Problem Set 2

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1 Models and Conditional Probability and Distributions

Q1. In a certain community 10 percent of all adults over 50 have diabetes. If a certain doctor correctly diagnoses 95 percent of all persons with diabetes as having the disease and incorrectly diagnoses 2 percent of all persons without diabetes as having the disease then determine the probability that someone diagnosed as having diabetes actaully has the disease.

Q2. A software house has developed a procedure for identifying logical errors in code segments produced by its programming section. Assume the following :

$$\mathbf{P}(LE) = .0001$$

where LE denotes a code segment having a logical error. Further assume that the procedure is 99.9 % accurate - meaning

$$\mathbf{P}(FLE|LE) = .999$$

and

$$\mathbf{P}(FLE^C|LE^C) = .999$$

where FLE denotes that a logical error is flaggerd by the procedure and FLE^C denotes that a logical error is not found.

What is the probability that a code segment will not have a logical error given that no error is flagged by the procedure.

Q3. Suppose a firm has decided to produce a new item to enhance its public offerings. Suppose that it costs \$700,000 for manufacturing set-up, advertising, and other sundry considerations. Suppose that it costs 110 to make each item. Further suppose that from previous experience of launching new items on the market that the company expects the number of items sold (demand) will be 70,000 - 200 P where P is the price of each bike. Determine the optimal price the company should charge for each item in order to maximise its profit.

Q4. As is question 3! What effect would it have if the demand equation was not linear ? Discuss an alternative model that is more "realistic". Express the resulting profit function mathematically.

Q5. A production line produces 1000 items each day. When production equipment is running normally it is usual that 12 faulty items are produced each day. If a random sample of 15 items is taken one day and 2 items are faulty determine the probability that this occurs **assuming the production prcess is working normally and comment briefly on the result**.

Q6. Let $\lambda = 9.6$ be the average number of people presenting into a queue in a supermarket in a typical half-hour period. Assuming X is a random variable with Poisson distribution models the number of people presenting to a queue in any given half-hour period then calculate the probability the number of people presenting to a queue in the above supermarket is greater than 6.

$$\mathbf{P}(X = k) = \frac{\lambda^k e^{-\lambda t}}{k!}$$