This exam consists of 20 questions. Total points: 30.

1. (1 point.) Which of the following are categorical variables: (a) Height measured in feet, (b) date of birth (c) gender of the subject, (d) political affiliation of the subject?

(b), (c), (d).

2. (2 points.) Name two ways of graphically displaying categorical variables and two for displaying quantitative variables.

Categorical: Pie Chart, Bar Graph. Quantitative: Stem plot, Histogram, Box plot.

3. (2 points.) Make a stem plot of the following data. Also find the Inter Quartile Range of the data set.

25, 37, 35, 15, 9, 8, 11, 10, 22, 29.

\[
\begin{array}{c|cccc}
0 & 8 & 9 \\
1 & 0 & 1 & 5 \\
2 & 2 & 5 & 9 \\
3 & 5 & 7 \\
\end{array}
\]

\[IQR = 29 - 10 = 19.\]
4. (1 point.) If the median of the distribution is much smaller than the mean, what can you say about the shape of the distribution?

The Distribution is Right Skewed.

5. (1 point.) Which of the following two carries more information: frequency histogram, relative frequency histogram. Why?

Frequency Histogram; since you can determine the total number of individuals in the data set from a frequency histogram but not from the relative frequency histogram.

6. (2 points.) If the stem plot has too many stems and too few leaves, what should one do? What if there are too few stems and too many leaves?

Too many stems....: Round off suitably..
Too few stems ...: break up the stems from 0-4 and 5-9.

7. (1 point.) Is it true that for a symmetric distribution; mean, median and mode are all equal? Give reasons.

No. If the distribution is multi-modal, the mean and median may not be same as any of the modes.

8. (1 point.) Find the class interval containing the median for the following Histogram.

Answer. [30, 40]
9. (1 point.) What is the advantage of using Inter Quartile Range, over standard deviation, as a measure of spread?

**IQR is more resistant to outliers and extreme observations.**

10. (1 point.) For what kind of variables is a time plot of use? What is plotted along the X-axis? Along the Y-axis?

variables which exhibit a systematic variation over time. **X-axis:** Time, **Y-axis:** variable value.

11. (2 points.) Find the standard deviation of the following data set. You must show all calculations.

\[
\{ -1, 0, -5, 10 \}
\]

\[
s = \sqrt{\frac{1}{3}((-1 - 1)^2 + (0 - 1)^2 + (-5 - 1)^2 + (10 - 1)^2)} = 6.38
\]

12. (2 points.) For a data set, \( Q_1 = 19 \) and \( Q_3 = 45 \). Which of the following are outliers? \{ -23, -17, 0, 27, 42, 78, 88, 90 \}.

\[
1.5 \times IQR = 39; \quad Q_1 - 39 = -20; \quad Q_3 + 39 = 84; \quad Outliers : -23, 88, 90
\]

13. (1 point.) What are the two main differences in the distribution of \( X \) and \( Y \)?

1. \( Y \) has a lower median than \( X \). 2. \( X \) is right skewed, whereas \( Y \) is left skewed.

14. (3 points.) Consider the linear transformation: \( x_{new} = 4 - 5x_{old} \). Suppose that

\[
\tau_{old} = 0, \quad s_{old} = 2, \quad Median_{old} = -1, \quad IQR_{old} = 1.2.
\]

Find

\[
\tau_{new}, \quad s_{new}, \quad Median_{new}, \quad IQR_{new}.
\]

What can you say about the skewness of the distribution of \( x_{new} \)?
\[ \bar{x}_{new} = 4, \ s_{new} = 10, \ \text{Median}_{new} = 9, \ \text{IQR}_{new} = 6.0. \]

Since \( x_{old} \) is right skewed, \( x_{new} \) is left skewed.

15. **(2 points.)** Items produced by a manufacturing process are Normally distributed with mean 90 grams and a standard deviation of 1 gram. What percentage of the items will weigh between 87 grams and 93 grams?

Let \( X \) be the weight of an item. Then \( X \sim N(90, 1) \).

\[
P(87 < X < 93) = P(-3 < Z < 3) = .997.
\]

16. **(2 points.)** The weight of a randomly selected can of a new soft drink is known to have a Normal distribution with mean of 8.3 ounces and a standard deviation of 0.2 ounces. What should the stamped weight on the can should be so that only 2% of the cans are below that weight?

Let \( X \) be the weight of a can. Then \( X \sim N(8.3, 0.2) \). Let \( x \) be the stamped weight. Then \( P(X \leq x) = .02 \). This implies that \( P(Z \leq \frac{x - 8.3}{0.2}) = .02 \). This implies that \( \frac{x - 8.3}{0.2} = -2.05 \). Thus \( x = 7.89 \).

17. **(1 point.)** Answer: (c) 49

18. **(1 point.)** Answer (c) : Five, four, one, two.

19. **(1 point.)** (d) 14