EGN 1932 Homework 6 (The Single-Server Queue) 40 Points

The following BASIC code simulates the single-server queue with FIFO service. It generates the interarrival times and the service times for 100,000 customers; and it produces estimates of the server utilization, the fraction of customers who must wait in the queue, and the average waiting time.

```
RANDOMIZE
100 FOR i = 1 TO 100000
110 IA =                          (generate interarrival time)
120 T = T + IA
130 W = W + X – IA
140 IF W < 0  THEN W = 0
150 IF W > 0  THEN c = c + 1
160 SW = SW + W
170 X =                           (generate service time)
180 SX = SX + X
190 NEXT i
200 PRINT SX/T, c/100000, SW/100000
```

Adapt the program and run it for the following 6 cases. Assume in each case that (i) the arrival rate is 1.6 customers per minute (that is, the average interarrival time is 37.5 seconds) and (ii) the average service time is 30 seconds.

(0) constant interarrival time; constant service time
(1) Poisson arrivals; service times uniformly distributed over 1 minute
(2) Poisson arrivals; exponential service times
(3) Poisson arrivals; constant service time
(4) Poisson arrivals; 80% of the customers require 18 seconds of service, and the other 20% require 18 seconds plus an additional minute of service time
(5) constant interarrival time; exponential service times

Fill in the table. Explain how the theoretical results were obtained. Summarize your observations. What would happen if the average service time were increased to 40 seconds?

	server utilization		**fraction who wait in queue**		**average waiting time**	
Case	theory	simulation	theory	simulation	theory	simulation
0						
1						
2						
3						
4						
5						