

Chapter 12 Questions from old tests

Spring 2009

Use of a calculator is permitted. Round all final answers to two decimal places; do your work to at least 3 decimal places.

1. The Alumni Office at Enterprise College recently sent a survey to its 200 most recent graduates along with requests for donations to the Annual Fund. The survey asked the graduates to mail in their responses to a questionnaire, which asked, among other things, their opinions of the value of their college degrees in the job market, using a scale of 1–5, with 1 indicating no value. Thirty-two of the 200 graduates surveyed returned the surveys. The data collected were as follows: two graduates rated the usefulness of their degrees as 1; seven rated them as 2; eight rated them as 3; fourteen rated them as 4; and one rated her degree as 5.

a) The mode rating of the value of the degree by the graduates was: 4 (rating given by 14 students)

b) Use a weighted mean to calculate the average rating of the value of the degree. ~ 3.2

$$\frac{(2 \times 1) + (7 \times 2) + (8 \times 3) + (14 \times 4) + (1 \times 5)}{32} = \frac{101}{32} = 3.15625 \approx 3.2$$

c) What are two possible sources of bias in this survey and its results? (a variety of possible responses)

- Typical answers:
 - asked on mail as part of a request for money, especially among younger alumni.
 - attached to a request for money, which may affect response rate and/or attitudes negatively.

2. Calculate the mean and sample standard deviation for the following set of 6 data points: $\{-1.5, -1, 0, 1, 3.5, 4\}$.

$$\text{Mean} = \frac{-1.5 - 1 + 0 + 1 + 3.5 + 4}{6} = \frac{6}{6} = 1 = \text{mean}$$

Data Pts.	Dev. from Mean	(Dev from Mean) ²
-1.5	-1.5 - 1 = -2.5	6.25
-1	-1 - 1 = -2	4
0	0 - 1 = -1	1
1	1 - 1 = 0	0
3.5	3.5 - 1 = 2.5	6.25
4	4 - 1 = 3	9

Note: all values are positive

$$1 \text{ S.D.} = \sqrt{\frac{\text{sum of (dev from mean)}^2}{n-1}}$$

$$= \sqrt{\frac{26.5}{5}} = \sqrt{5.3} \approx 2.302$$

26.5 ← sum of (dev from mean)²

n = 6

Must = 0.

5
 ↑
 n-1 = 6-1

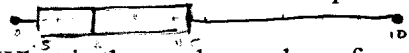
3. Nine students recorded their total number of cups of coffee in the 24 hours before a test. The reported numbers were: 10, 2, 2, 3, 1, 5, 0, 0, 4 cups of coffee. Use this information for parts a-g below. Lined up: 0 0 1 2 2 3 4 5 10

Q1 = .5 m = 2 Q3 = 4.5

5 Q1 m Q3 L
 { 0, .5, 2, 4.5, 10 }

a) Give the 5-number summary, using set notation. { 0, .5, 2, 4.5, 10 }

b) Draw a box-and-whiskers plot of the reported numbers of cups of coffee.



c) What is the mode number of cups of coffee? 0 and 2 (bimodal)

d) What is the mean number of cups of coffee? 3 $\frac{0+0+1+2+2+3+4+5+10}{9} = \frac{27}{9} = 3$

e) Is this data skewed? yes (If so, indicate right/left). Briefly explain your answer. Because mean = 3 & median = 2.

f) Identify:

i) The Range of the cups of coffee: 10 - 0 = 10

ii) The Interquartile Range (IQR) of the cups of coffee: 4.5 - .5 = 4

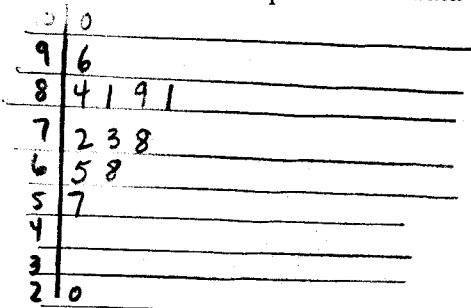
g) Identify all outliers, if there are any. None Justify your response mathematically.

(1.5) IQR = (1.5 x 4) = 6
 Check for outliers $Q_1 - 6 = .5 - 6 = -5.5$ (No values lower)
 $Q_3 + 6 = 4.5 + 6 = 10.5$ (No values higher)
 (means reasonable whiskers go from -5.5 to 10.5)

4. The scores of 13 students on a recent psychology exam were as follows:

84 57 72 65 100 81 73 89 68 96 20 78 81

a) Create a stem and leaf plot of the data in the space below.

