Lesson 7 Statistics and Probability Practice Test
Answer Explanations

Check your answers to the practice test and stop by the Discussion Area if you have any questions.

Question 1

The problem tells you that there are eight total gymnasts and three spots to fill.

First, because you can’t use a gymnast twice, you can’t use the multiplication formula. You’re left with either the permutation or combination formula.

Next, ask yourself whether order matters. Usually when it comes to medals, gold is best followed by silver and then bronze—in this case order would matter. But this problem says nothing of gold, silver, and bronze or any other method of medal ranking. It just says that the top three get medals. Apparently, order doesn’t matter.

So use the combination formula with eight choices and three selections:

\[
\binom{n}{r} = \frac{n!}{(n-r)! \times r!}
\]

\[
8C3 = \frac{8!}{(8-3)! \times 3!}
\]

\[
8C3 = \frac{8!}{(5! \times 3!)}
\]

\[
8C3 = \frac{(8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1)}{(5 \times 4 \times 3 \times 2 \times 1)(3 \times 2 \times 1)}
\]

Now look for the groups of numbers that cancel each other out and eliminate them from the formula. Both sides of the fraction contain \((5 \times 4 \times 3 \times 2 \times 1)\), so take this part out of the numerator and denominator to leave you with this:

\[
8C3 = \frac{(8 \times 7 \times 6)}{(3 \times 2 \times 1)}
\]

\[
8C3 = 56
\]
There are 56 possible sets of medalists.

**Question 2**

Your task is to find the possible number of different orderings of the wheels. The term *orderings* indicates that order matters. You’re filling the specific order of left front, right front, right rear, and left rear, so you should use a permutation. Use the permutation formula with four choices and four selections because there are four tires to choose from and four spots to fill on the car:

\[
\begin{align*}
\text{nPr} &= \frac{n!}{(n-r)!} \\
4\text{Pr} &= \frac{4!}{(4-4)!} \\
4\text{Pr} &= \frac{4!}{0!} \\
\text{Remember that, by definition, } 0! = 1 \\
\end{align*}
\]

There are 24 possible orderings of tires.

**Question 3**

This question asks you to find the probability that a person will choose a purple die and roll a six. The word *and* should tip you off that this is a problem that combines two probabilities; both events must occur.

Next, decide whether the events are independent or dependent. Does the outcome of the first event affect the probability of the second? No. One die roll doesn’t affect what could occur on subsequent die rolls, so the events are independent. This means you use the formula for independent events:

\[
\text{P}(A \text{ and } B) = \text{P}(A) \times \text{P}(B)
\]

\[
\begin{align*}
\text{P (purple and 6)} &= \text{P(purple)} \times \text{P(6)} \\
\text{P (purple and 6)} &= \left(\frac{3}{14}\right) \times \left(\frac{1}{6}\right) \\
\text{P (purple and 6)} &= \frac{3}{84}, \text{ which simplified is } \frac{1}{28}
\end{align*}
\]
There is a 1 in 28 chance that both of these conditions will be met.

**Question 4**

This one’s a little trickier! The best way to approach it is to take the question literally. It says the die is twice as likely to land on a 6 as it was prior to being weighted. When the die was unweighted, the probability of its landing on a 6 was 1/6 because there are six sides on the die and one of them is a 6. Now that the die is weighted, the probability of its landing on a 6 must double (because that’s what the question states), so now the probability must be 2 x 1/6, which is 2/6 or 1/3.

Now for the tricky part. You know that the probabilities of all the possible outcomes of the roll must add up to 1. (Just remember that a probability of 1 means a 100% chance. The sum of all possible rolls must be 1 since there is a 100% chance of the die landing on one of the sides.) Because you know that the probability of the die’s landing on a 6 is 1/3, you know that the probability of its landing on a side other than a 6 must be 1 – 1/3 or 2/3. To find out what the probability of rolling a 5 would be, you determine that, other than 6, all rolls are equally likely. That means there must be an equal chance that the die will land on 1, 2, 3, 4, or 5. Divide 2/3 by 5. 2/3 divided by 5/1 is 2/3 x 1/5, which is 2/15. So, the probability of the die’s landing on a 5 (or any number other than 6) is 2/15.

To check your answer, you can add up the probabilities to make sure they equal 1:

\[
p(1) + p(2) + p(3) + p(4) + p(5) + p(6) = 1 \\
2/15 + 2/15 + 2/15 + 2/15 + 2/15 + 1/3 = 1
\]

**Question 5**

Apply the formula for mean or average to the data in Experiment I. Plug in the correct values and solve:
The mean is calculated as:

\[
mean = \frac{\text{sum of values}}{\text{number of values}}
\]

\[
mean = \frac{54 + 64 + 72 + 50 + 68}{5}
\]

\[
mean = \frac{308}{5}
\]

\[
mean = 61.6
\]

**Question 6**

To find the median of a set of data, put the data in order from lowest to highest and choose the middle value:

53, 54, 58, 61, 68

The value in the middle is 58.

**Question 7**

The range of the set of data is equal to the highest value minus the lowest value.

Range = highest – lowest
Range = 72 – 50
Range = 22

**Question 8**

This question is the same as the previous. The range of a set of data is equal to the highest value minus the lowest value.

Range = 68 – 53
Range = 15

**Question 9**

As a rule, the smaller the range is for a set of data, the more reliable its mean is. So Experiment II's mean is probably more reliable than Experiment I's. The best way to discern closeness of data is by calculating its standard deviation:

To find the standard deviation for Experiment I, calculate the difference between each data point and the mean. Use your calculator!
61.6 – 54 = 7.6; 61.6 – 64 = -2.4; 61.6 – 72 = -10.4; 61.6 – 50 = 11.6; and 61.6 – 68 = -6.4

Square these differences.

7.6² = 57.76; -2.4² = 5.76; -10.4² = 108.16; 11.6² = 134.56; and -6.4² = 40.96

Add them together.

57.76 + 5.76 + 108.16 + 134.56 + 40.96 = 347.20

Divide by the number of values.

347.20 ÷ 5 = 69.44

The positive square root of 69.44 is 8.33. So the standard deviation for the first experiment is 8.33.

Perform the same calculations for the data in Experiment II:

The mean of the data in the second experiment is 58.8. When you subtract each data point from 58.8, you get these five values:

5.8, 4.8, -2.2, 0.8, and -9.2

Squaring the values results in these numbers:

33.64, 23.04, 4.84, 0.64, and 84.64

Their sum is 146.80, which divided by 5 is 29.36.

The positive square root of 29.36 and standard deviation is 5.42.

Experiment II has a smaller range of data and a smaller standard deviation than Experiment I. You know for sure that its mean is more reliable.

**Question 10**

When you combine the two sets of data, the resulting set is {50, 53, 54, 54, 58, 61, 64, 72, 68, 68}. But that's the union of the sets, not the intersection. The intersection of the two sets is {54, 68} because 54 and 68 are the two data points that the two sets have in common.
The intersection is \(\{54, 68\}\).