Probability Mastery

100 ESSENTIAL PROBLEMS · COMPLETE COURSE

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1. BASIC PROBABILITY · ●

A fair coin is flipped once. What is the probability of getting Heads?

A) 1 B) 1/4
C) 1/2 D) 3/4

> 💡 P(event) = favorable outcomes ÷ total outcomes.

2. BASIC PROBABILITY · ●

A fair die is rolled. What is the probability of rolling a 3?

A) 1/2 B) 1/6
C) 1/3 D) 1/4

> 💡 A standard die has 6 equally likely faces.

3. BASIC PROBABILITY · ●

A bag contains 3 red and 2 blue marbles. What is the probability of drawing a red marble?

A) 2/5 B) 3/2
C) 1/5 D) 3/5

> 💡 Count red marbles over total marbles.

4. BASIC PROBABILITY · ●

If P(A) = 0.4, what is P(A')? (complement of A)

A) 0.4 B) 0.6
C) 1.4 D) 0

> 💡 P(A) + P(A') = 1.

5. BASIC PROBABILITY · ●

What is the probability of an impossible event?

A) 1 B) 0.5
C) 0 D) −1

> 💡 Impossible means it can never happen.

6. BASIC PROBABILITY · ●

A fair die is rolled. What is P(even number)?

A) 1/6 B) 1/3
C) 1/2 D) 2/3

> 💡 Even faces: 2, 4, 6 — that's 3 of them.

7. BASIC PROBABILITY · ●

What is the probability of a certain (sure) event?

A) 0 B) 0.5
C) > 1 D) 1

> 💡 A certain event always occurs.

8. BASIC PROBABILITY · ●

A deck has 52 cards. What is P(drawing an Ace)?

A) 4/52 B) 1/52
C) 13/52 D) 4/13

> 💡 There are 4 Aces in a 52-card deck.

9. BASIC PROBABILITY · ●

A number is chosen at random from {1, 2, 3, 4, 5}. P(number > 3) = ?

A) 1/5
B) 3/5
C) 2/5
D) 4/5

> 💡 List numbers greater than 3 in the set.

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10. BASIC PROBABILITY · ●

A bag has 5 identical balls numbered 1–5. What is P(drawing ball #2)?

A) 2/5
B) 1/5
C) 1/2
D) 5/1

> 💡 Each ball is equally likely.

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PROBLEMS 11-20

11. ADDITION RULE · ●

$P(A) = 0.3$, $P(B) = 0.5$, A and B are mutually exclusive. Find $P(A \cup B)$.

A) 0.15 B) 0.2
C) 0.8 D) 0.7

💡 Mutually exclusive: $P(A \cup B) = P(A) + P(B)$.

12. ADDITION RULE · ●

$P(A) = 0.5$, $P(B) = 0.4$, $P(A \cap B) = 0.2$. Find $P(A \cup B)$.

A) 0.9 B) 0.7
C) 1.1 D) 0.3

💡 $P(A \cup B) = P(A) + P(B) - P(A \cap B)$.

13. ADDITION RULE · ●

A die is rolled. $A = \{1,2,3\}$, $B = \{3,4,5\}$. $P(A \cup B) = ?$

A) 5/6 B) 1/6
C) 4/6 D) 6/6

💡 List all elements in A or B (no repeats).

14. ADDITION RULE · ●

Are A and B mutually exclusive if $P(A \cap B) = 0$?

A) No B) Yes
C) Only sometimes D) Cannot determine

💡 Definition: mutually exclusive ↔ $P(A \cap B) = 0$.

15. ADDITION RULE · ●●

$P(A \cup B) = 0.75$, $P(A) = 0.5$, $P(B) = 0.4$. Find $P(A \cap B)$.

A) 0.15 B) 0.25
C) 0.35 D) 0.1

💡 Rearrange the addition rule: $P(A \cap B) = P(A)+P(B)-P(A \cup B)$.

16. ADDITION RULE · ●●

A card is drawn from 52 cards. P(Heart or King) = ?

A) 16/52 B) 17/52
C) 13/52 D) 4/52

💡 Hearts = 13, Kings = 4, King of Hearts = 1. Use addition rule.

17. ADDITION RULE · ●●

$P(A) = 1/3$, $P(B) = 1/4$, $P(A \cap B) = 1/12$. Find $P(A' \cap B')$.

