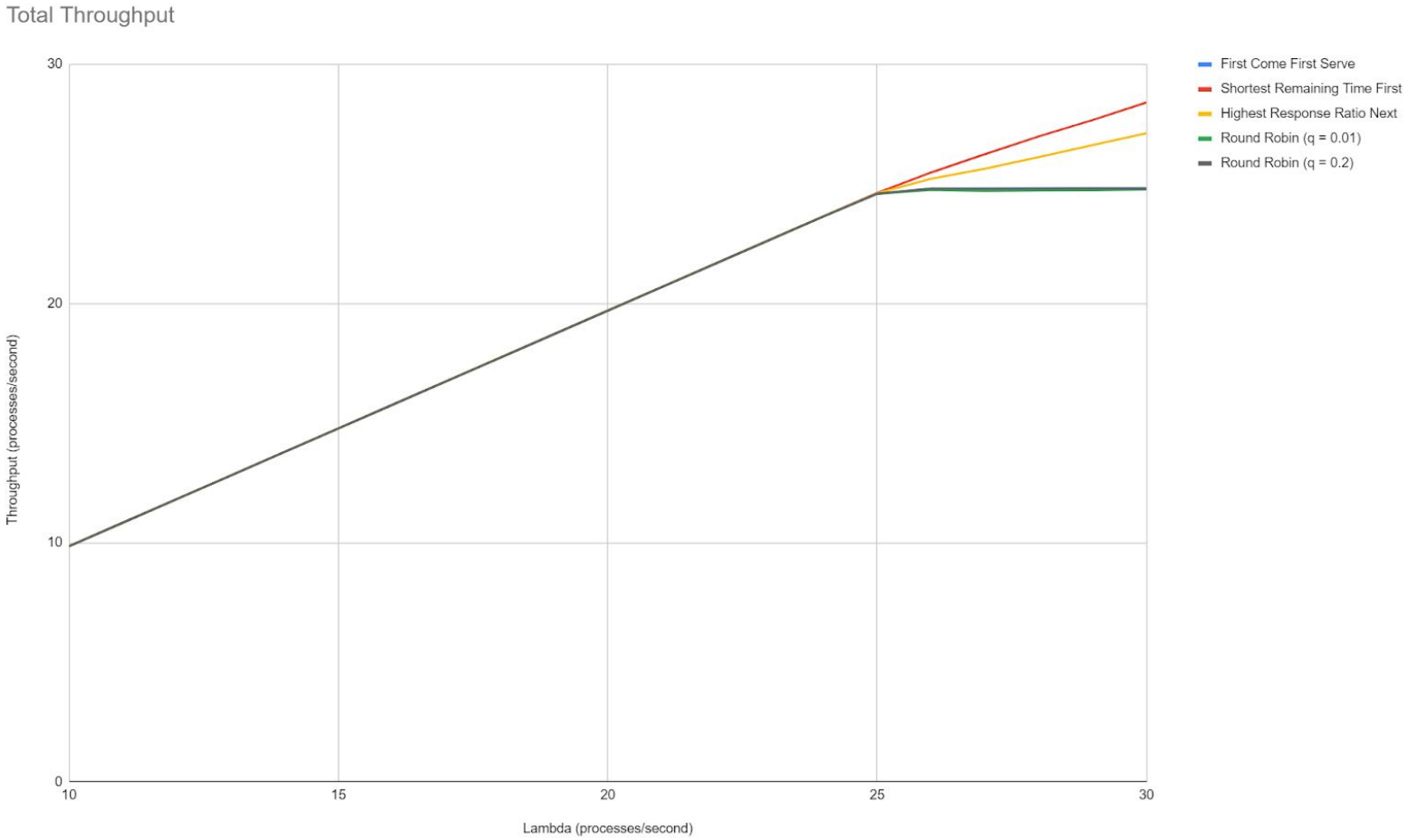
Project 1 Results

For this project I created a discrete time event simulator to model the behavior of four different CPU schedulers on a single CPU system. The simulator allows me to compare and assess the impact of the different schedulers on different performance metrics, across multiple workloads.

