📘 Assignment: Probability & Bayes’ Theorem

Objective: Strengthen the understanding of classical probability and conditional reasoning through Bayes’ Theorem.

Total Questions: 10

Chapters Covered:

Classical & Conditional Probability

Independent Events

Total Probability

Bayes’ Theorem with real-life use cases

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✅ Instructions:

Attempt all questions showing all steps and formulas used.

Round off answers to 2 decimal places where needed.

Diagrams/Venn may be used wherever necessary.

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🔢 PART A: PROBABILITY (Q1–Q6)

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Q1. Coin and Dice

A fair coin is tossed and a fair 6-sided die is rolled.

👉 Find the probability:

1. Getting a head and an even number

b) Getting a tail or a number greater than 4

c) Not getting head and number less than 4

**a) Getting a head and an even number**

* Coin: ½ (head)
* Die: there are 3 even numbers (2, 4, 6) out of 6 → 3/6 = ½
* Combined (independent): (½) × (½) = ¼ = **0.25**

**b) Getting a tail or a number greater than 4**  
Let events be T = “tail” and G = “die > 4” (i.e., 5 or 6).  
We want P(T ∪ G).  
Use inclusion‑exclusion:  
P(T) + P(G) − P(T ∩ G)

* P(T) = ½
* P(G): 2 outcomes (5, 6) out of 6 → 2/6 = 1/3
* P(T ∩ G): both tail AND die > 4 → (½) × (1/3) = 1/6

So:  
P = ½ + 1/3 − 1/6 = (3/6 + 2/6 − 1/6) = 4/6 = **2/3 ≈ 0.6667**

**c) Not getting head and number less than 4**  
Interpretation: "not (head and number < 4)" = the complement of (head AND die < 4).  
Alternatively, probability that either we get tail, or the die shows 4–6 (i.e. ≥ 4), or both.

First find P(head AND die < 4):

* P(head) = ½
* Die < 4 → numbers {1,2,3}, so 3/6 = ½
* Combined: (½) × (½) = ¼

Therefore, the complement is:  
1 − ¼ = **¾ = 0.75**

**a) Drawing a black face card**

* There are **6 black face cards** (Jack, Queen, King in **♣ Clubs** and **♠ Spades**)
* Total cards: 52
* Probability: 652=326≈0.1154\frac{6}{52} = \frac{3}{26} \approx 0.1154526​=263​≈0.1154  
  Supports: 6 black face cards in deck

**b) Drawing a card that is a diamond or a king**

Let:

* A = “diamond” (13 cards)
* B = “king” (4 cards)

Use the inclusion-exclusion formula:

* P(A) = 1352\frac{13}{52}5213​
* P(B) = 452\frac{4}{52}524​
* P(A ∧ B) = “King of diamonds” = 152\frac{1}{52}521​

**c) Drawing a non-ace card**

* “Ace” cards = 4
* Non-ace cards = 52 − 4 = 48
* Probability = 4852=1213≈0.9231\frac{48}{52} = \frac{12}{13} \approx 0.92315248​=1312​≈0.9231