

Assignment 2 (Week 3 - 4)

STAT 2601 - Business Statistics (2024 Fall)

SCHOOL OF MATHEMATICS AND STATISTICS, CARLETON UNIVERSITY

Due Date and Time: Wednesday 9 October 2024, before 10:00 am

Total Marks: 40

Instructions: Please refer to the document entitled *Submission Instructions* posted at Brightspace. Follow the instructions carefully.

Q1: [12] Dish Detergent

A manufacturing company has recently launched two new dish detergents in the market. To understand the market preferences for the new products, an analyst of the company took a random sample of customers in 2024 January who purchased the product(s). Of those sampled customers, 65% liked detergent A, 48% liked detergent B, and 25% liked both detergents.

Let the event A represent detergent A and the event B represent detergent B. Please show formulas and use correct event notation to answer the following questions.

- (a) [1.5] State each of the three probabilities above in terms of the events A and B .
- (b) [2] Draw a 2×2 contingency table with rows A, \bar{A} and columns B, \bar{B} . Also, include the marginal total columns and complete the table.
- (c) [1.5] What is the probability that a randomly selected customer likes only detergent A?
- (d) [1.5] What is the probability that a randomly selected customer likes at least one detergent?
- (e) [1.5] What is the probability that a randomly selected customer likes neither detergent A nor detergent B?
- (f) [1.5] What is the probability that a randomly selected customer likes only one detergent?
- (g) [1] Are the events A and B mutually exclusive? Justify.
- (h) [1.5] What is the probability that a randomly selected customer does not like detergent B?

Q2: [6] Credit Score and Default on Loans

A credit score is a three-digit number that indicates how creditworthy you are and how much risk you carry before giving you any credit. A credit score is important because it can affect your ability to get credit cards, loans, insurance, apartments, and even jobs. It can also determine the terms and interest rates you may receive from lenders. A higher credit score means you are more likely to repay borrowed funds and get favorable deals. Based on a survey in 2023 December, 60% had good credit score (i.e., higher than 680). Of those Canadians who had good credit score, 8% defaulted on loan. 25% of those who did not have good credit score also defaulted on loan.

Let C represent the event that a person had good credit score, and D be the event that a person defaulted on loan. Do not define any additional events.

- (a) [1.5] Express each of the above three probabilities in terms of the events C and D .
- (b) [2] If a person was randomly selected in 2023 December, what is the probability that the person defaulted on loan?
- (c) [2.5] If a person defaulted on loan, what is the probability that the person did not have good credit score?

Q3: [11] Starbucks Coffee

Starbucks Corporation is an American multinational chain of coffeehouses and roastery reserves headquartered in Seattle, Washington. It was founded in 1971, and is currently the world's largest coffeehouse chain. Suppose 15% of customers prefer purchasing coffee from Starbucks. A random sample of 10 customers is selected. Let X represent the number of customers prefers Starbucks coffee.

- (a) [1.5] What is the probability distribution of X ? State the name of the probability distribution and the value(s) of any relevant parameter(s).
- (b) [2] What are the mean and standard deviations of number of customers who prefer Starbucks coffee?
- (c) [1.5] What is the probability that exactly 2 customers in the sample will prefer Starbucks coffee?
- (d) [2] Use the procedure demonstrated in Lab 2 to create a probability distribution table and histogram for X . How would you describe the shape of the probability distribution? You may use this output as necessary to answer the questions (e) and (f). (**EXCEL**)
- (e) [2] What is the probability that at least one but fewer than 3 customers in the sample will prefer Starbucks coffee?
- (f) [2] What is the probability that number of customers in the sample not preferring Starbucks coffee will exceed 7?

EXCEL Instructions

- Open blank worksheet.
- In any cell, type “=” and click on f_x (function wizard).
- Select **Statistical Category**.
- Select the **BINOM.DIST** function.
- Fill in the information in the template and click OK.
 - (i) **Number_s**: Number of Success
 - (ii) **Trials**: Number of Trials
 - (iii) **Probability_s**: Probability of Success
 - (iv) **Cumulative**: TRUE (if cumulative)/ FALSE (otherwise)

Q4: [11] Pizza Hut

Pizza Hut, a popular pizza chain in Ottawa, makes an average of 8 pizzas every 30 minutes in the Friday night. Let X represent the number of pizzas ordered at the Pizza Hut during a 30-minute period in the Friday night.

- (a) [1] What is the probability distribution of X ? State the name of the probability distribution and the value(s) of any relevant parameter(s).
- (b) [1.5] What is the probability that exactly 5 pizzas will be ordered during a 30-minute period in the Friday night?
- (c) [2.5] Suppose the last order was received at 8:25 pm on Friday. What is the probability that at least 4 pizzas will be ordered by 8:32 pm?
- (d) [3] What is the probability that the number of pizzas to be ordered during a 15-minute period will be less than 3?
- (e) [3] Verify the calculation of the probabilities calculated in steps (b), (c), and (d) using EXCEL function **POISSON.DIST**. Do you get the same result? The function **POISSON.DIST** can be invoked following the same steps of **BINOM.DIST**.

EXCEL Instructions

- Open blank worksheet.
- In any cell, type “=” and click on f_x (function wizard).
- Select **Statistical Category**.
- Select the **POISSON.DIST** function.
- Fill in the information in the template and click OK.
 - (i) **X:** Number of Success
 - (ii) **Mean:** Mean of Poisson Distribution
 - (iii) **Cumulative:** TRUE (if cumulative)/FALSE (otherwise)