A) 1/2 B) 7/12
C) 5/12 D) 1/3

💡 $P(A' \cap B') = 1 - P(A \cup B)$. First find $P(A \cup B)$.

18. ADDITION RULE · ●●

If A and B are mutually exclusive, $P(A) = 0.3$, $P(B) = 0.4$. Find $P(A' \cap B')$.

A) 0.3 B) 0.7
C) 0.12 D) 0.88

💡 $P(A' \cap B') = 1 - P(A \cup B)$. For mutually exclusive: $P(A \cup B)=P(A)+P(B)$.

19. ADDITION RULE · ●●

A student can pass Math or English. P(Math) = 0.6, P(English) = 0.7, P(both) = 0.5. P(at least one) = ?

A) 0.8

B) 0.9

C) 1.3

D) 0.7

> 💡 P(at least one) = $P(M \cup E) = P(M)+P(E)-P(M \cap E)$.

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20. ADDITION RULE · ●●

$P(A) = 0.4$, $P(B) = 0.35$, $P(A \cup B) = 0.6$. Are A and B mutually exclusive?

A) Yes, because $P(A)+P(B)=P(A \cup B)$

B) No, because $P(A \cap B)=0.15 \neq 0$

C) Yes, $P(A \cap B)=0$

D) Cannot determine

> 💡 Check if $P(A)+P(B)$ equals $P(A \cup B)$.

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PROBLEMS 21-30

21. CONDITIONAL PROBABILITY · ●

$P(A \cap B) = 0.12$, $P(B) = 0.4$. Find $P(A|B)$.

A) 0.3
B) 0.48
C) 0.08
D) 0.52

💡 $P(A|B) = P(A \cap B) / P(B)$.

22. CONDITIONAL PROBABILITY · ●

A die is rolled. Given the result is even, what is P(result = 4)?

A) 1/6
B) 1/2
C) 1/3
D) 2/3

💡 Restrict sample space to {2,4,6}.

23. CONDITIONAL PROBABILITY · ●●

A bag has 4 red, 6 blue. Two drawn without replacement. P(2nd red | 1st red) = ?

A) 4/10
B) 3/10
C) 3/9
D) 4/9

💡 After drawing 1 red, 3 red remain out of 9 total.

24. CONDITIONAL PROBABILITY · ●●

$P(A) = 0.5$, $P(B|A) = 0.4$. Find $P(A \cap B)$.

A) 0.9
B) 0.1
C) 0.2
D) 0.8

💡 $P(A \cap B) = P(A) \times P(B|A)$.

25. CONDITIONAL PROBABILITY · ●●

In a class 60% study Math (M), 40% study Physics (P), 20% study both. Given a student studies Physics, P(studies Math) = ?

A) 0.5
B) 0.6
C) 0.2
D) 0.4

💡 $P(M|P) = P(M \cap P)/P(P)$.

26. CONDITIONAL PROBABILITY · ●●

$P(A|B) = 0.6$, $P(B) = 0.5$, $P(A) = 0.4$. Find $P(B|A)$.

A) 0.75
B) 0.5
C) 0.3
D) 1.2

💡 $P(B|A) = P(A \cap B)/P(A)$. First find $P(A \cap B) = P(A|B) \times P(B)$.

27. CONDITIONAL PROBABILITY · ●●

Cards numbered 1–10. Given a card > 5 is drawn, P(card is odd) = ?

A) 2/5
B) 1/2
C) 3/5
D) 2/10

💡 Restrict to {6,7,8,9,10}. Odd ones?

28. CONDITIONAL PROBABILITY · ●●

A family has 2 children. Given at least one is a boy, P(both boys) = ?

A) 1/4
B) 1/3
C) 1/2
D) 2/3

💡 Sample space with at least one boy: {BB, BG, GB}.

29. CONDITIONAL PROBABILITY · ●●●

$P(A) = 0.3$, $P(B) = 0.5$, $P(A \cup B) = 0.65$. Find $P(A|B)$.

A) 0.3
B) 0.6
C) 0.15
D) 0.5

> 💡 Find $P(A \cap B)$ first using the addition rule.

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30. CONDITIONAL PROBABILITY · ●●●

A box has 3 white, 2 black balls. 2 drawn without replacement. P(both white) = ?

A) 9/25
B) 3/10
C) 1/5
D) 6/20

> 💡 $P(W_1 \cap W_2) = P(W_1) \times P(W_2|W_1)$.

