DEAKIN BUSINESS SCHOOL
DEPARTMENT OF INFORMATION SYSTEMS AND BUSINESS ANALYTICS

MIS775 Decision Modelling for Business Analytics
Revision Questions with Solutions

WEEK 8 QUESTIONS

Exercise 1. Determine the appropriate probability distribution for each of the following random processes.

a. Consider the flight time, in minutes, of an airplane travelling from Melbourne to Sydney. Assume that the minimum time is 75 minutes and the maximum time is 2 hours. Suppose we have sufficient actual flight data to conclude that the flight time is equally likely to arrive within any five minute interval between these limits.

b. A car insurance salesman sells on the average 10 car insurance policies per week. We are interested in:
   1. the distribution of the number of car insurances he can sell in a day
   2. the distribution of time it takes to sell a car insurance policy.

c. A five-star hotel accepts 100 room reservations daily. For each reservation accepted, there is a 7% chance that the guest will not arrive. You decide to build a simulation model to describe the number of guests who will not show up.

d. Suppose that we are concerned with the occurrence of major defects in a section of highway one month after resurfacing. We assume that the probability of a defect is the same for any two intervals of equal length and that the occurrence or non-occurrence of a defect in any one interval is independent of the occurrence or non-occurrence in any other interval. Suppose that major defects occur at the average rate of two per km. Determine the appropriate probability distribution for the number of defects in a randomly selected km of the highway.

e. A bank has data on the proportion of defaulted creditors of a certain type out of the total number of creditors of this type. What is the appropriate distribution for calculating the probability that the next creditor of the same type will default.

Exercise 2. (From text, Q. 9, p. 536-7) A company is about to develop and then market a new product. It wants to build a simulation module for the entire process, and one key uncertain input is the development cost. For each of the following scenarios, choose an appropriate distribution together with its parameters. Justify your choice.

a. Company experts have no idea what the distribution of the development cost is. All they can state is "we are 95% sure that it will be at least $450,000 and we are 95% sure that it will be no more than $650,000."
b. Company experts still make the same statement as in part **a**, but now they can also state: "We believe the distribution to be symmetric, reasonably bell-shaped, and its most likely value is about $550,000."
c. Company experts still make the same statement as in part **a**, but now they can also state: "We believe the distribution is skewed to the right, and its most likely value is about $500,000."

Quiz

1. A variable whose value cannot be predicted or set with certainty is a:
   a. discrete variable
   b. random variable
   c. realistic variable
   d. simulation variable.
2. Simulation is used to:
   a. find the worst possible case values for the dependent variable(s)
   b. find the worst case and best case values for the dependent variable(s)
   c. find distribution information for the dependent variable(s)
   d. find median values for the dependent variable(s).

WEEK 8 SOLUTIONS

Exercise 1

a. We would infer that X has a uniform distribution on the interval between 75 and 120 minutes.

b. 1. Poisson with parameter $\lambda = 2$. The salesman expects to sell 2 policies per day.

   2. Exponential with parameter $\lambda = 2$. The salesman expects to sell a policy every half day.

c. Binomial with parameters $n = 100$ and $p = 0.07$. The number of guests that are not expected to show up is $\mu = np = 7$.

d. Poisson with parameter $\lambda = 2$ as on average we expect two defects per km.

e. Beta with a minimum value of 0 and a maximum value of 1. There is insufficient information to determine the values of parameters α and β.

Exercise 2

a. We would infer that the development cost has a uniform distribution on the interval between $450,000 and $650,000 since having "no idea" means that any one value in the interval is just as likely as any other value, which is the key characteristic of a uniform distribution. Also, the experts are almost certain (95% confidence) as to what the limits of the distribution will be.

b. As the distribution is symmetric, and reasonably bell-shaped, the Normal distribution should be a good fit. The most likely value of a Normal distribution is the same as the mean, so we can assume the mean is $550,000. You know that for a Normal distribution 90% of the area under the curve lies between the mean plus or minus 1.645 standard deviations, so 1.645 times the standard deviation equals $100,000. Therefore, the standard deviation is about $100,000/1.645 = $60,790.

c. The text cover the triangular distribution (which we don't cover) and this is the type of distribution that they argue would be appropriate. However, we have covered the Beta distribution (which isn't covered in the text) and that would be our answer, since it can handle skewness.

If this was an exam question, you wouldn't be able to provide figures for the parameters (α, β, minimum of A, and a maximum of B) because you need Excel to estimate them. Using trial and error, I found that $\alpha = 3.0$, and $\beta = 24.1$, with limits of A = 416.3, and B = 1465. But, as mentioned, this goes beyond what would be asked in an exam question, so we'll leave it there!

Quiz

1) b. 2) c.