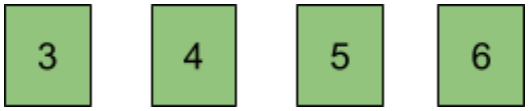
Quiz: Probability of Simple Combined Events

Section: Probability

Sub-section: Probability of Simple Combined Events and Expected Value

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Choose the correct answer.

1. 

2 from 4 cards shown above are selected at random. The selected 2 cards form a 2-digit number. What is the probability the 2-digit number is even?

(understand, MA 3.1 G.9/2)

A. $\frac{1}{2}$

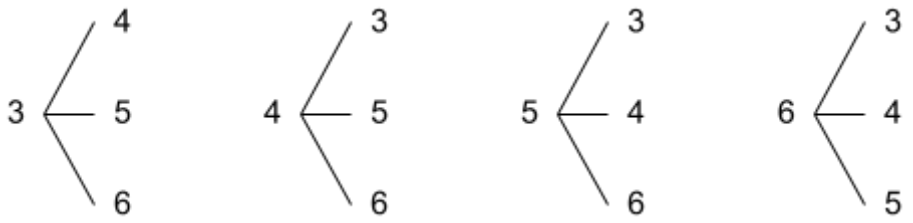
B. $\frac{1}{4}$

C. $\frac{3}{4}$

D. $\frac{5}{12}$

Solution $\frac{1}{2}$

The tree diagram shown in the figure below gives an all outcome.



Then, $S = \{34, 35, 36, 43, 45, 46, 53, 54, 56, 63, 64, 65\}$

So, $N(S) = 12$

Let E be an event that the 2-digit number is even.

Then, $E = \{34, 36, 46, 54, 56, 64\}$

So, $N(E) = 6$

Thus, $P(E) = \frac{6}{12} = \frac{1}{2}$

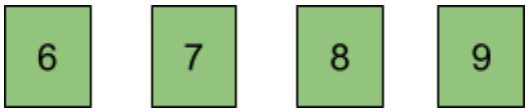
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2.



2 from 4 cards shown above are selected at random. The selected 2 cards form a 2-digit number. What is the probability the 2-digit number is more than 70? (understand, MA 3.1 G.9/2)

A. $\frac{1}{2}$

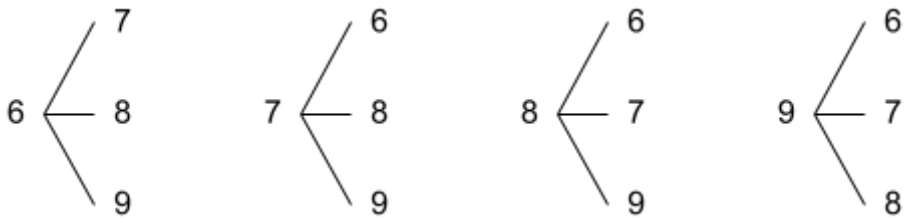
B. $\frac{1}{4}$

C. $\frac{3}{4}$

D. $\frac{5}{12}$

Solution $\frac{3}{4}$

The tree diagram shown in the figure below gives an all outcome.



Then, $S = \{67, 68, 69, 76, 78, 79, 86, 87, 89, 96, 97, 98\}$

So, $N(S) = 12$

Let E be an event that the 2-digit number is more than 70.

Then, $E = \{76, 78, 79, 86, 87, 89, 96, 97, 98\}$

So, $N(E) = 9$

Thus, $P(E) = \frac{9}{12} = \frac{3}{4}$

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3. There are 9 green marbles, 7 yellow marbles, and 4 red marbles in a bag. What is the probability of selecting a green or red marble on the first draw?
   (understand, MA 3.1 G.9/2)

   A. $\frac{4}{20}$

   B. $\frac{9}{20}$

   C. $\frac{4}{5}$

   D. $\frac{13}{20}$

   Solution $\frac{13}{20}$

   There are 9 green marbles, 7 yellow marbles, and 4 red marbles.

   So, $N(S) = 9 + 7 + 4 = 20$

   Let E be an event that selects a green or red marble on the first draw.

   There are 9 green marbles and 4 red marbles.

   So, $N(E) = 9 + 4 = 13$

   Thus, $P(E) = \frac{13}{20}$

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4. There are 5 green marbles, 8 yellow marbles, and 7 red marbles in a bag. What is the probability of selecting a yellow or red marble on the first draw?
   (understand, MA 3.1 G.9/2)

   A. $\frac{1}{4}$

   B. $\frac{3}{4}$

   C. $\frac{12}{20}$

   D. $\frac{13}{20}$

   Solution $\frac{3}{4}$

   There are 5 green marbles, 8 yellow marbles, and 7 red marbles.

   So, $N(S) = 5 + 8 + 7 = 20$

   Let E be an event that selects a yellow or red marble on the first draw.

   There are 8 green marbles and 7 red marbles.

   So, $N(E) = 8 + 7 = 15$

   Thus, $P(E) = \frac{15}{20} = \frac{3}{4}$

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5. A card is drawn from a well-shuffled pack of 52 cards. Find the probability that the card drawn is neither a red card nor a queen.
   (apply, MA 3.1 G.9/2)

   A. $\frac{3}{13}$

   B. $\frac{6}{13}$

   C. $\frac{10}{26}$

   D. $\frac{15}{26}$

   Solution $\frac{6}{13}$

   Let E be an event that the card drawn is neither a red card nor a queen.

