Independence, Mutual Exclusivity, and Permutations/Combinations

Determine whether the scenario involves independent or dependent events. Then find the probability.

1) There are five nickels and eight dimes in your pocket. You randomly pick a coin out of your pocket and place it on a counter. Then you randomly pick another coin. The first coin is a nickel and the second coin is a dime.

2) A bag contains six red marbles and six blue marbles. You randomly pick a marble and then pick a second marble without returning the marbles to the bag. Both marbles are red.

3) A cooler contains fourteen bottles of sports drink: five lemon-lime flavored, five orange flavored, and four fruit-punch flavored. You randomly grab a bottle. Then you return the bottle to the cooler, mix up the bottles, and randomly select another bottle. The first time, you get a lemon-lime drink. The second time, you get a fruit-punch.

4) You flip a coin twice. The first flip lands heads-up and the second flip also lands heads-up.

5) You select a card from a standard shuffled deck of 52 cards. You return the card, shuffle, and then select another card. Both times the card is a diamond. (Note that 13 of the 52 cards are diamonds.)

6) A basket contains seven apples and five peaches. You randomly select one piece of fruit and eat it. Then you randomly select another piece of fruit. The first piece of fruit is an apple and the second piece is a peach.

7) You flip a coin and then roll a fair six-sided die. The coin lands heads-up and the die shows an even number.

8) There are four nickels and eight dimes in your pocket. You randomly pick a coin out of your pocket and place it on a counter. Then you randomly pick another coin. Both coins are nickels.

9) There are six nickels and four dimes in your pocket. You randomly pick a coin out of your pocket and then return it to your pocket. Then you randomly pick another coin. Both times the coin is a nickel.

10) You roll a fair six-sided die twice. The first roll shows a six and the second roll shows a four.
Determine if the scenario involves mutually exclusive events. Then find the probability.

11) There are eleven shirts in your closet, three blue, five green, and three red. You randomly select one to wear. It is blue or green.

12) A basket contains three apples, four peaches, and four pears. You randomly select a piece of fruit. It is an apple or a peach.

13) There are four nickels, three dimes, and three quarters in your pocket. You randomly pick a coin. It is a nickel or a dime.

14) A box contains three red playing cards numbered one to three. The box also contains four black playing cards numbered one to four. You randomly pick a playing card. It is black or has a number greater than two.

15) A spinner has an equal chance of landing on each of its five numbered regions. After spinning, it lands in region one or five.

16) You roll a fair six-sided die. The die shows an even number or a number less than six.

17) A box of chocolates contains four milk chocolates and seven dark chocolates. Three of the milk chocolates and six of the dark chocolates have peanuts inside. You randomly select and eat a chocolate. It is a dark chocolate or has no peanuts inside.

18) A magazine contains fifteen pages. You open to a random page. The page number is eleven or fourteen.

19) There are five nickels, three dimes, and three quarters in your pocket. You randomly pick a coin. It is a nickel or a dime.

20) A litter of kittens consists of three gray kittens, two black kittens, and two mixed-color kittens. You randomly pick one kitten. The kitten is gray or mixed-color.

21) A magazine contains twelve pages. You open to a random page. The page number is four or eleven.

22) A bag contains three yellow tickets numbered one to three. The bag also contains three green tickets numbered one to three. You randomly pick a ticket. It is green or has a number greater than two.
23) There are five nickels, three dimes, and five quarters in your pocket. You randomly pick a coin. It is a nickel or a dime.

24) A litter of kittens consists of one gray female, three gray males, two black females, and one black male. You randomly pick one kitten. The kitten is black or male.

25) A magazine contains fifteen pages. You open to a random page. The page number is five or fifteen.

26) A basket contains five apples, three peaches, and five pears. You randomly select a piece of fruit. It is an apple or a peach.

27) A cooler contains eleven sports drinks: four lemon-lime and seven orange. One of the lemon-lime and three of the orange drinks are cold. The others are still warm. You randomly grab a bottle. It is lemon-lime flavored or cold.

28) There are three nickels, three dimes, and five quarters in your pocket. You randomly pick a coin. It is a nickel or a dime.

