Tasks 07-04 - Conditional Probability

Section 07: Probability & Statistics

Problem 1: Basic Conditional Probability (x)

Given $P(A) = 0.6$, $P(B) = 0.5$, and $P(A \cap B) = 0.3$:

a) Find $P(A \mid B)$
b) Find $P(B \mid A)$
c) Are A and B independent?

Problem 2: Multiplication Rule (x)

A bag contains 6 red and 4 blue balls. Two balls are drawn without replacement.

a) Find $P(\text{both red})$
b) Find $P(\text{first red, second blue})$
c) Find $P(\text{different colors})$

Problem 3: Tree Diagrams (xx)

A company has two production lines: - Line A produces 60% of items, with 5% defect rate - Line B produces 40% of items, with 8% defect rate

a) Draw a tree diagram
b) Find $P(\text{defective})$
c) Find $P(\text{Line A and defective})$
d) Given an item is defective, find $P(\text{from Line A})$

Problem 4: Law of Total Probability (xx)

A store has three suppliers: - Supplier X: 50% of stock, 2% return rate - Supplier Y: 30% of stock, 4% return rate - Supplier Z: 20% of stock, 5% return rate

a) What is the overall return rate?
b) A returned item is selected. What's the probability it came from Supplier Y?

Problem 5: Sequential Selection (xx)

From a group of 8 men and 5 women, 3 people are selected randomly (without replacement).

a) Find $P(\text{all women})$
b) Find $P(\text{all men})$
c) Find $P(\text{at least one woman})$
d) Find $P(\text{exactly 2 men})$

Problem 6: Independence Testing (xxx)

A survey of 400 employees collected data on job satisfaction (Satisfied/Not Satisfied) and work arrangement (Remote/Office):

	Remote	Office	Total
Satisfied	90	150	240
Not Satisfied	60	100	160
Total	150	250	400

a) Find $P(\text{Satisfied})$
b) Find $P(\text{Satisfied} \mid \text{Remote})$
c) Find $P(\text{Satisfied} \mid \text{Office})$
d) Are satisfaction and work arrangement independent?

Problem 7: Exam-Style Problem (xxx)

At a university, 70% of students pass the statistics exam. Of those who pass, 80% studied more than 10 hours. Of those who fail, 30% studied more than 10 hours.

a) Draw a complete tree diagram with all probabilities
b) Find $P(\text{studied more than 10 hours})$
c) A student studied more than 10 hours. What's the probability they passed?
d) Are "passing" and "studying more than 10 hours" independent?