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1. Consider the following probability distribution for a random variable X.

1 / 1 point

X	1	3	5
$P(X)$	0.3	0.4	0.3

What is the expected mean $E[X]$ for this probability distribution?

- ○ $\mu = 3.3$
- ◉ $\mu = 3.0$
- ○ $\mu = 3.5$
- ○ $\mu = 6$

Correct
The expected value measures the central tendency of a probability distribution. It can be calculated by $E[X] = x_1p_1 + x_2p_2 + x_3p_3 = 1 * 0.3 + 3 * 0.4 + 4 * 0.3 = 3.0$.

2. What is the advantage of looking at the standard deviation instead of the variance?

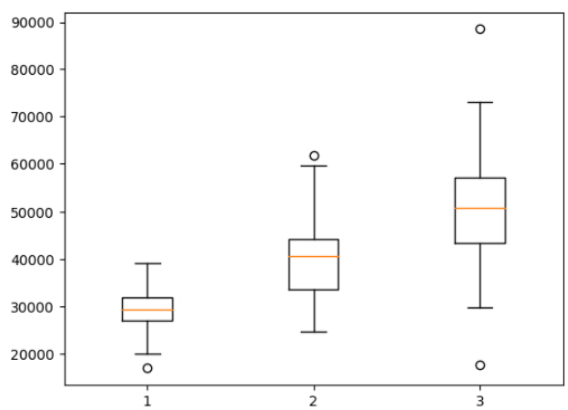
1 / 1 point

- ○ The standard deviation is less affected by outliers than the variance.
- ◉ The standard deviation has the same unit as the sample.
- ○ The standard deviation may be negative.
- ○ There are no advantages. They mean the same thing.

Correct
The variance has the sample's unit squared, whereas the standard deviation has the same unit as the sample. This makes it easier to interpret.

3. The box plot below shows the distribution of salaries for employees in **three** different company departments.

1 / 1 point



Based on the boxplots above, which of the following statements aretrue? **Select all that apply.**

- ☑ The median salary of department 2 is higher than the median salary of department 1.

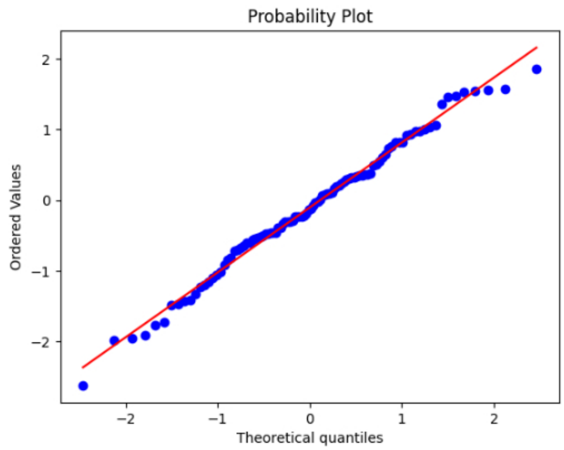
Correct
The box plot shows that the median salary of department 2 is around 40,000 and the median salary of department 1 is around 30,000.

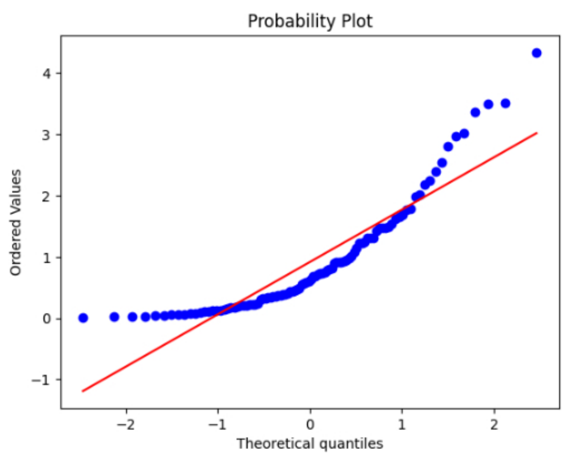
- ☐ The IQR of department 3 is smaller than department 1.
- ☐ There are no outliers in department 2.
- ☑ The range of salaries in department 3 is larger than the range of salaries in department 2.

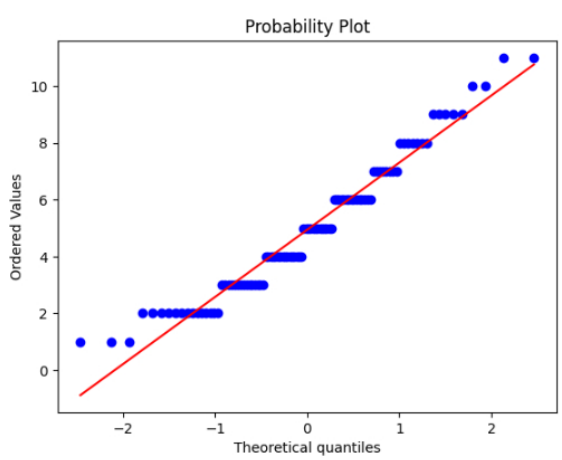
Correct
The box plot shows that the range of salaries in department 3 is larger than the range of salaries in department 2. Therefore, the correct statement is that the range of salaries in department 3 is larger than department 2.

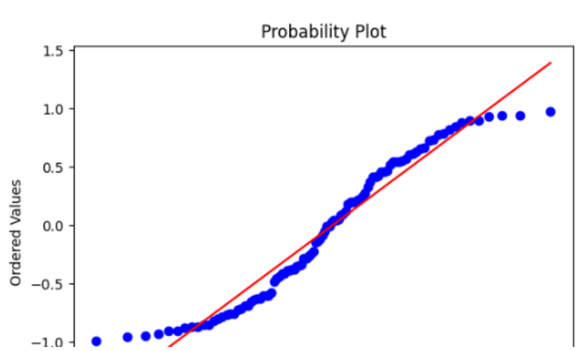
4. Which of the following QQ plots represents a set of data that is more likely normally distributed?