29) A magazine contains twelve pages. You open to a random page. The page number is seven or nine.

30) A box of chocolates contains four milk chocolates, four dark chocolates, and three white chocolates. You randomly select a chocolate. It is a milk chocolate or a dark chocolate.

Find the probability of each event, based on whether it is a permutation or a combination.

31) A politician is about to give a campaign speech and is holding a stack of seven cue cards, of which the first 3 are the most important. Just before the speech, he drops all of the cards and picks them up in a random order. What is the probability that cards #1, #2, and #3 are still in order on the top of the stack?

32) A technician is launching fireworks near the end of a show. Of the remaining eleven fireworks, seven are blue and four are red. If she launches seven of them in a random order, what is the probability that all of them are blue?
33) A politician is about to give a campaign speech and is holding a stack of thirteen cue cards, of which the first 3 are the most important. Just before the speech, he drops all of the cards and picks them up in a random order. What is the probability that cards #1, #2, and #3 are still in order on the top of the stack?

34) A child is drawing a rainbow using a box of ten different colored crayons, which include the seven required colors. After drawing the red, orange, yellow, and green arcs in the proper order, she forgets the last three colors. From the remaining six crayons, she chooses three at random to finish drawing the rainbow. What is the probability that she correctly finishes the ROYGBIV rainbow?

35) A gambler places a bet on a horse race. To win, she must pick the top three finishers in order. Seven horses of equal ability are entered in the race. Assuming the horses finish in a random order, what is the probability that the gambler will win her bet?

36) A jar contains five black buttons and three brown buttons. If five buttons are picked at random, what is the probability that all of them are black?

37) A gambler places a bet on a horse race. To win, he must pick the top three finishers in any order. Seven horses of equal ability are entered in the race. Assuming the horses finish in a random order, what is the probability that the gambler will win his bet?

38) You've purchased a lottery ticket and your numbers are: 4-8-3. A lottery official randomly selects three balls from a set of nine balls that are numbered from #1 to #9. To win, your numbers must match the selected numbers in order. What is the probability of winning the lottery?

39) A meeting takes place between a diplomat and thirteen government officials. However, three of the officials are actually spies. If the diplomat gives secret information to ten of the attendees at random, what is the probability that no secret information was given to the spies?

40) Jacob and Jennifer each purchase one raffle ticket. If a total of five raffle tickets are sold, what is the probability that Jacob wins the grand prize and Jennifer wins the second prize?
41) A child is drawing a rainbow using a box of fourteen different colored crayons, which include the seven required colors. After drawing the red, orange, yellow, and green arcs in the proper order, he forgets the last three colors. From the remaining ten crayons, he chooses three at random to finish drawing the rainbow. What is the probability that he correctly finishes the ROYGBIV rainbow?

42) A car dealership has twelve cars in the lot. Unfortunately, the keys to the cars have been mixed up. The manager randomly grabs a key and tries to start a car. A salesman also randomly picks a different key and tries to start another car. What is the probability that both cars start?

43) You've purchased a lottery ticket and your numbers are: 2-9-6. A lottery official randomly selects three balls from a set of twelve balls that are numbered from #1 to #12. To win, your numbers must match the selected numbers in order. What is the probability of winning the lottery?

44) A meeting takes place between a diplomat and nine government officials. However, two of the officials are actually spies. If the diplomat gives secret information to seven of the attendees at random, what is the probability that no secret information was given to the spies?

45) A child is drawing a rainbow using a box of seventeen different colored crayons, which include the seven required colors. After drawing the red, orange, yellow, and green arcs in the proper order, he forgets the last three colors. From the remaining thirteen crayons, he chooses three at random to finish drawing the rainbow. What is the probability that he correctly finishes the ROYGBIV rainbow?

46) A mechanic working under a car requires five different size wrenches from his toolbox, which contains nine different wrenches. Reaching for his toolbox, he grabs five of them at random. What is the probability that the mechanic has all of the wrenches he needs?

47) A car dealership has five cars in the lot. Unfortunately, the keys to the cars have been mixed up. The manager randomly grabs a key and tries to start a car. A salesman also randomly picks a different key and tries to start another car. What is the probability that both cars start?

