Quantitative Analyst Application Exercises

Below are a set of problems involving basic statistics, a cost/benefit analysis, and a simulation. You need to produce your answers in an Excel spreadsheet. Candidates will be evaluated on the number of correct answers and, just as importantly, how professional the spreadsheet looks (formatting, explanations of inputs and outputs, etc.) Assume you are providing these results to one of our clients.

1. Suppose you're trying to determine what percentage of employees at a large corporation take public transportation to get to work. From a random sample of 20, 9 say they do. Give a 90 percent confidence interval for the proportion of all employees who take public transportation to work. Please explain the formula or method you use.

2. Consider the following facts about the detection of a certain disease in human patients:
   A. The test produces a positive result 95 percent of the time when the person has the disease.
   B. The test produces a positive result 0.5 percent of the time when the patient does not have the disease.
   C. The overall prevalence of the disease in the population is one in 100,000 people.

   Compute the probability a person has the disease, given a positive test result.

3. Make a *cumulative* probability chart. Assume a quantity has a normal distribution with a mean of 100 and a standard deviation of 15. Make x the horizontal axis and make the vertical axis equal to the probability that the quantity is less than x.

4. Use the estimates in Table 1 (next page) to build a cash flow and compute the NPV for this food cart investment over three years. Use the following assumptions:

   A. The food cart will be purchased in 2021.
   B. Revenue starts in 2022 and ends in 2024.
   C. Every customer buys food and a drink.
   D. The opportunity cost of labor applies in years 2022 through 2024.
   E. The license cost applies in years 2021 through 2024.
   F. The discount rate for the NPV calculation is 10%.

Table 1: Estimates for Question 4

Variable	Estimate
Revenue	
Food purchased (per person)	$5.00
Beverages purchased (per person)	$2.25
People served per day	50
Workdays per year	250
Investment/Fixed Costs	
Food Cart Purchase	$25,000
Opportunity Cost of Labor (annual)	$40,000
License (annual)	$1,200
Variable Costs	
Food & drink (per person)	$2.00
Utensils (per person)	$0.15
Fuel (per day)	$12.00

5. Make a copy of your cash flow model from the previous question to use as a starting point.
   A. Build a probabilistic cash flow with the following 90% confidence interval estimates and the stated distributions.
   B. Run a Monte Carlo simulation to generate 1,000 random trials for the NPV of this uncertain food cart investment over three years.
      i. What is the average NPV over all 1,000 trials?
      ii. What is the probability of a negative NPV?

Table 2: Estimates for Question 5

Variable	Lower Bound	Upper Bound	Distribution
Revenue			
Food purchased (per person)	$4.25	$5.75	Normal
Beverages purchased (per person)	$1.94	$2.56	Normal
People served per day	44	56	Normal
Workdays per year	221	265	Normal
Investment/Fixed Costs			
Food Cart Purchase	$18,000	$35,000	Lognormal
Opportunity Cost of Labor (annual)	$37,000	$52,000	Lognormal
License (annual)	$1,200	$2,500	Uniform
Variable Costs			
Food & drink cost (per person)	$1.69	$2.31	Lognormal
Utensil cost (per person)	$0.12	$0.18	Lognormal
Fuel (per day)	$6.00	$18.00	Lognormal