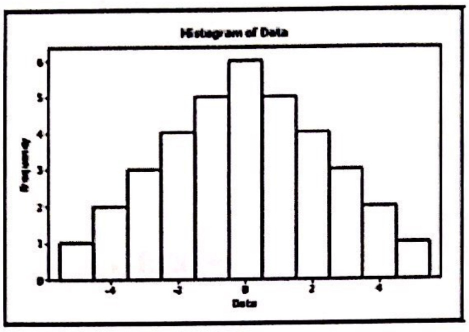
Key

School administrators collect data on students attending the school. Which of the following variables is quantitative?

A) class (freshman, soph., junior, senior)
B) grade point average
C) whether the student is in AP classes
D) whether the student has taken the SAT
E) none of these

Which is true of the data shown in the histogram?



I. The distribution is approximately symmetric.
II. The mean and median are approximately equal.
III. The median and IQR summarize the data better than the mean and standard deviation.

A) I only B) III only C) I and II D) I and III E) I, II, and III

Suppose that a Normal model described student scores in a history class. Parker has a standardized score (z-score) of +2.5. This means that Parker

A) is 2.5 points above average for the class.
B) is 2.5 standard deviations above average for the class.
C) has a standard deviation of 2.5.
D) has a score that is 2.5 times the average for the class.
E) None of the above.

The five-number summary of credit hours for 24 students in a statistics class is:

Min	Q1	Median	Q3	Max
13.0	15.0	16.5	18.0	22.0

Which statement is true?

A) There are no outliers in the data.
B) There is at least one low outlier in the data.
C) There is at least one high outlier in the data.
D) There are both low and high outliers in the data.
E) None of the above.

Which of the following summaries are changed by adding a constant to each data value?

I. the mean
II. the median
III. the standard deviation

measures of spread change by multiplying only

A) I only B) III only C) I and II D) I and III E) I, II, and III

Health insurance The *World Almanac and Book of Facts 2004* reported the percent of people not covered by health insurance in the 50 states and Washington, D.C., for the year 2002. Computer output gives these summaries for the percent of people not covered by health insurance;

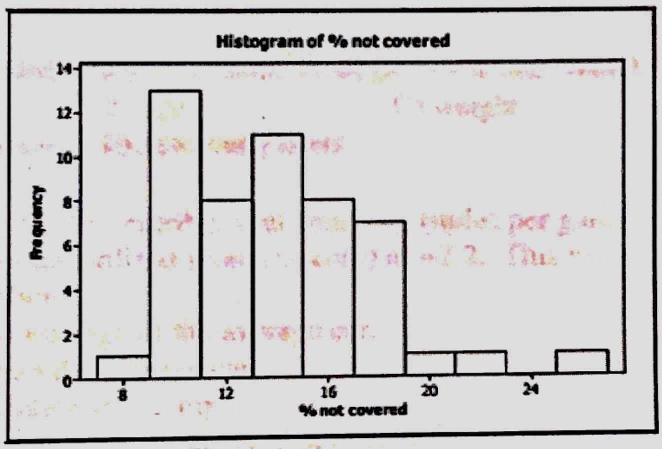
Min	Q1	Median	Q3	Max	Mean	SD
7.9	10.8	13.4	16.7	25.8	13.9	3.6

use 1.5(IQR) rule!

a. Were any of the states outliers? Explain how you made your decision.

At least 1 is higher than 25.55 (the max is 25.8). None are lower than 1.95 (the min is 7.9).

b. A histogram of the data is as follows:



Is it more appropriate to use the mean and standard deviation or the median and IQR to describe these data? Explain.

Median & IQR since data is skewed & may contain outliers.

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Soda cans A machine that fills cans with soda fills according to a Normal model with mean 12.1 ounces and standard deviation 0.05 ounces.

a. If the cans claim to have 12 ounces of soda each, what percent of cans are under-filled?

$z = \frac{12 - 12.1}{.05} = -2 \rightarrow .0228$ or 2.5%

2.28%

b. Management wants to ensure that only 1% of cans are under-filled.

i. Scenario 1: If the mean fill of the cans remains at 12.1 ounces, what standard deviation does the filling machine need to have to achieve this goal?

1% is associated with a z-score of ≈ -2.33

$-2.33 = \frac{12 - 12.1}{x}$ $\boxed{x = .043 \text{ oz} = \sigma}$

ii. Scenario 2: If the standard deviation is to remain at 0.05 ounces, what mean does the filling machine need to have to achieve this goal?

$-2.33 = \frac{12 - x}{.05}$ $\boxed{x = 12.12 \text{ oz}}$

The SPCA collects the following data about the dogs they house. Which is categorical?

A) breed B) age C) weight
D) number of days housed E) veterinary costs

Suppose that a Normal model describes fuel economy (miles per gallon) for automobiles and that a Saturn has a standardized score (z-score) of +2.2. This means that Saturns . . .

A) get 2.2 miles per gallon.
B) get 2.2 times the gas mileage of the average car.
C) get 2.2 mpg more than the average car.
D) have a standard deviation of 2.2 mpg.
E) achieve fuel economy that is 2.2 standard deviations better than the average car.

