Data Distribution

Name: _____ Date: _____ Score: _____ / 30

Quick Review

The **shape** of a distribution tells you where the data sits and how the values cluster. Four shapes show up over and over: **symmetric**, **right-skewed**, **left-skewed**, and **uniform**.

Symmetric. The left and right halves are mirror images. Mean $\approx$ median. Bell-shaped (normal) distributions are the classic case.

Right-skewed (positive skew). The tail stretches to the right – a few unusually large values. The mean gets pulled *toward* the tail: mean $>$ median. Income, house prices, and wait times are usually right-skewed.

Left-skewed (negative skew). The tail stretches left. Mean $<$ median. Lifespan data can be left-skewed because most people make it to old age and a few die young.

Uniform. Roughly equal frequency across all bins. No clear peak. Mean $\approx$ median (similar to symmetric, but flat instead of bell-shaped).

Number of peaks. Unimodal has one peak. **Bimodal** has two distinct peaks – often a hint that two different populations got mixed together.

Choosing a measure of center for skewed data. If the distribution is skewed, the mean is pulled by the tail and misrepresents the typical value. Use the **median**. For symmetric data the mean is fine.

Common slips. Naming the skew by where the bulk sits instead of where the tail points (the long tail to the right is *right*-skewed, even though most data is on the left). Reporting the mean as the typical value for clearly skewed data. Calling a flat shape "symmetric" (it is symmetric, but the more informative name is *uniform*).

PRACTICE

Name the shape, choose the appropriate measure of center, or compare.

1. Shape with mean $\approx$ median _____
2. Shape: mean $>$ median _____
3. Shape: mean $<$ median _____
4. Best measure of center for heavily skewed data? _____
5. Distribution shape with all bars roughly equal height _____
6. Distribution with two distinct peaks _____
7. For the data set in the table, the mean is about 15.9 and the median is 13. Name the likely shape. _____

Value
$10,\ 11,\ 12,\ 12,\ 13,\ 14,\ 15,\ 16,\ 40$

8. For the data set in the table, the mean is about 33.9 and the median is 38. Name the likely shape. _____

Value
$5,\ 30,\ 34,\ 36,\ 38,\ 39,\ 40,\ 41,\ 42$

9. For the symmetric data set in the table, both the mean and the median equal 7. What shape does this suggest? _____

Value
$4,\ 5,\ 6,\ 7,\ 8,\ 9,\ 10$

10. Wait times at a busy clinic. Likely shape? _____
11. Bell-shaped histogram with a single peak. _____
12. Test scores where most students did well, with a few low outliers. _____
13. True or false: the median always exists for numerical data. _____

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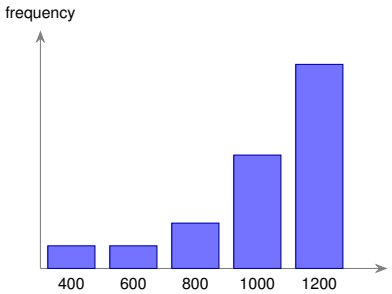
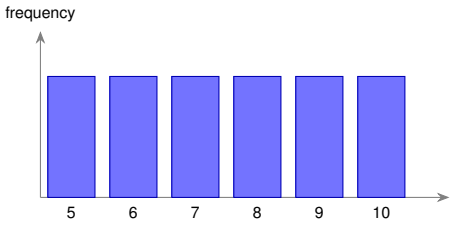
14. True or false: every data set has a unique mode. _____
15. Customer wait times: mean 12, median 8. Better summary? _____
16. Distribution with mean μ, tail to the right. Sign of skew? _____
17. Symmetric distribution: which is the largest – mean, median, mode? _____
18. House prices in a wealthy zip code. Mean or median for a typical price? _____
19. A histogram has one tall peak and roughly even tails on both sides. _____
20. If the data is bimodal, what might that tell you? _____

Word Problems

21. A real-estate agent looks at home prices in her city. The mean price is \$520,000 and the median is \$340,000. Describe the shape of the distribution and explain which measure she should report when describing a "typical" home. ____
22. A statistics class plots final exam scores and finds two distinct peaks – one near 72 and another near 92. What term describes this distribution, and what's a plausible explanation for the shape? ____
23. A factory tracks the lifespan of a batch of light bulbs (in hours). The histogram is below. Describe the skew and choose the better measure of center. ____



24. A teacher gives a 10-question quiz and tabulates the scores. The histogram is below. Describe the distribution shape and what it suggests about the quiz. ____



Additional Practice

25. Find the mean of $4, 6, 8, 10$. _____
26. Find the median of $3, 9, 4, 10, 7$. _____
27. Find the range of $12, 5, 9, 20$. _____
28. Find the mode of $2, 3, 3, 5, 8$. _____
29. Find z for $x = 72$, mean 60, standard deviation 6. _____
30. Interpret $z = -1.5$. _____

