

Attempt all questions:

1. What is the cardinality of the event, X = The event of getting a spade in a standard deck of cards?
2. What is the cardinality of the sample space, S = Two six-sided dice (one red and one blue)?
3. Calculate the probability of drawing a six out of a standard 52-card deck.
4. Would you consider the following events independent or dependent of each other?
 - a. Drawing a king from a well-shuffled pack of 52 cards
 - b. Drawing an ace from a different well-shuffled pack of 52 cards
5. Would you consider the following events independent or dependent of each other?
 - a. Drawing a king from a well-shuffled pack of 52 cards
 - b. Subsequently drawing a second king from the same pack of 52 cards
6. What is the probability of flipping a coin and getting heads, and then rolling a six-sided die and getting a result with two or fewer pips showing?
7. A real-estate development firm has two unrelated projects (assume the projects are completely independent of each other); the first project has been given a 40% probability of being finished on time, and the second project has been given a 30% probability of being completed on time. What is the probability that the first project is done on time, but the second is not?
8. Assume the real estate development firm from Q7 takes on a third project, with a 0.8 probability of on-time completion. What is the probability that all three projects finish on time (assume this project is also independent of the others)?
9. Given a well-shuffled standard deck of 52 playing cards, what is the probability of drawing either a face card, or a spade, or an ace?
10. Using the patterns described above and creating your own venn diagrams, how many intersections would be subtracted given the union of four events?
11. Suppose a pet census was given to 100 students at a university; 48 respondents checked the box which reported owning a dog, and 38 respondents checked the box which reported owning a cat. Of those surveyed, 19 of the students had checked both boxes. What is the probability that a randomly selected student owns a cat, a dog, or both types of animals?
12. A software development firm employs 96 engineers. Of these engineers 35 are proficient in python, 60 are proficient in Java, and 37 are proficient in C#. There are 14 engineers proficient in python and Java, 12 proficient in python and C#, and 19 proficient in Java and C#. There are only 3 engineers who are proficient in all three languages. If an engineer is chosen at random, what is the probability that they are not proficient in any of these three languages? Assume these are independent events.
13. Let A , B and C be sets as defined as $A = \{1,2\}$; $B = \{a, b\}$; $C = \{\text{red, blue}\}$. Find the cross product of these three sets.
14. College XYZ has four members on their marketing team, three members on the admissions team, and seven members on the instructional staff. There is a committee being formed with one member from each team to develop a new course. How many unique outcomes are possible?

15. College XYZ has four members on their marketing team, three members on the admissions team, and seven members on the instructional staff. There is a committee being formed with one member from each team to develop a new course, but we now know that Michael from admissions will be leading the committee (and will be the only representative from the admissions team). Assuming that there are no individuals with the same first name, what is the probability that the committee will be made of Michael (admissions), Devon (instruction), and Julia (marketing)?
16. Six dogs are competing in the City Dog Show. They must each run the agility course, one at a time. In how many different orders can the six dogs run the course?
17. Refer to previous question. One of the dogs, Pickles, was the winner of the dog show from the previous year, and therefore has been given the advantage of going last. Considering this, in how many orders could the dogs run the course?
18. The statistics club at a local university is choosing their leadership from their 18 people. There are three leadership positions to be filled: President, Treasurer, and Secretary. In how many different ways can these three positions be filled?
19. Suppose you are playing a game that requires you to guess three unique alphanumeric characters in a specific order. You can assume that letters will be case-insensitive, e.g.: $Av3 == aV3 == av3 == AV3$. What is the probability of winning the game?
20. As you found in the previous challenge, the odds of correctly guessing the 3-letter-or-number combo are pretty slim. Suppose you're given the hint that the first value will be a digit (0 - 9) and the second value will be a letter from the alphabet. The third slot can still be any of the remaining numbers or letters. Calculate the probability winning the game given this new information.
21. Given that of our 6 dogs in the City Dog Show, 2 of the dogs will be chosen as the most charismatic. How many different combinations of dogs could be chosen to be the award winner?
22. In the statistics club, out of 18 people, there was a revolt by a subsection of the club. The members demanded that instead of choosing a President, Treasurer, and Secretary, the club should be ran by a board of five directors, where consensus determines the actions of the club. How many different ways could these five board members be chosen, being that each of the five board members share the same title and responsibilities?
23. According to a poll, 8% of children under the age of 18 carry at least one food allergy. Of those with food allergies, 39% of children displayed a severe reaction when exposed to their allergen. If a child younger than 18 is randomly selected, what is the probability that they have at least one food allergy, and has a history of a severe reaction?
24. Given the information from the previous challenge, it was also reported that 30% of those children with an allergy actually carry multiple food allergies. If a child is randomly selected, what is the probability that they have multiple allergies?
25. A recent poll was taken concerning the finances of college students. It was found that 82% of students had a checking account, and that only 27% of students have a savings account; it was also reported that 24% of the students have both a savings and a checking account. Given that a randomly selected student has a checking account, what is the probability that they also have a savings account?

26. How many valid three digit integers (base 10) are there? Numbers which begin with a zero are not considered valid.
27. A private tech company is applying for four government contracts: A, B, C, and D. They theorize that their chance of getting contract A is 23.4%. They believe that their chance of winning contract B is 88.8%, for contract C is 4%, and for D is 15.4%. What is the probability that they end up getting all four contracts. Assume that the contracts are all awarded independently.
28. Given the same probabilities as above question, what is the likelihood that the private tech company will get none of the contracts?
29. The probability that an adult who is at least 6'6" tall played basketball in college is 40%, and the probability that an adult who is shorter than 6'6" tall played basketball in college is 3% and 2% of the adult population is 6'6" or taller, calculate the total probability that a randomly chosen adult has played College Basketball.
30. There are three urns, each filled with red and blue marbles. Urn #1 has 75 red 25 blue marbles, urn #2 has 60 red and 40 blue marbles, urn #3 has 45 red and 55 blue marbles. Urn #1 is chosen twice as often as urn #2 and urn #3.
 $P(U1)$ = Probability that Urn #1 is chosen = 0.5,
 $P(U2)$ = Probability that Urn #2 is chosen = 0.25 and
 $P(U3)$ = Probability that Urn #1 is chosen = 0.25
 What is the total probability that a red ball is chosen at random from one of the urns?
31. There are two bowls of marbles: bowl #1 contains 30 blue marbles and 10 red marbles, and bowl #2 contains 20 blue marbles and 20 red marbles. what is the probability of having picked from bowl #1, given that we grabbed a blue marble?

"The irreducible price of learning is realizing that you do not know." - James Baldwin