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PROBLEMS 31-40

31. INDEPENDENCE · ●

Events A and B are independent. $P(A) = 0.4$, $P(B) = 0.5$. Find $P(A \cap B)$.

A) 0.9
B) 0.1
C) 0.2
D) 0.8

> 💡 Independent: $P(A \cap B) = P(A) \times P(B)$.

32. INDEPENDENCE · ●

A coin is flipped and a die is rolled. P(Head AND 6) = ?

A) 1/12
B) 1/6
C) 1/2
D) 7/12

> 💡 These are independent. Multiply the probabilities.

33. INDEPENDENCE · ●●

$P(A) = 0.6$, $P(B) = 0.5$, $P(A \cap B) = 0.3$. Are A and B independent?

A) Yes, because $P(A) \times P(B) = P(A \cap B)$
B) No, $P(A) \times P(B) \neq P(A \cap B)$
C) Yes, because $P(A \cap B) > 0$
D) Cannot determine

> 💡 Check: $P(A) \times P(B) = 0.6 \times 0.5 = 0.3$. Compare to $P(A \cap B)$.

34. INDEPENDENCE · ●●

A and B are independent. $P(A) = 0.7$. Find $P(A' \cap B')$ if $P(B) = 0.4$.

A) 0.28
B) 0.18
C) 0.12
D) 0.42

> 💡 A' and B' are also independent. $P(A')=0.3$, $P(B')=0.6$.

35. INDEPENDENCE · ●●

Two dice rolled. P(first die = 2 AND second die = 5) = ?

A) 7/36
B) 2/36
C) 1/36
D) 1/6

> 💡 Dice rolls are independent.

36. INDEPENDENCE · ●●

$P(A|B) = P(A)$. What does this tell us?

A) A and B are mutually exclusive
B) A and B are independent
C) $P(B) = 0$
D) $P(A) = 0.5$

> 💡 This is the definition of independence.

37. INDEPENDENCE · ●●

A and B are independent with $P(A) = 0.3$ and $P(B) = 0.5$. Find $P(A \cup B)$.

A) 0.8
B) 0.65
C) 0.15
D) 0.85

> 💡 $P(A \cup B) = P(A)+P(B)-P(A \cap B)$. For independent: $P(A \cap B)=P(A)P(B)$.

38. INDEPENDENCE · ●●●

$P(A \cap B) = 0.12$, $P(A') = 0.6$. If A and B are independent, find $P(B)$.

A) 0.2
B) 0.3
C) 0.48
D) 0.5

> 💡 $P(A) = 1-0.6 = 0.4$. Then $P(B) = P(A \cap B)/P(A)$.

39. INDEPENDENCE · ●●●

Three independent events A, B, C with P(A)=P(B)=P(C)=0.5. P(all three occur) = ?

A) 1.5

B) 0.125

C) 0.25

D) 0.5

💡 Multiply all three probabilities.

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40. INDEPENDENCE · ●●●

A machine works if parts A AND B both work. P(A works)=0.9, P(B works)=0.8. They work independently. P(machine works) = ?

A) 0.72

B) 0.98

C) 0.17

D) 0.8

💡 Multiply for independent AND condition.

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PROBLEMS 41-50

41. BAYES' THEOREM · ●●

$P(A) = 0.4$, $P(B|A) = 0.3$, $P(B|A') = 0.2$. Find $P(B)$.

A) 0.24
B) 0.5
C) 0.14
D) 0.12

> 💡 Total probability: $P(B) = P(B|A)P(A) + P(B|A')P(A')$.

42. BAYES' THEOREM · ●●

$P(A) = 0.5$, $P(B|A) = 0.4$, $P(B|A') = 0.2$. Find $P(A|B)$.

A) 0.5
B) 0.667
C) 0.4
D) 0.3

> 💡 Bayes: $P(A|B)=P(B|A)P(A)/P(B)$. First find $P(B)$.

43. BAYES' THEOREM · ●●

A test for a disease is 90% accurate. Disease rate is 1%. P(positive test) = ?

A) 0.9
B) 0.1071
C) 0.01
D) 0.099

> 💡 $P(+) = P(+|D)P(D) + P(+|D')P(D')$. $P(+|D')=0.1$ (10% false positive).

44. BAYES' THEOREM · ●●

Box 1 has 3R,2B. Box 2 has 1R,4B. A box is chosen at random, then a ball. P(R) = ?

