

Practice Problems for Basic Probability Concepts

- Determine the probability of each event: a) an odd number appears in a toss of a fair die; b) one or more heads appear in the toss of four fair coins; c) one or both numbers exceed 4 in the toss of two fair dice; d) a red or a face card appears when a card is randomly selected from a 52-card deck. Ans: $3/6$; $15/16$; $20/36$; $32/52$
- A student is chosen at random to represent a class with 5 freshmen, 8 sophomores 3 juniors and 2 seniors. Find the probability that the student is a) a sophomore; b) a junior; c) a junior or a senior. Ans: $8/18$; $3/18$; $5/18$
- Of 10 girls in a class, 3 have blue eyes. Two of the girls are chosen at random. Find the probability that a) both have blue eyes; b) neither has blue eyes; c) at least one has blue eyes; d) exactly one has blue eyes. Ans: $1/15$; $7/15$; $8/15$; $7/15$
- Three bolts and three nuts are in a box. Two parts are chosen at random. Find the probability that one is a bolt and one is a nut. Ans: $3/5$.
- A box contains two white socks, two blue socks and two red socks. Find the probability that they are a match (same color). Ans: $1/5$
- Of 120 students, 60 are studying French, 50 are studying Spanish and 20 are studying both French and Spanish. A student is chosen at random. Find the probability that the student is studying a) French or Spanish; b) neither French nor Spanish; c) only French; d) exactly one of the two languages. Ans: $3/4$; $1/4$; $1/3$; $7/12$
- Refer to problem 5, page 34, Probability and Statistics for Engineers and Scientists by Walpole and Myers, 6th ed. Ans: 0.3; 0.2
- Refer to problem 8, page 34, Walpole and Myers, 6th ed. Ans: 0.22; 0.78
- Refer to problem 14, page 34, Walpole and Myers, 6th ed. Ans: $25/1296$
- Refer to problem 17, page 34, Walpole and Myers, 6th ed. Ans: 0.32; 0.68; office or den
- A coin is weighted so that heads is three times as likely as to appear as tails. Find $P(H)$ and $P(T)$. Ans: $3/4$; $1/4$
- Three students A, B and C are in a swimming race. A and B have the same probability of winning and each is twice as likely to win as C. Find the probability that a) B wins; b) C wins; c) B or C wins. Ans: $2/5$; $1/5$; $3/5$.
- Suppose that A and B are events with $P(A) = 0.7$, $P(B) = 0.5$ and $P(A \cap B) = 0.4$. Find the probability that a) A does not occur; b) A or B occurs; c) A but not B occurs; d) neither A nor B occurs. Ans: 0.3; 0.8, 0.3, 0.2
- A pair of fair dice is tossed. If the faces appearing are different, find the probability that a) the sum is even; b) the sum exceeds 9. Ans: $3/5$; $4/30$.
- Let A and B be events with $P(A) = 0.6$, $P(B) = 0.3$ and $P(A \cap B) = 0.2$. Find: a) $P(A \cup B)$; b) $P(A/B)$; c) $P(B/A)$. Ans: 0.7; $2/3$; $1/3$
- Let A and B be events with $P(A) = 1/3$, $P(B) = 1/4$ and $P(A \cup B) = 1/2$. a) Find $P(A/B)$ and $P(B/A)$. b) Are A and B independent? Ans: $1/3$; $1/4$, Yes
- Two marbles are selected one after the other without replacement from a box containing 3 white marbles and 2 red marbles. Find: a) $P(2 \text{ white})$;

