Tasks 07-07 - Binomial Distribution

Section 07: Probability & Statistics

Problem 1: Binomial Formula (x)

Identify whether each scenario follows a binomial distribution. If yes, state n, p, and what constitutes a "success."

a) Rolling a die 10 times and counting 6s
b) Surveying people until you find 5 who prefer Brand A
c) Testing 20 products and counting defectives (defect rate 3%)
d) Drawing 5 cards from a deck and counting hearts (without replacement)

Problem 2: Calculating Binomial Probabilities (x)

A fair coin is flipped 8 times. Calculate:

a) $P(\text{exactly } 5 \text{ heads})$
b) $P(\text{exactly } 0 \text{ heads})$
c) $P(\text{at least } 1 \text{ head})$
d) $P(\text{at most } 2 \text{ heads})$

Problem 3: Quality Control (xx)

A manufacturing process produces items with a 5% defect rate. A sample of 15 items is randomly selected.

a) What is the probability that exactly 2 items are defective?
b) What is the probability that at most 1 item is defective?
c) What is the probability that at least 2 items are defective?
d) What is the expected number of defective items?
e) What is the standard deviation?

Problem 4: Customer Survey (xx)

In a survey, 30% of customers indicate they would recommend a product. If 12 customers are randomly surveyed:

a) Find $P(\text{exactly } 4 \text{ recommend})$
b) Find $P(\text{fewer than } 3 \text{ recommend})$
c) Find $P(\text{between } 3 \text{ and } 6 \text{ inclusive recommend})$
d) What's the most likely number of customers to recommend?

Problem 5: Geometric Distribution (xx)

A basketball player makes free throws with 80% accuracy.

a) What's the probability the first miss is on the 5th shot?
b) What's the probability of making at least 4 shots before the first miss?
c) On average, how many shots until the first miss?
d) What's the probability of missing within the first 3 shots?

Problem 6: Exam-Style Problem (xxx)

A company receives customer complaints with a 2% complaint rate per order. In a day with 200 orders:

a) Calculate the expected number of complaints
b) Calculate the standard deviation
c) Find $P(\text{exactly } 4 \text{ complaints})$
d) Find $P(\text{at most } 3 \text{ complaints})$
e) Find $P(\text{more than } 6 \text{ complaints})$
f) Using the normal approximation with continuity correction, estimate $P(X \leq 5)$

Problem 7: Multiple Scenarios (xxx)

A call center receives calls where each has a 15% chance of being a complaint.

a) In 20 calls, what's the probability of exactly 3 complaints?
b) In 20 calls, what's the probability of at least one complaint?
c) The center receives calls sequentially. What's the probability the first complaint is on the 10th call?
d) On average, after how many calls does the first complaint occur?
e) If the center handles 100 calls per day, between what numbers would you expect the daily complaint count to fall 95% of the time?