A) 0.4
B) 0.3
C) 0.5
D) 0.45

> 💡 $P(R) = P(R|B1)\times 1/2 + P(R|B2)\times 1/2$.

45. BAYES' THEOREM · ●●●

$P(A) = 0.6$, $P(B|A) = 0.5$, $P(B|A') = 0.3$. Find $P(A|B)$.

A) 0.5
B) 0.625
C) 0.714
D) 0.6

> 💡 Find P(B) first, then apply Bayes.

46. BAYES' THEOREM · ●●●

3 factories make bulbs: 30%, 50%, 20% of total. Defect rates: 2%, 1%, 3%. A random bulb is defective. P(from factory 1) = ?

A) 0.35
B) 0.30
C) 0.375
D) 0.25

> 💡 $P(D)$=sum of $P(D|Fi)P(Fi)$. Then use Bayes.

47. BAYES' THEOREM · ●●●

Two urns: Urn A has 4W,2B; Urn B has 2W,4B. Urn chosen with P(A)=1/3. A white ball drawn. P(urn A | white) = ?

A) 1/3
B) 2/3
C) 4/9
D) 1/2

> 💡 $P(W|A)=4/6=2/3$. $P(W|B)=2/6=1/3$. Apply Bayes.

48. BAYES' THEOREM · ●●●

P(H) = 0.4 (hypothesis). P(E|H) = 0.8, P(E|H') = 0.3. Evidence E observed. P(H|E) = ?

A) 0.64
B) 0.64/0.50
C) 0.64
D) 0.64

> 💡 P(E)=P(E|H)P(H)+P(E|H')P(H'). Then Bayes.

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49. BAYES' THEOREM · ●●●

P(B|A) = 0.7, P(A) = 0.3, P(B) = 0.4. Find P(A|B).

A) 0.21
B) 0.5
C) 0.525
D) 0.3

> 💡 P(A|B) = P(B|A)×P(A) / P(B).

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50. BAYES' THEOREM · ●●●

A disease affects 2% of population. A test has 95% sensitivity, 90% specificity. P(disease | positive test) = ?

A) 0.95
B) 0.162
C) 0.02
D) 0.90

> 💡 P(+)=P(+|D)P(D)+P(+|D')P(D'). P(+|D')=1−specificity=0.10.

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PROBLEMS 51-60

51. PERMUTATIONS · ●

How many ways can 3 students be arranged in a line from 5 students?

A) 10
B) 20
C) 60
D) 120

> 💡 P(5,3) = 5×4×3.

52. PERMUTATIONS · ●

In how many ways can 4 people sit in 4 chairs?

A) 4
B) 8
C) 16
D) 24

> 💡 4! = 4×3×2×1.

53. PERMUTATIONS · ●●

How many 3-letter codes can be formed from {A,B,C,D,E} if no letter repeats?

A) 15
B) 60
C) 125
D) 10

> 💡 P(5,3) = 5×4×3.

54. PERMUTATIONS · ●●

How many ways can the word 'MATH' be arranged?

A) 12
B) 16
C) 24
D) 4

> 💡 4 distinct letters: 4!

55. PERMUTATIONS · ●●

How many arrangements of 'LEVEL' are there?

A) 120
B) 30
C) 60
D) 20

> 💡 LEVEL has 5 letters: L×2, E×2, V×1. Formula: 5!/(2!2!).

56. PERMUTATIONS · ●●

How many 4-digit numbers can be formed from digits 1–9 with no repetition?

A) 3024
B) 6561
C) 9×9×9×9
D) 9!/5!

> 💡 P(9,4) = 9×8×7×6.

57. PERMUTATIONS · ●●

6 people sit around a circular table. How many arrangements?

A) 720
B) 360
C) 120
D) 6

> 💡 Circular permutations: (n−1)!

58. PERMUTATIONS · ●●●

How many ways can 5 people be arranged in a row if 2 specific people must be adjacent?

A) 24
B) 48
C) 120
D) 60

> 💡 Treat the 2 as a block: 4!×2!.

59. PERMUTATIONS · ●●●

How many arrangements of 'PROBABILITY' contain all the letters? (11 letters: P,R,O,B,A,B,I,L,I,T,Y — B×2, I×2, rest unique)

A) 39916800
B) 9979200
C) 19958400
D) 4989600

> 💡 11!/(2!2!) for the repeated B and I.