- b) $P(2 \text{ white} / \text{first is white})$; c) $P(2 \text{ red})$; d) $P(2 \text{ red} / \text{second is red})$.
 Ans: $3/10$; $1/2$; $1/10$; $1/4$
18. Two marbles are selected one after the other with replacement from a box containing 3 white marbles and 2 red marbles. Find: a) $P(2 \text{ white})$; b) $P(2 \text{ white} / \text{first is white})$; c) $P(2 \text{ red})$; d) $P(2 \text{ red} / \text{second is red})$.
 Ans: $9/25$; $3/5$; $4/25$; $2/5$
19. Two different digits are selected at random from the digits 1 through 5.
 a) If the sum is odd, what is the probability that 2 is one of the numbers selected? b) If 2 is one of the digits, what is the probability that the sum is odd? Ans: $1/2$; $3/4$.
20. Three cards are drawn in succession (without replacement) from a 52-card deck. Find: a) $P(3 \text{ aces} / \text{first card is an ace})$; b) $P(3 \text{ aces} / \text{first two cards are aces})$. Ans: $1/425$; b) 0.04
21. In a country club, 65% of the members play tennis, 40% percent play golf and 20% play both tennis and golf. A member is chosen at random. a) Find the probability that he plays neither tennis nor golf. b) If he plays tennis, find the probability that he plays golf. c) If he plays golf, find the probability that he plays tennis. 0.15; 0.308; 0.5
22. In a certain college town, 25% of the boys and 10% of the girls are studying mathematics. The girls constitute 60% of the student body. If a student is chosen at random and is studying mathematics, determine the probability that the student is a girl. Ans: 0.375
23. Refer to problem 2, page 42, Walpole and Myers, 6th ed. Ans: $5/9$
24. Refer to problem 7, page 42, Walpole and Myers, 6th ed. Ans: 0.018; 0.614; 0.166, 0.479.
25. Refer to problem 9, page 42, Walpole and Myers, 6th ed. Ans: 0.35; 0.875; 0.55.
26. Refer to problem 12, page 43, Walpole and Myers, 6th ed. Ans: 0.12
27. Refer to problem 17, page 43, Walpole and Myers, 6th ed. Ans: 0.0016; 0.9984.
28. Refer to problem 18, page 43, Walpole and Myers, 6th ed. Ans: 0.03
29. Refer to problem 20, page 43, Walpole and Myers, 6th ed. Ans: 0.018
30. Two boxes are given as follows: Box A contains 5 red marbles, 3 white marbles and 8 blue marbles. Box B contains 3 red marbles and 5 white marbles. A box is selected at random and a marble is randomly chosen. Find the probability that the marble is a) red; b) white; c) blue.
 Ans: $11/32$; $13/32$; $8/32$
31. Refer to problem 30. Find the probability that Box A was selected if the marble is a) red; b) white; c) blue. Ans: $5/11$; $3/13$; 1
31. Two boxes are given as follows: Box A contains 5 red marbles, 3 white marbles and 8 blue marbles. Box B contains 3 red marbles and 5 white marbles. A fair die is tossed; if a 3 or a 6 appears, a marble is randomly chosen from A, otherwise a marble is chosen from B. Find the probability that the marble is a) red; b) white; c) blue. Ans: $17/48$; $23/48$; $8/48$.
32. Refer to problem 31. Find the probability that box A was selected if the marble is a) red; b) white; c) blue. Ans: $5/17$; b) $3/23$; c) 1
33. A box contains three coins, two of them fair and one two-headed. A coin is randomly selected and tossed twice. If heads appear both times, what is the probability that the coin is two-headed? Ans: $2/3$