48) You've purchased a lottery ticket and your numbers are: 2-9-6. A lottery official randomly selects three balls from a set of six balls that are numbered from #1 to #6. To win, your numbers must match the selected numbers in order. What is the probability of winning the lottery?
Determine whether the scenario involves independent or dependent events. Then find the probability.

1) There are five nickels and eight dimes in your pocket. You randomly pick a coin out of your pocket and place it on a counter. Then you randomly pick another coin. The first coin is a nickel and the second coin is a dime.

Dependent; \( \frac{10}{39} \approx 0.256 \)

2) A bag contains six red marbles and six blue marbles. You randomly pick a marble and then pick a second marble without returning the marbles to the bag. Both marbles are red.

Dependent; \( \frac{5}{22} \approx 0.227 \)

3) A cooler contains fourteen bottles of sports drink: five lemon-lime flavored, five orange flavored, and four fruit-punch flavored. You randomly grab a bottle. Then you return the bottle to the cooler, mix up the bottles, and randomly select another bottle. The first time, you get a lemon-lime drink. The second time, you get a fruit-punch.

Independent; \( \frac{5}{49} \approx 0.102 \)

4) You flip a coin twice. The first flip lands heads-up and the second flip also lands heads-up.

Independent; \( \frac{1}{4} = 0.25 \)

5) You select a card from a standard shuffled deck of 52 cards. You return the card, shuffle, and then select another card. Both times the card is a diamond. (Note that 13 of the 52 cards are diamonds.)

Independent; \( \frac{1}{16} \approx 0.063 \)

6) A basket contains seven apples and five peaches. You randomly select one piece of fruit and eat it. Then you randomly select another piece of fruit. The first piece of fruit is an apple and the second piece is a peach.

Dependent; \( \frac{35}{132} \approx 0.265 \)

7) You flip a coin and then roll a fair six-sided die. The coin lands heads-up and the die shows an even number.

Independent; \( \frac{1}{4} = 0.25 \)

8) There are four nickels and eight dimes in your pocket. You randomly pick a coin out of your pocket and place it on a counter. Then you randomly pick another coin. Both coins are nickels.

Dependent; \( \frac{1}{11} \approx 0.091 \)

9) There are six nickels and four dimes in your pocket. You randomly pick a coin out of your pocket and then return it to your pocket. Then you randomly pick another coin. Both times the coin is a nickel.

Independent; \( \frac{3}{5} = 0.6 \)

10) You roll a fair six-sided die twice. The first roll shows a six and the second roll shows a four.

Independent; \( \frac{1}{36} \approx 0.028 \)
Determine if the scenario involves mutually exclusive events. Then find the probability.

11) There are eleven shirts in your closet, three blue, five green, and three red. You randomly select one to wear. It is blue or green.
   Mutually exclusive; \( \frac{8}{11} \approx 0.727 \)

12) A basket contains three apples, four peaches, and four pears. You randomly select a piece of fruit. It is an apple or a peach.
   Mutually exclusive; \( \frac{7}{11} \approx 0.636 \)

13) There are four nickels, three dimes, and three quarters in your pocket. You randomly pick a coin. It is a nickel or a dime.
   Mutually exclusive; \( \frac{7}{10} = 0.7 \)

14) A box contains three red playing cards numbered one to three. The box also contains four black playing cards numbered one to four. You randomly pick a playing card. It is black or has a number greater than two.
   Not mutually exclusive; \( \frac{5}{7} \approx 0.714 \)

15) A spinner has an equal chance of landing on each of its five numbered regions. After spinning, it lands in region one or five.
   Mutually exclusive; \( \frac{2}{5} = 0.4 \)

16) You roll a fair six-sided die. The die shows an even number or a number less than six.
   Not mutually exclusive; 1

17) A box of chocolates contains four milk chocolates and seven dark chocolates. Three of the milk chocolates and six of the dark chocolates have peanuts inside. You randomly select and eat a chocolate. It is a dark chocolate or has no peanuts inside.
   Not mutually exclusive; \( \frac{8}{11} \approx 0.727 \)