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60. PERMUTATIONS · ●●●

8 books on a shelf: 3 Math, 3 Science, 2 English. Books of same subject must be together. How many arrangements?

A) 432
B) 1296
C) 864
D) 216

> 💡 Arrange 3 groups: 3! ways. Within: 3!×3!×2!.

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PROBLEMS 61-70

61. PERMUTATIONS · ●●●

8 books on a shelf: 3 Math, 3 Science, 2 English. Books of same subject together. Total arrangements?

A) 432
B) 864
C) 1296
D) 72

> 💡 3! ways to arrange subject groups × internal arrangements.

62. COMBINATIONS · ●

C(6,2) = ?

A) 12
B) 15
C) 30
D) 6

> 💡 C(n,r) = n!/(r!(n-r)!).

63. COMBINATIONS · ●

A committee of 3 is chosen from 7 people. How many ways?

A) 210
B) 35
C) 21
D) 7

> 💡 C(7,3) = 7!/(3!4!).

64. COMBINATIONS · ●●

From 10 students, 4 are selected. How many ways?

A) 5040
B) 210
C) 3024
D) 240

> 💡 Order doesn't matter, so use C(10,4).

65. COMBINATIONS · ●●

A hand of 5 cards is dealt from 52. How many possible hands?

A) 2598960
B) 311875200
C) 54145
D) 10!

> 💡 C(52,5).

66. COMBINATIONS · ●●

From 5 men and 4 women, a committee of 3 men and 2 women is formed. How many ways?

A) 60
B) 120
C) 45
D) 126

> 💡 C(5,3)×C(4,2). Multiply.

67. COMBINATIONS · ●●

C(n,2) = 10. Find n.

A) 4
B) 5
C) 6
D) 3

> 💡 n(n−1)/2 = 10 → n(n−1) = 20.

68. COMBINATIONS · ●●

A pizza can be topped with any selection of 4 toppings from 8 available. How many different pizzas?

A) 32
B) 70
C) 1680
D) 56

> 💡 C(8,4).

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69. COMBINATIONS · ●●●

From 12 students, 4 are picked. At least 2 must be girls. There are 5 girls and 7 boys. How many ways?

A) 310
B) 280
C) 35
D) 175

> 💡 At least 2 girls: (exactly 2G + exactly 3G + exactly 4G). Add them.

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70. COMBINATIONS · ●●●

From 5 girls and 7 boys, select 4 students with AT LEAST 2 girls. How many ways?

A) 285
B) 210
C) 495
D) 310

> 💡 Sum: 2G2B + 3G1B + 4G0B.

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PROBLEMS 71-80

71. COMBINATIONS · ●●●

In how many ways can 6 different colored balls be divided into two groups of 3?

A) 10 B) 20
C) 15 D) 40

> 💡 C(6,3)=20. But are the groups labeled or not? If unlabeled, divide by 2.

72. COMBINATIONS · ●●●

6 different colored balls divided into two DISTINCT groups of 3. How many ways?

A) 10 B) 20
C) 60 D) 15

> 💡 C(6,3) — once first group is chosen, second is determined.

73. DISCRETE DISTRIBUTIONS · ●●

$X \sim B(10, 0.3)$. $E[X]$ = ?

A) 0.3 B) 10
C) 3 D) 7

> 💡 For Binomial: $E[X] = np$.

74. DISCRETE DISTRIBUTIONS · ●●

$X \sim B(n, p)$. $Var(X)$ = ?

A) np B) np^2
C) npq where $q=1-p$ D) n^2p

> 💡 Variance of Binomial = $np(1-p)$.

75. DISCRETE DISTRIBUTIONS · ●●

A fair coin flipped 8 times. P(exactly 3 Heads) = ?

A) $C(8,3)(0.5)^8$ B) $C(8,3)(0.5)^3$
C) $(0.5)^3$ D) 3/8

> 💡 Binomial: $P(X=k) = C(n,k)p^k(1-p)^{(n-k)}$.

76. DISCRETE DISTRIBUTIONS · ●●

$X \sim \text{Geometric}(p=0.2)$. $E[X]$ = ?

A) 5 B) 0.2
C) 4 D) 0.8

> 💡 For Geometric (# of trials until first success): $E[X]=1/p$.

77. DISCRETE DISTRIBUTIONS · ●●

$X \sim \text{Poisson}(\lambda=3)$. $E[X]$ = ?