34. Two boxes are given as follows: Box A contains 5 red marbles and 3 white marbles. Box B contains one red marble and 2 white marbles. Box B contains one marble and 2 white marbles. A fair die is tossed; if a 3 or a 6 appears, a marble is randomly chosen from B and put into A and a marble is drawn from A, otherwise a marble is chosen from A and put into B and a marble is drawn from B. Find the probability that both marbles are a) red; b) white. Ans: 0.282; 0.286
35. A city is partitioned into districts A, B, C having 20%, 40% and 40% of the registered voters respectively. The registered voters listed as Democrats are 50% in A, 25% in B, and 75% in C. a) If a registered voter is randomly chosen in the city, find the probability that the voter is listed as a Democrat. b) A registered voter is listed as a Democrat. What is the probability that the voter came from district B? (chosen at random) Ans: 0.5; 0.2
36. Women in City College constitute 60% of the freshmen, 40% of the sophomores, 40% of the juniors, and 45% of the seniors. The school population is 30% freshmen, 25% sophomores, 25% juniors and 20% seniors. a) If a student from City College is chosen at random, find the probability that the student is a woman. b) If the student is a woman, what is the probability that she is a sophomore? Ans: 0.47; 0.213
37. A company produces light bulbs at three factories A, B and C. Factory A produces 40% of the total number of bulbs, of which 2% are defective. Factory B produces 35% of the total number of bulbs of which 4% are defective. Factory C produces 25% of the total number of bulbs, of which 3% are defective. If a defective bulb is found among the total output, find the probability that it came from factory a) A; b) B; c) C. Ans: 0.271; 0.475; 0.254
38. Refer to problem 37. Suppose a factory is chosen at random and one of the bulbs is randomly selected. If the bulb is defective, find the probability that it came from factory a) A; b) B; c) C. Ans: 2/9; 4/9; 1/3.
39. A test for Alzheimer's disease is 95% effective in detecting the disease when it is present, but also gives a positive result of 10% effective when it is not present (false positive). Suppose 4% of the population over 65 years have Alzheimer's disease. a) What is the probability that a person over 65 years chosen at random will test positively for the disease? b) Suppose a person over 65 years tests positively, what is the probability that the person has the disease? c) Suppose a person over 65 years of age tests negatively, what is the probability that the person has the disease? Ans: 0.134; 0.2836; 0.0023
40. Refer to problem 5, page 48, Walpole and Myers, 6th ed. Ans: 0.1123
41. Let A and B be independent events with $P(A) = 0.3$ and $P(B) = 0.4$. Find a) $P(A \cap B)$ and $P(A \cup B)$; b) $P(A/B)$; c) $P(B/A)$. Ans: 0.12; 0.58; 0.3; 0.4
42. Box A contains 5 red marbles and 3 blue marbles, and Box B contains 2 red and 3 blue. A marble is drawn at random from each box. a) Find the probability that both marbles are red. b) Find the probability that one is red and one is blue. Ans: 0.25; 0.525
43. The probability that A hits a target is $\frac{1}{4}$ and the probability that B hits a target is $\frac{1}{3}$. They each fire once at the target. a) Find the probability that they both hit the target. b) Find the probability that the

- target is hit exactly once. c) If the target is hit only once, what is the probability that A hit the target? Ans: $1/12$; $5/12$; $2/5$
44. The probability that A hits a target is $1/4$ and the probability that B hits a target is $1/3$. They each fire twice. Find the probability that the target will be hit at least once? Ans: $3/4$
45. The probabilities that three men hit a target are respectively 0.3, 0.5 and 0.4. Each fires once at the target. Assuming independence, a) find the probability that they all hit the target. B) Find the probability that exactly one of them hits the target. c) If only one hits the target, what is the probability that it was the first man? Ans: 0.06; 0.44; 0.2045
46. Whenever horses a, b and c race together, their respective probabilities of winning are 0.3, 0.5 and 0.2. They race three times. a) Find the probability that the same horse wins all three races. b) Find the probability that a, b, and c each win one race. Ans: 0.16; 0.18
47. A team wins (W) with probability 0.5, loses (L) with probability 0.3 and ties (T) with probability 0.2. The team plays twice. Find the probability that the team wins at least once. Ans: 0.75
48. A certain type of missile hits its target with probability $1/3$. If three missiles are fired, find the probability that the target is hit exactly once. Ans: $19/27$
49. In any game, the probability that the Hornets (H) will defeat the Rockets [R] is 0.6. Find the probability that the Hornets will win a best-of-three series. (Assume no ties.) Ans: 0.648
50. The batting average of a baseball player is 0.3. He comes to bat 4 times. Find the probability that he will get a) exactly two hits; b) at least one hit. Ans: 0.265; 0.76
51. Refer to problem 4, page 123, Walpole and Myers, 6th ed. Ans: 0.0879; 0.3672.