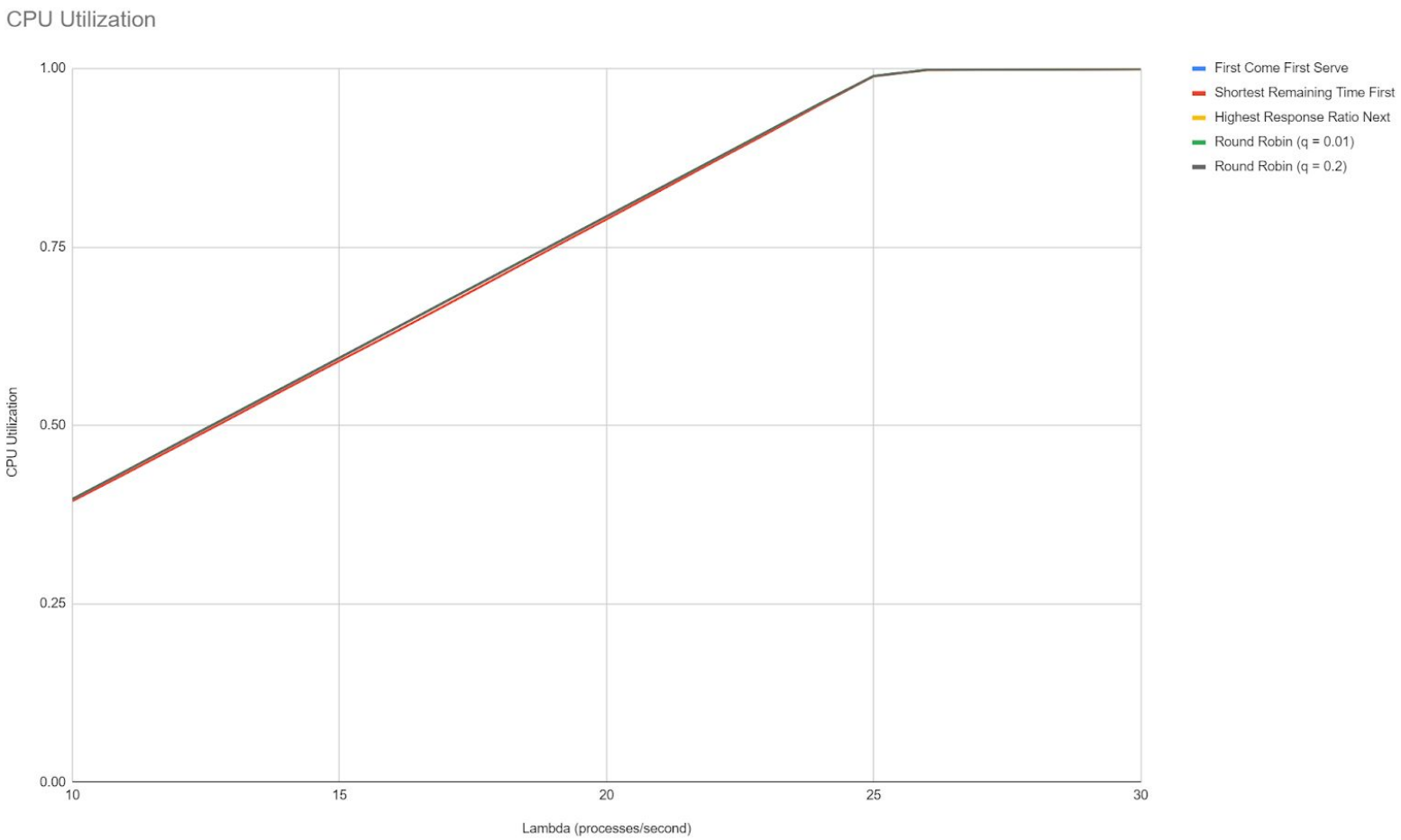
The following graphs were created by observing a specific metric and how it changed for each scheduler as the workload increased from 10 processes arriving per second to 30 processes arriving per second. The average service time for a particular process was kept the same across all runs and was set to 0.04 seconds.