A) 1/3 B) 9
C) 3 D) $\sqrt{3}$

> 💡 For Poisson: $E[X] = \lambda$.

78. DISCRETE DISTRIBUTIONS · ●●

$X \sim \text{Poisson}(\lambda=2)$. $Var(X)$ = ?

A) 4 B) $\sqrt{2}$
C) 2 D) 1/2

> 💡 Poisson: $Var(X) = \lambda$.

79. DISCRETE DISTRIBUTIONS · ●●●

$X \sim B(5, 0.4)$. $P(X \geq 1) = ?$

A) 0.4

B) 0.92224

C) 0.07776

D) 0.5

> 💡 $P(X\geq1)=1-P(X=0)$. $P(X=0)=(0.6)^5$.

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80. DISCRETE DISTRIBUTIONS · ●●●

$X \sim B(n=100, p=0.02)$. Using Poisson approximation, $P(X=0) \approx ?$

A) e^{-2}

B) $2e^{-2}$

C) $e^{-0.02}$

D) $1/e$

> 💡 $\lambda = np = 2$. Poisson: $P(X=0) = e^{(-\lambda)}$.

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PROBLEMS 81-90

81. DISCRETE DISTRIBUTIONS · ●●●

$X \sim B(4, 0.5)$. $P(X = 2) = ?$

A) 3/8
B) 1/4
C) 1/2
D) 1/8

> 💡 $C(4,2)(0.5)^2(0.5)^2$.

82. DISCRETE DISTRIBUTIONS · ●●●

A fair die rolled 3 times. P(exactly two 6s) = ?

A) 5/72
B) 15/216
C) 1/36
D) 5/216

> 💡 Binomial: n=3, p=1/6, k=2. $C(3,2)(1/6)^2(5/6)$.

83. EXPECTED VALUE · ●●

X takes values 1,2,3 with P(1)=0.2, P(2)=0.5, P(3)=0.3. E[X] = ?

A) 2.1
B) 1.8
C) 2.5
D) 2.0

> 💡 $E[X] = \Sigma x_i P(x_i)$.

84. EXPECTED VALUE · ●●

E[X] = 4, Var(X) = 9. Find $E[X^2]$.

A) 25
B) 16
C) 13
D) 81

> 💡 $Var(X) = E[X^2] - (E[X])^2$. Solve for $E[X^2]$.

85. EXPECTED VALUE · ●●

A game: win $10 with P=0.3, lose $5 with P=0.7. Expected gain per game?

A) $5
B) −$0.50
C) $3
D) $1.50

> 💡 E = 10×0.3 + (−5)×0.7.

86. EXPECTED VALUE · ●●

E[3X + 5] where E[X] = 4.

A) 17
B) 12
C) 20
D) 7

> 💡 E[aX+b] = aE[X]+b.

87. EXPECTED VALUE · ●●

Var(2X) where Var(X) = 9.

A) 18
B) 36
C) 6
D) 9

> 💡 $Var(aX) = a^2Var(X)$.

88. EXPECTED VALUE · ●●

E[X]=3, E[Y]=5, X,Y independent. E[XY] = ?

A) 8
B) 15
C) 2
D) 30

> 💡 For independent X,Y: E[XY]=E[X]×E[Y].

89. EXPECTED VALUE · ●●●

$P(X=0)=0.5$, $P(X=2)=0.3$, $P(X=4)=0.2$. $Var(X) = ?$

A) 2.0
B) 2.36
C) 1.6
D) 3.2

> 💡 $Var(X)=E[X^2]-(E[X])^2$. Find $E[X]$ and $E[X^2]$ first.

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90. EXPECTED VALUE · ●●●

$E[X]=2$, $Var(X)=4$. Find $Var(3-2X)$.

A) 16
B) 4
C) 12
D) 8

> 💡 $Var(a+bX) = b^2Var(X)$. Constant doesn't affect variance.

Probability Mastery

PROBLEMS 91-100

91. EXPECTED VALUE · ●●●

X,Y independent. Var(X)=3, Var(Y)=4. Var(X+Y) = ?

A) 7
B) 12
C) 5
D) 1

💡 For independent: Var(X+Y)=Var(X)+Var(Y).

92. EXPECTED VALUE · ●●●

E[X]=5, E[Y]=2, X,Y independent. $E[(X-Y)^2]$ = ?

