MSBA7003 Decision Analytics – Assignment 2 (Due Sep 21 noon at 11:55 a.m.)

Please review the example answer sheet provided, and use the specified template to submit your solutions. You need to submit a Excel file for Q1-Q3 and an appendix file for Q3.

Q1.

Jack is watching short videos on Tic-Tac. There are two types of videos: A and B. The probability of Jack liking each type of video is different. His interest in a type will drop to a lower level if he keeps watching the same type; his interest will go back to a higher level if otherwise.

For type A, the probability of Jack liking a video is

$$\begin{cases} 0.5, & \text{if the last video watched is of type A;} \\ 0.7, & \text{otherwise.} \end{cases}$$

For type B, the probability of Jack liking a video is

$$\begin{cases} 0.65, & \text{if the last video watched is of type B;} \\ 0.55, & \text{if the last two videos watched is of type B;} \\ 0.85, & \text{otherwise.} \end{cases}$$

If Jack does not like three videos in a row, he will close the app. Suppose Tic-Tac cannot know whether Jack likes a video. Use Monte Carlo simulation (at least 10,000 times) to check the statements below and choose the correct ones.

(A) If Tic-Tac always shows Jack type A videos, he is expected to watch 14~15 videos before he closes the app.
(B) If Tic-Tac always shows Jack type B videos, he is expected to watch 21~22 videos before he closes the app.
(C) If Tic-Tac alternates between the two types when showing Jack videos (the first is type A), he is expected to watch 50~60 videos before he closes the app.
(D) If Tic-Tac alternates between the two types when showing Jack videos (the first is type B), he is expected to watch 60~70 videos before he closes the app.
(E) None of the above.

Q2.

Cyclone Appliance Center sells and services several brands of major appliances. Past sales for a particular model of electric fan have resulted in the following probability distribution for demand:

Demand per Week	0	1	2	3	4
Probability	0.20	0.20	0.20	0.35	0.05

The replenishment lead time, in weeks, is described by the following distribution:

Lead Time (weeks)	1	2	3
Probability	0.15	0. 50	0.35

Based on cost considerations as well as storage space, the company has decided to order 15 units each time. The shipping cost for each order is $30. The holding cost is $5 per week per unit that is left in inventory at the end of the week. The stock-out cost is $40 per unit. The company has decided to place an order whenever there are only two or fewer fans left at the end of the week. No order can be placed when fans are being shipped on the way. Simulate 10 weeks of operation for Cyclone Appliance by hand, assuming that there are currently 5 units in inventory. You must use the random numbers listed in the table below to generate demand and lead time values.

Week	Order Received	Total Available	R.N.	Demand	Sales	Lost Sales	Ending Inventory	Place Order	R.N.	Lead Time
1	0	5	0.52						0.56	
2			0.37						0.45	
3			0.82						0.07	
4			0.98						0.16	
5			0.96						0.48	
6			0.33						0.61	
7			0.50						0.31	
8			0.88						0.43	
9			0.90						0.28	
10			0.06						0.31	

Which of the following statement(s) is(are) true?

A) The total sales during this 10-week period are 15.

B) The total lost sales during this 10-week period are 6.

C) The total number of orders placed during this 10-week period is 2.

D) The total (not average) cost of inventory holding, ordering, and stock-out costs during this 10-week period is $415.

E) None of the above.

Q3.

Jack is the director of an electronic components factory. The factory has just completed an order of 20,000 pieces of an integrated circuit board. The total value of the order is $50,000, and the production cost is $10,000. The customer requires that the defective rate should not exceed 0.1%. If it exceeds, the customer's full payment should be refunded, and the goods should not be returned. Jack's prior judgment is that the batch of goods either has no defects or has a defect rate of 0.5%. Each scenario has a half

chance. Now he has three options. The first is to deliver the goods directly without inspection. The second is to reproduce a batch of absolutely non-defective products at a cost of $20,000 for delivery. The third is to randomly select 100 pieces for inspection. The inspection cost is $5,000. After the inspection, Jack will reassess the chance of each scenario (i.e., whether the batch of goods has no defects or has a defect rate of 0.5%). Then he can choose between reproducing non-defective products at a high cost or delivering the goods directly. When reproducing the products, the existing products will be dismantled. Please solve for the optimal decision by drawing a decision tree.

Please answer the following questions in the answer template and upload your detailed calculations in a separate file as the appendix.

Please **round off your answers to two decimal places**.

(A) The expected net payoff of option 1 is $_____.
(B) The net payoff of option 2 is $_____.
(C) The expected net payoff of option 3 is $_____.
(D) The value of the inspection is $_____.