18) A magazine contains fifteen pages. You open to a random page. The page number is eleven or fourteen.
   Mutually exclusive; \( \frac{2}{15} \approx 0.133 \)

19) There are five nickels, three dimes, and three quarters in your pocket. You randomly pick a coin. It is a nickel or a dime.
   Mutually exclusive; \( \frac{8}{11} \approx 0.727 \)

20) A litter of kittens consists of three gray kittens, two black kittens, and two mixed-color kittens. You randomly pick one kitten. The kitten is gray or mixed-color.
   Mutually exclusive; \( \frac{5}{7} \approx 0.714 \)

21) A magazine contains twelve pages. You open to a random page. The page number is four or eleven.
   Mutually exclusive; \( \frac{1}{6} \approx 0.167 \)

22) A bag contains three yellow tickets numbered one to three. The bag also contains three green tickets numbered one to three. You randomly pick a ticket. It is green or has a number greater than two.
   Not mutually exclusive; \( \frac{2}{3} \approx 0.667 \)
23) There are five nickels, three dimes, and five quarters in your pocket. You randomly pick a coin. It is a nickel or a dime.

\[ \text{Mutually exclusive;} \quad \frac{8}{13} \approx 0.615 \]

25) A magazine contains fifteen pages. You open to a random page. The page number is five or fifteen.

\[ \text{Mutually exclusive;} \quad \frac{2}{15} \approx 0.133 \]

27) A cooler contains eleven sports drinks: four lemon-lime and seven orange. One of the lemon-lime and three of the orange drinks are cold. The others are still warm. You randomly grab a bottle. It is lemon-lime flavored or cold.

\[ \text{Not mutually exclusive;} \quad \frac{7}{11} \approx 0.636 \]

29) A magazine contains twelve pages. You open to a random page. The page number is seven or nine.

\[ \text{Mutually exclusive;} \quad \frac{1}{6} \approx 0.167 \]

24) A litter of kittens consists of one gray female, three gray males, two black females, and one black male. You randomly pick one kitten. The kitten is black or male.

\[ \text{Not mutually exclusive;} \quad \frac{6}{7} \approx 0.857 \]

26) A basket contains five apples, three peaches, and five pears. You randomly select a piece of fruit. It is an apple or a peach.

\[ \text{Mutually exclusive;} \quad \frac{8}{13} \approx 0.615 \]

28) There are three nickels, three dimes, and five quarters in your pocket. You randomly pick a coin. It is a nickel or a dime.

\[ \text{Mutually exclusive;} \quad \frac{6}{11} \approx 0.545 \]

30) A box of chocolates contains four milk chocolates, four dark chocolates, and three white chocolates. You randomly select a chocolate. It is a milk chocolate or a dark chocolate.

\[ \text{Mutually exclusive;} \quad \frac{8}{11} \approx 0.727 \]

**Find the probability of each event, based on whether it is a permutation or a combination.**

31) A politician is about to give a campaign speech and is holding a stack of seven cue cards, of which the first 3 are the most important. Just before the speech, he drops all of the cards and picks them up in a random order. What is the probability that cards #1, #2, and #3 are still in order on the top of the stack?

\[ \frac{1}{210} \approx 0.476\% \]

32) A technician is launching fireworks near the end of a show. Of the remaining eleven fireworks, seven are blue and four are red. If she launches seven of them in a random order, what is the probability that all of them are blue?

\[ \frac{1}{330} \approx 0.303\% \]
33) A politician is about to give a campaign speech and is holding a stack of thirteen cue cards, of which the first 3 are the most important. Just before the speech, he drops all of the cards and picks them up in a random order. What is the probability that cards #1, #2, and #3 are still in order on the top of the stack?

\[
\frac{1}{1716} \approx 0.058\%
\]

34) A child is drawing a rainbow using a box of ten different colored crayons, which include the seven required colors. After drawing the red, orange, yellow, and green arcs in the proper order, she forgets the last three colors. From the remaining six crayons, she chooses three at random to finish drawing the rainbow. What is the probability that she correctly finishes the ROYGBIV rainbow?