A) 9
B) 16
C) 7
D) 34

💡 $E[(X-Y)^2]=Var(X-Y)+(E[X-Y])^2$. Var(X−Y)=Var(X)+Var(Y) for independent.

93. EXPECTED VALUE · ●●●

Given E[X]=5, Var(X)=4, E[Y]=2, Var(Y)=3, X and Y independent. $E[(X-Y)^2]$ = ?

A) 9
B) 16
C) 7
D) 16

💡 $E[(X-Y)^2]=Var(X-Y)+(E[X-Y])^2$. Var(X−Y)=Var(X)+Var(Y).

94. COUNTING & SAMPLE SPACE · ●

A coin is tossed twice. How many outcomes in the sample space?

A) 2
B) 3
C) 4
D) 8

💡 Each toss has 2 outcomes. Use multiplication principle.

95. COUNTING & SAMPLE SPACE · ●

A restaurant offers 4 appetizers, 5 mains, 3 desserts. How many different meals (one of each)?

A) 12
B) 60
C) 15
D) 20

💡 Multiply the number of choices for each course.

96. COUNTING & SAMPLE SPACE · ●●

A password is 3 letters (A–Z) followed by 2 digits (0–9). How many passwords?

A) 1757600
B) 260000
C) 175760
D) 456976

💡 26×26×26×10×10. Repetition allowed.

97. COUNTING & SAMPLE SPACE · ●●

How many subsets does a set with 4 elements have?

A) 4
B) 8
C) 16
D) 12

💡 Number of subsets = 2^n.

98. COUNTING & SAMPLE SPACE · ●●

Two dice rolled. How many outcomes sum to 7?

A) 4
B) 5
C) 6
D) 7

💡 List pairs: (1,6),(2,5),(3,4),(4,3),(5,2),(6,1).

99. COUNTING & SAMPLE SPACE · ●●

A binary string of length 5 is formed (each digit 0 or 1). How many strings have exactly three 1s?

A) 10
B) 32
C) 5
D) 20

> 💡 C(5,3) = choose 3 positions for the 1s.

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100. COUNTING & SAMPLE SPACE · ●●

How many ways can you choose a president and vice-president from 8 candidates?

A) 28
B) 56
C) 64
D) 16

> 💡 Order matters (different roles). P(8,2)=8×7.

Probability Mastery

PROBLEMS 101-100

101. COUNTING & SAMPLE SPACE · ●●●

How many integers from 1 to 100 are divisible by 3 or 5?

A) 47
B) 40
C) 33
D) 53

> 💡 Inclusion-exclusion: $|3\cup 5|=|3|+|5|-|15|$.

102. COUNTING & SAMPLE SPACE · ●●●

In a group of 30 students: 18 study French, 15 study Spanish, 10 study both. How many study neither?

A) 5
B) 7
C) 8
D) 10

> 💡 Inclusion-exclusion: $|F\cup S|=18+15-10=23$. Neither$=30-23$.

103. COUNTING & SAMPLE SPACE · ●●●

How many 5-digit numbers (no leading zero, digits 0–9, no repetition) are there?

A) 27216
B) 90000
C) 30240
D) 50400

> 💡 First digit: 9 choices (1–9). Remaining 4 from 9: $P(9,4)=9\times8\times7\times6$.

Answer Key

All 100 answers — verify after completing the test.

1. C	2. B	3. D	4. B	5. C
6. C	7. D	8. A	9. C	10. B
11. C	12. B	13. A	14. B	15. A
16. A	17. A	18. A	19. A	20. B
21. A	22. C	23. C	24. C	25. A
26. A	27. A	28. B	29. A	30. B
31. C	32. A	33. A	34. B	35. C
36. B	37. B	38. B	39. B	40. A
41. A	42. B	43. B	44. A	45. C
46. C	47. D	48. A	49. C	50. B
51. C	52. D	53. B	54. C	55. B
56. A	57. C	58. B	59. B	60. C
61. A	62. B	63. B	64. B	65. A
66. A	67. B	68. B	69. A	70. A
71. B	72. B	73. C	74. C	75. A
76. A	77. C	78. C	79. B	80. A
81. A	82. B	83. A	84. A	85. B
86. A	87. B	88. B	89. B	90. A
91. A	92. D	93. B	94. C	95. B
96. A	97. C	98. C	99. A	100. B
101. A	102. B	103. A		