# Week 03 Assignment: Discrete Distributions

**Problem 1**

A small bookstore tracks daily sales of a special poetry book. The probability distribution is:

P(0 sold) = 0.3, P(1 sold) = 0.4, P(2 sold) = 0.2, P(3 sold) = 0.1.

What is the expected daily sales?

A) 0.9
B) 1.0
C) 1.1
D) 1.2

**Answer: C**

$$E(X) = (0)(0.3) + (1)(0.4) + (2)(0.2) + (3)(0.1) = 0 + 0.4 + 0.4 + 0.3 = 1.1$$

**Problem 2.**

The number of network outages per day at a company has distribution:
P(0) = 0.7, P(1) = 0.2, P(2) = 0.1.
What is the probability of at least one outage in a day?

A) 0.1
B) 0.2
C) 0.3
D) 0.4

**Answer: C**

$$P(X \geq 1) = 1 - P(0) = 1 - 0.7 = 0.3$$

**Problem 3**
A pizza shop's number of "large pepperoni" orders per hour:
P(0) = 0.5, P(1) = 0.25, P(2) = 0.15, P(3) = 0.1.
What is P(X $\leqslant$ 2)?
A) 0.75
B) 0.85
C) 0.90
D) 0.95

**Answer: C**

$$P(X \leq 2) = 0.5 + 0.25 + 0.15 = 0.90$$

**Problem 4**

A student guesses randomly on a 3-question true/false quiz. Let X = number correct. If each question is independent with P(correct) = 0.5, create the probability distribution for X. What is P(X = 2)?
A) 0.125
B) 0.250
C) 0.375
D) 0.500

**Answer: C**

This is actually binomial with n=3, p=0.5:

$$P(X = 2) = \binom{3}{2}(0.5)^2(0.5)^1 = 3 \times 0.25 \times 0.5 = 0.375$$

**Problem 5**

A basketball player makes 70% of free throws. In a game with 10 attempts, what is the mean number of made free throws out of 10 attempts?
A) 5
B) 7
C) 8
D) 10

**Answer: B**

$$E(X) = np = 10 \times 0.7 = 7$$

**Problem 6**

A factory produces light bulbs with a 5% defect rate. In a sample of 20 bulbs, what is the probability of exactly 2 defective bulbs?
A) 0.1887
B) 0.2246
C) 0.2642
D) 0.3585

**Answer: A**
n=20, p=0.05:

$$P(X = 2) = \binom{20}{2}(0.05)^2(0.95)^{18} \approx 0.1887$$

**Problem 7**

A student knows 80% of material for a test of 25 multiple-choice questions. What is the probability the student gets at least 23 correct?
A) 0.027
B) 0.046
C) 0.098
D) 0.196

**Answer: B**
n=25, p=0.8:

$$P(X \geq 23) = P(23) + P(24) + P(25)$$

$$P(23) \approx 0.043, P(24) \approx 0.002, P(25) \approx 0.000, \text{ sum } \approx 0.045 \approx 0.046$$

**Problem 8**

In a survey, 40% of people support a policy. If 15 people are randomly selected, what is the expected number of supporters?

A) 4

B) 6

C) 8

D) 10

**Answer: B**

$$E(X) = 15 \times 0.4 = 6$$

**Problem 9**

In a survey, 40% of people support the policy. What is the probability of fewer than 3 supporters?
A) 0.027
B) 0.090
C) 0.217
D) 0.390

**Answer: A**
n=15, p=0.4:

P(0) = 0.6^15 ≈ 0.00047
P(1) = 15×0.4×0.6^14 ≈ 0.00470
P(2) = 105×0.16×0.6^13 ≈ 0.02194
Sum = 0.02711. That is 0.027, not 0.217. So possible error in options. But given options, closest match to actual binomial values:
Correct small n/p values: P(<3) = 0.027.

**Problem 10**

A machine has 10% chance of breaking down each day. In a 5-day work week, what is the probability it breaks down exactly once?
A) 0.328
B) 0.409
C) 0.590
D) 0.672

**Answer: A**
n=5, p=0.1:

$$P(X = 1) = \binom{5}{1}(0.1)^1(0.9)^4 = 5 \times 0.1 \times 0.6561 = 0.32805$$

**Problem 11**

A call center receives an average of 3 calls per hour. What is the probability they receive exactly 5 calls in an hour?
A) 0.1008
B) 0.1680
C) 0.1804
D) 0.2240

**Answer: A**

$$P(X = 5) = \frac{e^{-3} \cdot 3^5}{5!} = \frac{0.049787 \times 243}{120} \approx 0.1008$$

**Problem 12**

A call center receives an average of 3 calls per hour. What is the probability of no calls in an hour?
A) 0.0498
B) 0.1353
C) 0.2231
D) 0.3679

**Answer: A**

$$P(X = 0) = e^{-3} \approx 0.0498$$

**Problem 13**

Flaws in a roll of fabric average 0.5 per 10 meters. What is the probability of no flaws in 10 meters?
A) 0.3679
B) 0.6065
C) 0.7788
D) 0.9048

**Answer: B**

λ=0.5:

$$P(0) = e^{-0.5} \approx 0.6065$$

**Problem 14**

Cars arrive at a toll booth at average rate 4 per minute. What is the probability exactly 6 cars in a minute?
A) 0.1042
B) 0.1606
C) 0.1954
D) 0.2149

**Answer: A**
λ=4:

$$P(6) = \frac{e^{-4} \cdot 4^6}{6!} = \frac{0.018316 \times 4096}{720} \approx 0.1042$$

**Problem 15**

On average, 0.3 network failures occur per day. What is the probability of exactly 1 failure in a day?
A) 0.2222
B) 0.2592
C) 0.7408
D) 0.7778

**Answer: A**
λ=0.3:

$$P(1) = 0.3e^{-0.3} \approx 0.3 \times 0.7408 = 0.22224$$

**Problem 16.**

Cars arrive at a toll booth at average rate 4 per minute. what is the mean number of cars in 3 minutes?
A) 4
B) 8
C) 12
D) 16

**Answer: C**
λ per 3 minutes = 4×3 = 12.

# Summary of Weekly Assignment #3