\[
\frac{1}{120} \approx 0.833\%
\]

35) A gambler places a bet on a horse race. To win, she must pick the top three finishers in order. Seven horses of equal ability are entered in the race. Assuming the horses finish in a random order, what is the probability that the gambler will win her bet?

\[
\frac{1}{210} \approx 0.476\%
\]

36) A jar contains five black buttons and three brown buttons. If five buttons are picked at random, what is the probability that all of them are black?

\[
\frac{1}{56} \approx 1.786\%
\]

37) A gambler places a bet on a horse race. To win, he must pick the top three finishers in any order. Seven horses of equal ability are entered in the race. Assuming the horses finish in a random order, what is the probability that the gambler will win his bet?

\[
\frac{1}{35} \approx 2.857\%
\]

38) You’ve purchased a lottery ticket and your numbers are: 4-8-3. A lottery official randomly selects three balls from a set of nine balls that are numbered from #1 to #9. To win, your numbers must match the selected numbers in order. What is the probability of winning the lottery?

\[
\frac{1}{504} \approx 0.198\%
\]

39) A meeting takes place between a diplomat and thirteen government officials. However, three of the officials are actually spies. If the diplomat gives secret information to ten of the attendees at random, what is the probability that no secret information was given to the spies?

\[
\frac{1}{286} \approx 0.35\%
\]

40) Jacob and Jennifer each purchase one raffle ticket. If a total of five raffle tickets are sold, what is the probability that Jacob wins the grand prize and Jennifer wins the second prize?

\[
\frac{1}{20} = 5\%
\]
41) A child is drawing a rainbow using a box of fourteen different colored crayons, which include the seven required colors. After drawing the red, orange, yellow, and green arcs in the proper order, he forgets the last three colors. From the remaining ten crayons, he chooses three at random to finish drawing the rainbow. What is the probability that he correctly finishes the ROYGBIV rainbow?

\[
\frac{1}{720} \approx 0.139\%
\]

42) A car dealership has twelve cars in the lot. Unfortunately, the keys to the cars have been mixed up. The manager randomly grabs a key and tries to start a car. A salesman also randomly picks a different key and tries to start another car. What is the probability that both cars start?

\[
\frac{1}{132} \approx 0.758\%
\]

43) You've purchased a lottery ticket and your numbers are: 2-9-6. A lottery official randomly selects three balls from a set of twelve balls that are numbered from #1 to #12. To win, your numbers must match the selected numbers in order. What is the probability of winning the lottery?

\[
\frac{1}{1320} \approx 0.076\%
\]

44) A meeting takes place between a diplomat and nine government officials. However, two of the officials are actually spies. If the diplomat gives secret information to seven of the attendees at random, what is the probability that no secret information was given to the spies?

\[
\frac{1}{36} \approx 2.778\%
\]

45) A child is drawing a rainbow using a box of seventeen different colored crayons, which include the seven required colors. After drawing the red, orange, yellow, and green arcs in the proper order, he forgets the last three colors. From the remaining thirteen crayons, he chooses three at random to finish drawing the rainbow. What is the probability that he correctly finishes the ROYGBIV rainbow?

\[
\frac{1}{1716} \approx 0.058\%
\]

46) A mechanic working under a car requires five different size wrenches from his toolbox, which contains nine different wrenches. Reaching for his toolbox, he grabs five of them at random. What is the probability that the mechanic has all of the wrenches he needs?

\[
\frac{1}{126} \approx 0.794\%
\]

47) A car dealership has five cars in the lot. Unfortunately, the keys to the cars have been mixed up. The manager randomly grabs a key and tries to start a car. A salesman also randomly picks a different key and tries to start another car. What is the probability that both cars start?

\[
\frac{1}{20} = 5\%
\]

48) You've purchased a lottery ticket and your numbers are: 2-9-6. A lottery official randomly selects three balls from a set of six balls that are numbered from #1 to #6. To win, your numbers must match the selected numbers in order. What is the probability of winning the lottery?

\[
\frac{1}{120} \approx 0.833\%
\]