Queuing and waiting line theory example problem

This problem is similar to problem 14-17 on page 618 in your text, but I added additional data to make it interesting. Use Excel QM for the first part then QM3 for the second and last parts.

Automobiles arrive at the local Sonic Burger where employees on roller skates service them in parking lot while they sit in their automobiles at the rate of 4 every 10 minutes. The average service time is 2 minutes. The Poisson distribution is appropriate for the arrival rate and service times are exponentially distributed. If only one (1) employee is used answer a – g.

a) What is the average time a car is in the Que?

b) What is the average number of cars in the Que?

c) What is the average time cars spend waiting to receive service (system)?

d) What is the average number of cars in line (system) behind the customer receiving service?

e) What is the probability that there are no cars on the lot?

f) What percentage of the time is the employee busy?

g) What is the probability that there are exactly 2 cars in the system?

Additional Data for a new question: Use QM3 for Windows it will allow you to include costs. The Sonic is open 11 hours per day and the number of employees can be 2, 3, or 4 with each working the same rate. Wage Cost per employee is $25/hr.

The store estimates that every hour of customer time spent waiting for service costs the store $35 in lost sales and ill will.

a) Find the average time in the Que if 2, 3 or 4 employees are used.

b) What is the total time spent waiting in line each day if 2, 3 or 4 employees are used?

c) Calculate the daily total cost (daily waiting cost plus service cost) if 2, 3 or 4 employees are used?

d) What is the minimum total daily cost if 2, 3 or 4 employees are used?

Additional Data: What if employees receive a $5. 25 per hour raise and because of quality improvements the waiting costs haves increased to $45 per hour, BUT only 2 or 3 employees are used. Compute a – d using the above criteria and the new data.