   The number of hearts in a deck 52 cards = 13

   The number of diamonds in a deck 52 cards = 13

   Then, the number of red cards = 13 +13 = 26

   The number of the queens in a deck 52 cards = 4

   Since the queen of heart and the queen of diamond are removed (red cards), then the remainder of the queens = 2

   So, the total number of red cards and the queens = 26 + 2 = 28

   So, the number of cards which is neither a red card nor a queen = 52 - 28 = 24,

   that is $N(E) = 24$

   Thus, $P(E) = \frac{24}{52} = \frac{6}{13}$

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6. A card is drawn from a well-shuffled pack of 52 cards. Find the probability that the card drawn is neither a black card nor a king.
   (apply, MA 3.1 G.9/2)

   A. $\frac{6}{13}$

   B. $\frac{8}{13}$

   C. $\frac{15}{26}$

   D. $\frac{20}{26}$

   Solution $\frac{6}{13}$

   Let E be an event that the card drawn is neither a black card nor a king.

   The number of spades in a deck 52 cards = 13

   The number of clubs in a deck 52 cards = 13

   Then, the number of black cards = 13 +13 = 26

   The number of the kings in a deck 52 cards = 4

   Since the king of spades and the king of clubs are removed (black cards), then the remainder of the kings = 2

   So, the total number of black card and the kings = 26 + 2 = 28

   So, the number of card which is neither a black card nor a king = 52 - 28 = 24,

   that is $N(E) = 24$

   Thus, $P(E) = \frac{24}{52} = \frac{6}{13}$

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7. A road construction project is open for bid proposal. Assume that you are an owner of a construction company that is qualified to propose bidding. The company has a probability of 0.2 to win the bid and gain a profit of $12,000. On the other hand, the company may have to lose $4,000 for submitting the documents. What is the expected value of your company?

   (apply, MA 3.1 G.9/2)

   A. -800 dollars

   B. 800 dollars

   C. $2,400$ dollars

   D. $5,600$ dollars

   Solution -800 dollars

   Let X_1 be the value of winning the bid

   and X_2 be the value of losing the bid.

   Then, $X_1 = 12,000 \; and \; X_2 = -4,000$

   The probability to win is 0.2. So, $P(X_1) = 0.2$

   Then, the probability to lose is $1 - 0.2 = 0.8$. So, $P(X_2) = 0.8$

   Thus, $E(X) = (0.2)(12,000) + (0.8)(-4,000) = 2,400 - 3,200 = -800$

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8. A road construction project is open for bid proposal. Assume that you are an owner of a construction company who is qualified to propose bidding. The company has the probability of 0.3 to win the bid and gain a profit of $16,000. On the other hand, the company may have to lose $6,000 for submitting the documents. What is the expected value of your company?

   (apply, MA 3.1 G.9/2)

   A. -600 dollars

   B. 600 dollars

   C. $4,800$ dollars

   D. $9,000$ dollars

   Solution 600 dollars

   Let X_1 is the value of winning the bid

   and X_2 is the value of losing the bid.

   Then, $X_1 = 16,000 \; and \; X_2 = -6,000$

   The probability to win is 0.3. So, $P(X_1) = 0.3$

   Then, the probability to lose is $1 - 0.3 = 0.7$. So, $P(X_2) = 0.7$

   Thus, $E(X) = (0.3)(16,000) + (0.7)(-6,000) = 4,800 - 4,200 = 600$

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9. A stack of cards contains two cards labeled with 5, three cards labeled with 10, four cards labeled with 15, and one card labeled with 20. If the stack is shuffled and a card is drawn, what is the expected value of the card drawn?

   (understand, MA 3.1 G.9/2)

   A. 10

   B. 12

   C. 14

   D. 16

   Solution 12

   Let X_1 be a value of the cards labeled with 5,

   X_2 be a value of the cards labeled with 10,

   X_3 be a value of the cards labeled with 15,

   and X_4 be a value of the card labeled with 20

   Then, $X_1 = 5, X_2 = 10, X_3 = 15 \; and \; X_4 = 20$

   There are two cards labeled with 5, three cards labeled with 10, four cards labeled with 15, and one card labeled with 20.

   Then, $P(X_1) = \frac{2}{10}, P(X_2) = \frac{3}{10}, \; P(X_3) = \frac{4}{10} \; and \; P(X_4) = \frac{1}{10}$

   Thus, $E(X) = (\frac{2}{10})(5) + (\frac{3}{10})(10) + (\frac{4}{10})(15) + (\frac{1}{10})(20) = 12$

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10. A stack of cards contains three cards labeled with 5, one card labeled with 10, two cards labeled with 15, and four cards labeled with 20. If the stack is shuffled and a card is drawn, what is the expected value of the card drawn?
(understand, MA 3.1 G.9/2)

    A. 10.5

    B. 11.5

    C. 12.5

    D. 13.5

    Solution 13.5

    Let X_1 be a value of the cards labeled with 5,

    X_2 be a value of the card labeled with 10,

    X_3 be a value of the cards labeled with 15,

    and X_4 be a value of the cards labeled with 20

    Then, $X_1 = 5, X_2 = 10, X_3 = 15 \; and \; X_4 = 20$

    There are three cards labeled with 5, one card labeled with 10, two cards labeled with 15, and four cards labeled with 20.

    Then, $P(X_1) = \frac{3}{10}, P(X_2) = \frac{1}{10}, \; P(X_3) = \frac{2}{10} \; and \; P(X_4) = \frac{4}{10}$

    Thus, $E(X) = (\frac{3}{10})(5) + (\frac{1}{10})(10) + (\frac{2}{10})(15) + (\frac{4}{10})(20) = 13.5$