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Answer Keys

1.	symmetric	**13.**	True
2.	right-skewed	**14.**	False
3.	left-skewed	**15.**	median
4.	median	**16.**	positive
5.	uniform	**17.**	they are approximately equal
6.	bimodal	**18.**	median
7.	right-skewed	**19.**	symmetric, unimodal
8.	left-skewed	**20.**	two mixed groups
9.	symmetric or uniform	**21.**	right-skewed; report the median
10.	right-skewed	**22.**	bimodal; two underlying groups
11.	symmetric, unimodal	**23.**	left-skewed; report the median
12.	left-skewed	**24.**	uniform; the quiz didn't separate students well

Additional Practice Answers

25.	7	**28.**	3
26.	7	**29.**	2
27.	15	**30.**	1.5 SD below mean

Additional Practice: Answers for all numbered items, including the added practice, are shown in the grid above.

Step-by-Step Explanations

1. When the two halves of the distribution mirror each other, the mean and median land at the same place.
2. The mean is pulled to the right by the long tail of unusually large values, so it ends up above the median.
3. One steady path is: The tail stretches to the left, pulling the mean below the middle position. That gives a quick check on the answer.
4. In skewed data the long tail drags the mean toward the extreme values, so the mean overstates (or understates) a typical value. The median sits at the middle position and barely moves, so it reports the typical value honestly.
5. A careful way to see it: Equal frequency across bins means no peak and no skew. This is the part to check before moving on, because it keeps the answer tied to the original question.
6. Keep the rule visible: Two clear humps. Often hints at two different groups mixed into one data set. That gives a quick check on the answer.
7. Mean (≈ 15.9) sits above the median (13) – the lone high value 40 stretches a tail to the right and drags the mean up.
8. Mean (≈ 33.9) sits below the median (38) – the low value 5 stretches a tail to the left and pulls the mean down.
9. With mean equal to median, the distribution is balanced around the center. Could be a bell curve or, as here, a flat evenly spread set.
10. Most patients wait a short time; a few wait much longer. Long right tail $\Rightarrow$ right skew. Use the median to report a "typical" wait.
11. One peak (unimodal); mirror-image halves (symmetric). The classic normal-distribution shape.
12. Most data sits high; a few outliers trail to the left. Long left tail $\Rightarrow$ left skew.
13. Sort the data, take the middle position (or average of two middles). Every numerical data set has a median.
14. A data set can have one mode, two modes (bimodal), more (multimodal), or even none (if every value appears equally often).
15. Skewed right; mean is pulled by long waits. Median tells you what most people experience.
16. Right skew is also called positive skew – the mean exceeds the median by a positive amount.
17. Perfect symmetry forces all three measures of center to land at the same point (or very close).
18. Housing data is almost always right-skewed; a few mansions pull the mean up. The median tells a more honest story.
19. One steady path is: Single peak, balanced tails. Sound familiar? That's a normal-ish shape. That gives a quick check on the answer.
20. Two clear peaks often mean you're looking at two different populations – e.g., two classes that had different experiences with the material.
21. Mean $>$ median by a wide margin signals right-skew: a few high-priced mansions are yanking the mean up. The median ($\$340$k) sits at the middle position and isn't pulled around. For a "typical" house, the median is the honest number; the mean overstates what most buyers will pay.
22. Two distinct peaks $\Rightarrow$ bimodal. When you see this, suspect that the data is *mixing two populations*. In a stats class, a common cause is two groups with different preparation: maybe students who attended review sessions clustered near 92, and those who skipped clustered near 72. The single mean (somewhere in the middle) would describe almost *nobody*.
23. Most bulbs cluster high (long-lasting); a few die early on the left. Long left tail $\Rightarrow$ left-skewed (negative skew). The few early failures drag the mean below the median, so the mean understates a typical bulb's lifespan. Use the median.
24. A flat histogram with no peak is a uniform distribution – students are spread evenly across the score range. That's unusual on a quiz; usually you expect a single peak somewhere. A uniform shape suggests the quiz might not have differentiated student ability well, or that the questions covered a wide range of difficulties without a clear "typical" performance level.

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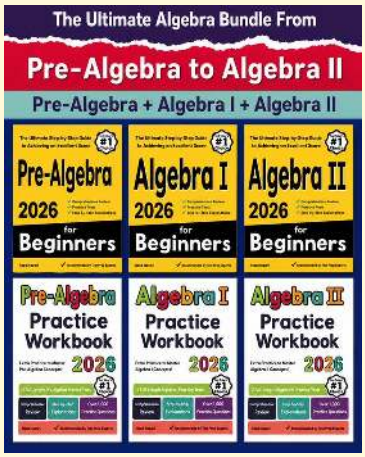

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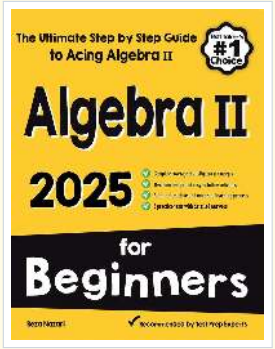

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