Cordless phones In their October 2003 issue, *Consumer Reports* evaluated the price and performance of 23 models of cordless phones. Computer output gives these summaries for the prices:

Min	Q1	Median	Q3	Max	MidRange	Mean	TrMean	SD
15	30	50	110	200	107.5	71.75	67.63	52.08

a. Were any of the prices outliers? Explain how you made your decision.

IQR = 80

1.5 (80) = 120

110 + 120 = 230

30 − 120 = −90

NO outliers

b. One of the manufacturers advertises a cordless phone "economy-priced at only $31.95". Would you consider that to be a very low price? Explain.

$z = \frac{31.95 - 71.75}{52.08} = -.76$

It's only .76 standard deviations below the mean, so that's not unusually low.

Concrete thickness A roadway construction process uses a machine that pours concrete onto the roadway and measures the thickness of the concrete so the roadway will measure up to the required depth in inches. The concrete thickness needs to be consistent across the road, but the machine isn't perfect and it is costly to operate. Since there's a safety hazard if the roadway is thinner than the minimum 23 inch thickness, the company sets the machine to average 26 inches for the batches of concrete. They believe the thickness level of the machine's concrete output can be described by a Normal model with standard deviation 1.75 inches. [Show work]

a. What percent of the concrete roadway is under the minimum depth?

$z = \frac{23-26}{1.75} = \frac{-3}{1.75} = -1.71 \rightarrow .0436 \rightarrow 4.36\%$

Given a confidence level of 95%, what would the minimum sample size need to be so that the sample is within 5 units of the true population, given that the standard deviation is 3.9?

$5 = 1.96\left(\frac{3.9}{\sqrt{n}}\right)$ $n = 2.337 \rightarrow$ 3 people

You work for a consumer advocacy agency and want to estimate the population mean cost of replacing a car transmission. As part of your study, you randomly select 50 replacement costs and find the mean to be $2650. The sample standard deviation is $425. Construct a 95% confidence ***interval*** for the population mean replacement cost. Interpret the results in a complete sentence.

MOE $= \pm 1.96\left(\frac{425}{\sqrt{50}}\right) = 117.8$

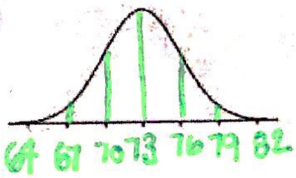
confidence interval: (2532.20, 2767.80)

A government agency reports a confidence interval of (26.2, 30.1) when estimating the mean commute time in minutes for the population of workers in a city. Find the estimated margin of error and sample mean.

$\frac{26.2+30.1}{2} = 28.15$ = sample mean $30.1 - 28.15 = 1.95 =$ MOE

The adult men of the Dinaric Alps have the highest average height of all regions. The distribution of height is approximately normal with a mean height of 6 ft 1 in (73 inches) and standard deviation of 3 inches.

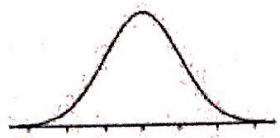
5. Find the 40th percentile of the height of Dinaric Alps distribution for men.



$-.25 = \frac{x-73}{3}$

$-.75 = x-73$ $x = 72.25$

6. What percentage of men have a height greater than 74 inches?



$z = \frac{74-73}{3} = .333 \rightarrow .6293$ below

$1-.6293 = .3707$

37.07%

Suppose that there are 100 franchises of Betty's Boutique in similar shopping malls across America. The gross Saturday sales of these boutiques are approximately normally distributed with $4610 and a standard deviation of $370.

(a) Find the z-scores of each of the following gross Saturday sales amounts: $3870, $4425, and $5535.

$z = \frac{x - \mu}{\sigma}$ -2 , -.5 , 2.5

(b) What percentage of Betty's Boutique franchises had gross Saturday sales between $4425 and $5535? Use the z-scores you found in part (a) and the z-score table from class.

2.5 → 99.38% 99.38 − 30.85 = 68.53%

−.5 → 30.85%

(c) What percentage had gross Saturday sales between $3870 and $5535? Use the z-scores you found in part (a) and the z-score table from class.

2.5 → 99.38% 99.38 − 2.28 = 97.1%

−2.0 → 2.28%

(d) What percentage of stores had gross Saturday sales less than $5535?

2.5 → 99.38%

Suppose that a certain insect has a mean lifespan of 5.6 days with a standard deviation of 1.2 days. Assume that the lifespan of this insect is approximately normally distributed.

(a) Calculate the percentage of insects with a life-span between 3.2 and 8 days.

$\frac{3.2 - 5.6}{1.2} = -2$ 2.28% $\frac{8 - 5.6}{1.2} = 2$ 97.72% 97.72 − 2.28 = 95.44%

(b) Calculate the percentage of insects with a life-span between 2.6 and 8.6 days.

$\frac{2.6 - 5.6}{1.2} = -2.5$ .62% $\frac{8.6 - 5.6}{1.2} = 2.5$ 99.38% 99.38 − .62 = 98.76%

(c) What percentage of insects will live longer than 3.32 days?

$\frac{3.32 - 5.6}{1.2} = -1.9$ → 2.87% 100 − 2.87 = 97.13%

(d) What percentage of insects will live less than 6.56 days?

$\frac{6.56 - 5.6}{1.2} = .8$ → 78.81%