

Probability — Assignment 2

Class 12 Maths · Higher-difficulty challenge set + integrated problems · Answer key included · Narayan Gurukul Academy

Instructions: (1) Attempt all questions; start with the topic-wise challenge set, then attempt the integrated (multi-topic) problems.
(2) Give all answers with correct SI units. $g = 10 \text{ m/s}^2$ unless stated.
(3) A final answer key is provided at the end — try the full set before checking it.

Part A — Topic-wise challenge questions

Conditional Probability and the Multiplication Theorem

1. If $P(A) = 0.5$, $P(B) = 0.4$ and A , B are independent, find $P(A \cap B)$.
2. If $P(A) = 0.3$ and $P(B|A) = 0.4$, find $P(A \cap B)$.
3. Given $P(A) = 0.6$, $P(B) = 0.5$ and $P(A \cap B) = 0.3$, find $P(A|B)$ and $P(B|A)$.

Total Probability and Bayes' Theorem

1. Given $P(E_1) = 0.4$, $P(E_2) = 0.6$, $P(A|E_1) = 0.5$, $P(A|E_2) = 0.3$, find $P(A)$.
2. Bag I has 3 red 4 black, Bag II has 5 red 6 black. A bag is chosen and a ball drawn is red. Find $P(\text{Bag I chosen})$.
3. Two machines produce 60% and 40% of items; defect rates 2% and 5%. An item is defective, find $P(\text{it came from machine 1})$.

Random Variables and Their Distribution

1. Find the mean of X with $P(X = 0) = 0.3$, $P(X = 1) = 0.5$, $P(X = 2) = 0.2$.
2. For that distribution, find $E(X^2)$ and $\text{Var}(X)$.
3. Two cards are drawn; let X be the number of aces. Find the probability distribution of X .

Bernoulli Trials and the Binomial Distribution

1. A coin is tossed 5 times. Find the probability of exactly 3 heads.
2. A die is thrown 4 times. Find the probability of getting a 6 exactly once.
3. In 10 tosses of a fair coin, find the probability of at least 8 heads.

Part B — Integrated problems (multi-topic)

1. Write the formula for $P(A|B)$.
2. State the theorem of total probability.
3. Write the formula for the mean of a random variable.
4. Write the binomial probability formula.
5. What is the relation between p and q ?

Answer Key

Conditional Probability and the Multiplication Theorem

0.2. 0.12. $P(A|B) = 0.6$, $P(B|A) = 0.5$.

Total Probability and Bayes' Theorem

0.38. $P(\text{Bag I}) = (3/7)/(3/7 + 5/11) = 33/68$. $P(\text{Machine 1}) = 0.012/0.032 = 0.375$.

Random Variables and Their Distribution

$E(X) = 0.9$. $E(X^2) = 1.3$, $\text{Var}(X) = 0.49$. Distribution of $X = 0, 1, 2$.

Bernoulli Trials and the Binomial Distribution

$10/32 = 5/16$. $4(1/6)(5/6)^3 = 500/1296$. $P(X \geq 8) = 56/1024$.

Integrated problems

1: $P(A \cap B)/P(B)$. 2: $P(A) = \sum P(E_i)P(A|E_i)$. 3: $\sum x P(X = x)$. 4: ${}^nC_r p^r q^{n-r}$. 5: $p + q = 1$.