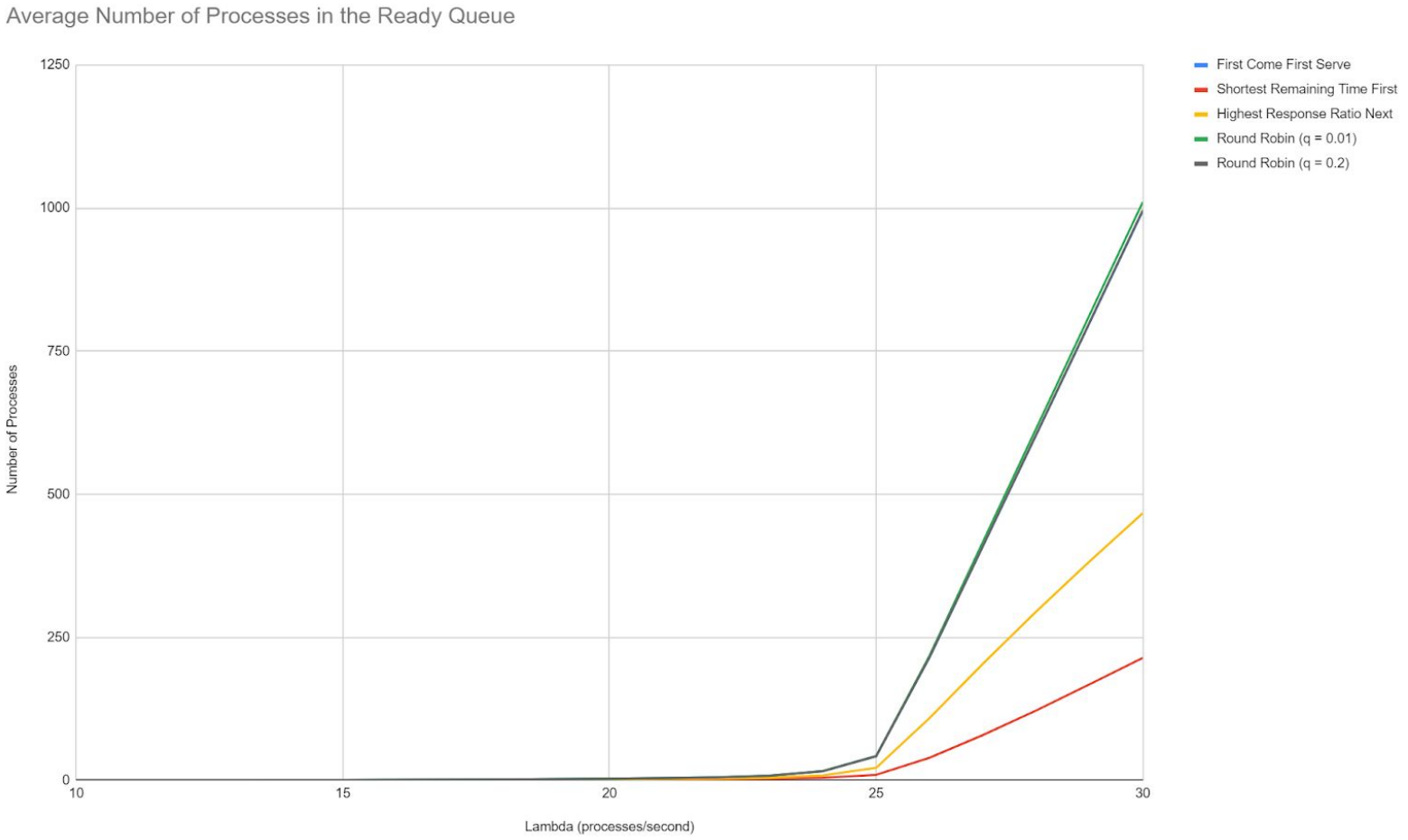
Looking at this graph, there appears to be a critical point where the turnaround time begins to increase significantly. That point is at lambda = 25, which is when the interarrival time between processes is, on average, equal to the service time of each process. After this point the SRTF scheduler maintains its relatively low turnaround time, which is to be expected since SRTF always chooses the processes with the least remaining service time, and runs that process to completion. The other schedulers, however, begin to experience a significant increase in turnaround time after the critical point, with RR (q = 0.2) behaving almost exactly like FCFS.



There appears to be a critical point for throughput for all four schedulers as well. This point is again lambda = 25. Before this point the throughput for all schedulers increases linearly as lambda increases. After the critical point we see that FCFS and RR (both q = 0.01 and q = 0.2) reach a maximum throughput and level off. That maximum throughput for FCFS and RR is equal to the inverse of the average process service time. The throughput for SRTF and HRRN, however, continues to increase, with SRTF increasing more than HRRN.



CPU utilization is very similar for all schedulers. Again, the critical point is lambda = 25, which is where we see the schedulers approach 100% CPU utilization. This makes sense because at this point the interarrival time between processes is the same as the service time of the processes. Something to note is that none of the schedulers actually reached full 100% CPU utilization in my simulation. I believe the reason for this is because the first process never arrived at time 0, instead the first process would arrive one interarrival from time 0. This means that the CPU was always idle for a very short time at the start of the simulation.



Once again the critical point for this metric is lambda = 25, which is where the ready queue starts filling up in all schedulers. FCFS and RR (both q = 0.01 and q = 0.2) behave very similar to each other, with their average ready queue sizes increasing rapidly after the critical point. HRRN and SRTF have their ready queue sizes increase more slowly, with SRTF having a slower increase than HRRN. SRTF being the slowest makes sense since this scheduler is always trying to get the process with the shortest remaining service time out of it's ready queue, which leads to it decreasing its ready queue size more frequently.