5.1 A manufacturer of magnetic tapes is interested in reducing the variability of the thickness of the coating on the type. It is estimated that loss to the customer is $10 per reel if the thickness exceeds 0.005±0.0004 mm. Each reel has 200 meters of tape. A random sample of 10 yielded the following thicknesses (in mm): 0.0048, 0.0053, 0.0051, 0.0051, 0.0052, 0.0049, 0.0051, 0.0047, 0.0054, 0.0052.

(1) Find the average loss per reel;

(2) Suppose that the manufacturer can rework the thickness prior to shipping the product at a cost of $2.00 per reel. What should be the manufacturer’s tolerance?

(3) Suppose the manufacturer has the ability to centre the process such that the average thickness of the coating is at 0.005 mm, which is the target value. In doing so, the manufacturer estimates that the standard deviation of the process will be 0.018 mm. The cost of making this change in the process is estimated to be $1.50 per reel. Would it be cost-effective to make this change, compared to the original process? If so, what would be the annual savings if the annual production is 10,000 reels?

5.2 A restaurant believes that two of the most important factors that help it attract and retain customers are the price of the item and the time taken to serve the customer. Based on the price for similar items in other neighboring restaurants, it is estimated that the customer tolerance limit for price is $8, and the associated customer loss is estimated to be $50. Likewise, the customer tolerance limit for the service time is 10 minutes, for which the associated customer loss is $40. A random sample of size 10 yielded the following values of price: 6.50, 8.20, 7.00, 8.50, 5.50, 7.20, 6.40, 5.80, 7.40, 8.30. The sample service times (in minutes) were 5.2, 7.5, 4.8, 11.4, 9.8, 10.5, 8.2, 11.0, 12.0, 8.5.

Find the total expected loss per customer.

(1) If the restaurant expects 2000 customers monthly, what is the expected monthly loss?

(2) The restaurant is thinking of hiring more personnel to cut down the service time. However, the additional cost of increasing personnel is estimated to be $0.50 per customer. Sample of results with the added personnel yielded the following waiting times (in minutes): 8.4, 5.6, 7.8, 6.8, 8.5, 6.2, 6.5, 5.9, 6.4, 7.5. Is it cost-effective to added personnel? What is the total expected monthly loss?

(Note: the problem 5.2 belongs to the type of “The smaller-the-best”)

(The assignment is due at 2:00pm 29 August; it might be handed it in to Pam in the office, put in my pigeon box which neighbors Pam’s office, or submitted during the class time)