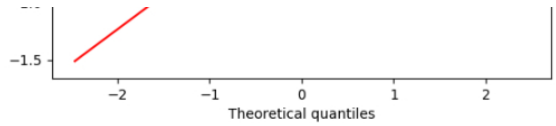
1 / 1 point







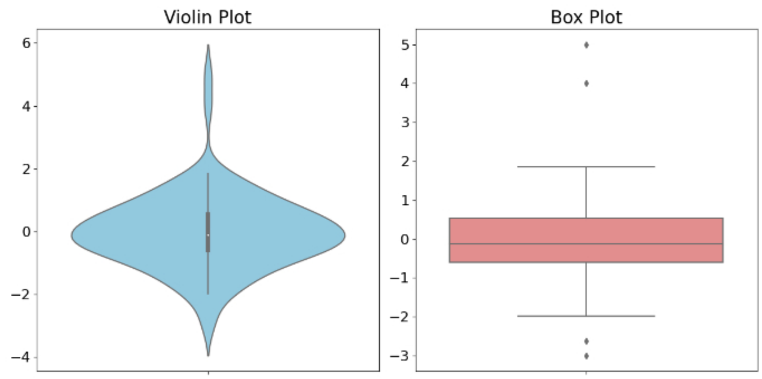




Correct
This is the graph that best fits in the red line!

5. The violin plot and box plot below are visualizations of the **same dataset**. Based on the violin plot and box plot above, which of the following statements are **true**?

0.6 / 1 point



- [ ] The interquartile range (IQR) is smaller in the violin plot compared to the box plot.
- [x] Outliers are visible in the box plot but not in the violin plot.

Correct
Outliers are represented by points beyond the whiskers in the box plot, which are not present in the violin plot.

- [x] The dataset has a bimodal distribution.

This should not be selected
A bimodal distribution is a probability distribution with two different modes. A bimodal distribution has two distinct peaks or high points in the frequency or probability distribution. Since there is only one peak in the violin plot, it is not a bimodal distribution.

- [x] The median of the dataset is approximately 0.

Correct
The box plot displays the quartiles of the data. The horizontal line in the box indicates the median.

- [ ] The dataset has a positive skewness.

6. Suppose that the joint probability distribution of two random variables X and Y is given by the following table:

1 / 1 point

X/Y	1	2	3
1	0.1	0.2	0.3
2	0.2	0.1	0.1

What is the probability that X and Y both take even values?

- ( ) 0.2
- (•) 0.1
- ( ) 0.3
- ( ) 0.4

Correct
The even values for X are 2, and the even values for Y are 2. Thus, the probability that X and Y both take even values is the sum of the probabilities in the joint distribution table where $X = 2$ and $Y = 2$:

$$P(X = 2 \text{ and } Y = 2) = 0.1$$

7. Which of the following statements are true regarding marginal and conditional distributions? Select all that apply.

1 / 1 point

- [x] Marginal distribution summarizes the behavior of one variable at a time by aggregating over the other variable(s).

Correct

- [x] Conditional distribution involves taking slices of the joint distribution to focus on specific conditions.

Correct

- [x] To find the marginal distribution for a variable, probabilities are summed over all variable values, either by adding columns or rows in the joint distribution table.

Correct

8. Suppose that the joint probability distribution of two random variables X and Y is given by the following table:

0 / 1 point

X/Y	1	2
1	0.05	0.15
2	0.1	0.2
3	0.15	0.35

What is the conditional distribution $P(X=3|Y=1)$?

- (●) 0.15
- ( ) 0.25
- ( ) 0.5
- ( ) 0.333

Incorrect
Almost! To calculate the conditional distribution $P(X=3|Y=1)$ it is important to **normalize** the probabilities in the column $P(Y=1)$.

$P(X=3|Y=1) = \frac{P(X=3,Y=1)}{P(Y=1)}$

9. Which of the following statements regarding the correlation coefficient are true? **Select all that apply.**

1 / 1 point

- [ ] It is a positive real number.
- [ ] It can be any real number.
- [x] It measures how linearly correlated two variables are.

Correct
The correlation coefficient, known as Pearson coefficient, measures how close to a linear relationship two variables are.

- [x] It is a real number between -1 and 1.

Correct
The correlation coefficient is a real number between -1 and 1. Where the closer to -1, the more negatively correlated the variables are, the closer to 1, the more positively correlated the variables are and the closer to 0, it means that the variables have no linear relationship.

10. Suppose that the joint probability distribution of two random variables X and Y is given by the following table:

1 / 1 point

X/Y	0	1
0	0.2	0.1
1	0.1	0.6

What is the covariance between X and Y?

- ( ) -0.04
- (●) 0.11
- ( ) 0.02
- ( ) 0.04

Correct
The mean of X is

$$\mu_X = (0 \times 0.2 + 1 \times 0.1) + (0 \times 0.1 + 1 \times 0.6) = 0.7$$

And the mean of Y is

$$\mu_Y = (0 \times 0.2 + 0 \times 0.1) + (1 \times 0.1 + 1 \times 0.6) = 0.7$$

Therefore, the covariance between X and Y is:

$$\begin{aligned}\operatorname{cov}(X, Y) &= (0 - 0.7)(0 - 0.7) \times 0.2 \\ &+ (1 - 0.7)(0 - 0.7) \times 0.1 \\ &+ (0 - 0.7)(1 - 0.7) \times 0.1 \\ &+ (1 - 0.7)(1 - 0.7) \times 0.6 \\ &= 0.11\end{aligned}$$