

Homework Assignment-4

POM 500 Statistical Analysis

Note: Attempt all questions as per rubric. Problems including case study has a weightage of 10 marks each. The maximum you can score is 50. Use Excel function wherever possible.

Problem-1

Given a standard normal random variable (z values) or probabilities, compute the following probabilities or z values, as applicable.

- a) $P(0 \leq z \leq 0.83)$ (Write Excel function)
- b) $P(-1.57 \leq z < 0)$ (Write Excel function)
- c) $P(z > 0.44)$ (Write Excel function)
- d) The area to the left of z is 0.975 (Write Excel function)
- e) The area to the right of z is 0.35 (Write Excel function)

Problem-2

The average annual amount American households spend for daily transportation is \$6312 (Money, August 2001). Assume that the amount spent is normally distributed.

- a) Suppose you learn that 5% of American households spend less than \$1000 for daily transportation. What is the standard deviation of the amount spent? (Write Excel function)
- b) What is the probability that a household spends between \$4000 and \$6000? (Write Excel function)
- c) What is the range of spending for the 3% of households with the highest daily transportation cost? (Write Excel function)

Problem-3

Conde Nast Traveler publishes a Gold List of the top hotels all over the world. The Broadmoor Hotel in Colorado Springs contains 700 rooms and is on the 2004 Gold List (Conde Nast Traveler, January 2004). Suppose Broadmoor's marketing group forecasts a mean demand of 670 rooms for the coming weekend. Assume that demand for the upcoming week-end is normally distributed with a standard deviation of 30.

- a) What is the probability all the hotel's rooms will be rented? (Write Excel function)
- b) What is the probability 50 or more rooms will not be rented? (Write Excel function)
- c) Would you recommend the hotel consider offering a promotion to increase demand? What considerations would be important?

Problem-4

Suppose interarrival times at a hospital emergency room during weekday are exponentially distributed, with an average interarrival time of 10 minutes. If the arrivals are Poisson distributed, what would the average number of arrivals per hour be? What is the probability that less than 5 minutes will elapse between any two arrivals? (Write Excel function)

Case Study: Specialty Toys

Specialty Toys, Inc., sells a variety of new and innovative children's toys. Management learned that the preholiday season is the best time to introduce a new toy, because many families use this time to look for new ideas for December holiday gifts. When Specialty discovers a new toy with good market potential, it chooses an October market entry date. In order to get toys in its stores by October, Specialty places one-time orders with its manufacturers in June or July of each year. Demand for children's toys can be highly volatile. If a new toy catches on, a sense of shortage in the marketplace often increases the demand to high levels and large profits can be realized. However, new toys can also flop, leaving Specialty stuck with high levels of inventory that must be sold at reduced prices. The most important question the company faces is deciding how many units of a new toy should be purchased to meet anticipated sales demand. If too few are purchased, sales will be lost; if too many are purchased, profits will be reduced because of low prices realized in clearance sales. For the coming season, Specialty plans to introduce a new product called Weather Teddy. This variation of a talking teddy bear is made by a company in Taiwan. When a child presses Teddy's hand, the bear begins to talk. A built-in barometer selects one of five responses that predict the weather conditions. The responses range from "It looks to be a very nice day! Have fun." to "I think it may rain today. Don't forget your umbrella." Tests with the product show that, even though it is not a perfect weather predictor, its predictions are surprisingly good. Several of Specialty's managers claimed Teddy gave predictions of the weather that were as good as many local television weather forecasters. As with other products, Specialty faces the decision of how many Weather Teddy units to order for the coming holiday season. Members of the management team suggested order quantities of 15 000, 18 000, 24 000, or 28 000 units. The wide range of order quantities suggested indicating considerable disagreement concerning the market potential. The product management team asks you for an analysis of the stock-out probabilities for various order quantities, an estimate of the profit potential, and to help make an order quantity recommendation. Specialty expects to sell Weather Teddy for \$24 based on a cost of \$16 per unit. If inventory remains after the holiday season, Specialty will sell all surplus inventory for \$5 per unit. After reviewing the sales history of similar products, Specialty's senior sales forecaster predicted an expected demand of 20 000 units with a 0.95 probability that demand would be between 10 000 units and 30 000 units.

Managerial Report

Prepare a managerial report that addresses the following issues and recommends an order quantity for the Weather Teddy product.

1. Use the sales forecaster's prediction to describe a normal probability distribution that can be used to approximate the demand distribution. Sketch the distribution and show its mean and standard deviation. (Write Excel function) (2.5 points)
2. Compute the probability of a stock-out for the order quantities suggested by members of the management team. (Write Excel function) (2.5 points)
3. Compute the projected profit for the order quantities suggested by the management team under three scenarios: worst case in which sales = 10 000 units, most likely case in which sales = 20 000 units, and best case in which sales = 30 000 units. (2.5 points)

4. One of Specialty's managers felt that the profit potential was so great that the order quantity should have a 70% chance of meeting demand and only a 30% chance of any stock-outs. What quantity would be ordered under this policy, and what is the projected profit under the three sales scenarios? (Write Excel function) (2.5 points)

5. Provide your own recommendation for an order quantity and note the associated profit projections. Provide a rationale for your recommendation. (2 points Bonus)