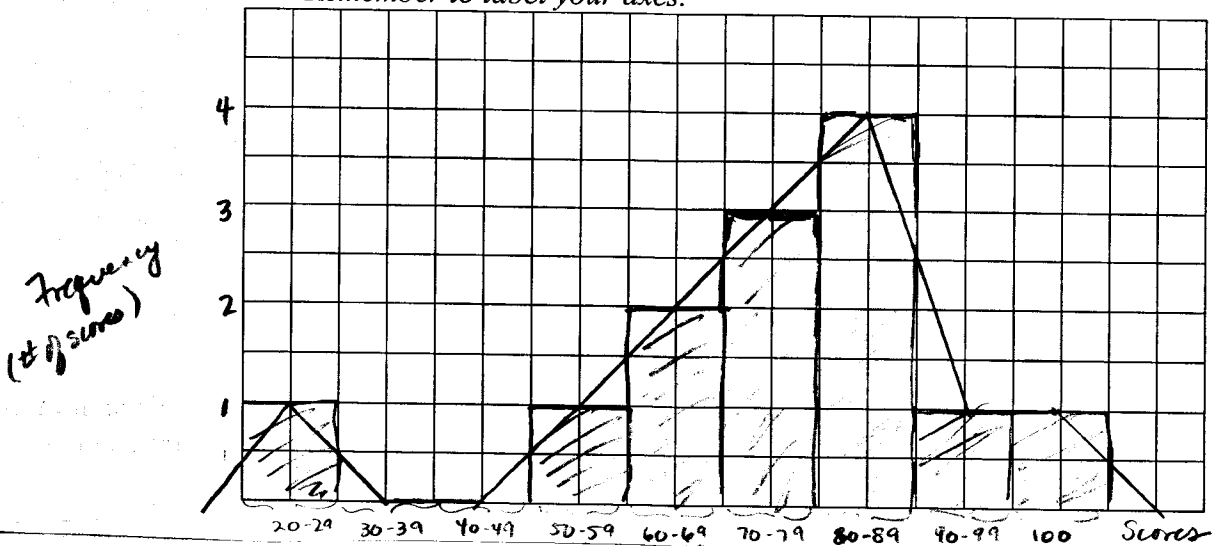


Frequency Distribution:

100	1
90	1
80	4
70	3
60	2
50	1
20's	1

b) Construct a histogram and a frequency polygon of these scores in the graph paper below, using classes of size 10.

Remember to label your axes.



5. In one part of Franklin County, the average home cost is \$453,000, with a standard deviation of \$40,000. Assume that the prices of homes are closely approximated by a normal curve, and answer the following questions. Use the table on page 720 of your book as necessary to answer these questions

a) What is the z-score of a home that costs \$417,000? -0.9

$$z = \frac{417,000 - 453,000}{40,000} = \frac{-36,000}{40,000} = -0.9$$

b) What percent of homes costs more than \$481,000? 24.20%

$$z = \frac{481,000 - 453,000}{40,000} = \frac{28,000}{40,000} = .7 \text{ Percentile for } z = .7 \text{ is } 75.80\%, \text{ \% greater than } z = .7 \text{ is } 100\% - 75.80\% = 24.2\%$$

c) What percent of homes costs between \$413,000 and \$453,000? 34.13% (or 34%)

$$z = \frac{413,000 - 453,000}{40,000} = \frac{-40,000}{40,000} = -1. \text{ z score of } 453,000 = 0. \text{ } 50\% - 15.87\% = 34.13\% \text{ (or alternatively, using benchmarks, 34\% of prices fall between the mean and -1 S.D.)}$$

d) What percent of homes costs less than 413,000? 15.87%

$$z = -1, \therefore \text{percentile} = 15.87\% \text{ (or } 16\% \text{ using benchmarks: } 50\% - 34\%)$$

(2 x 1 s.d.) e) What is the cost of a home with a z-score of -1.2? \$405,000

$$(-1.2)(40,000) = -48,000. \text{ Mean} - 48,000 = 453,000 - 48,000 = 405,000$$

f) If the size of one standard deviation were \$50,000, would you expect to see more homes or fewer homes priced above \$550,000 than with a standard deviation of \$40,000? MORE

Explain. A higher standard deviation indicates that the data is more spread out. Thus we might expect to see more values at the extremes.

6. Following a rash of complaints from customers about the electrical and computer systems in Volkswagen New Bumblebees, VW America conducted a random sample of 250 one-year-old New Bumblebees to try to determine the extent of electrical or computer defects in its cars. Of the 250 cars checked, 70 showed evidence of electrical or computer problems.

- a) What is the population being studied? *One-year-old VW New Bumblebees*
- b) What sample is used in the study? *The 250 cars actually sampled.*
- c) What percent of VW New Bumblebees in this sample showed evidence of electrical or computer problems? *28% of the sample had problems* $\frac{70}{250} = 28\%$

- d) What is the margin of error in this survey? *About 6.3%*

$$ME = \frac{1}{\sqrt{n}} = \frac{1}{\sqrt{250}} \approx .0632 \approx 6.3\%$$

- e) Find the 95% confidence interval for the percentage of all VW New Bumblebees with evidence of electrical or computer problems.

95% confidence interval is 28% ± 6.3%, or 21.7% ≤ p ≤ 34.3% (where p is the actual % with problems)

- f) The senior managers of VW America plan to make substantial revisions to the design of the New Bumblebee if they think that 35% of New Bumblebees have problems with their electrical or computer systems. Should they start making the revisions now? *Not yet*
 Explain your answer. *With 95% confidence they can say that less than 35% have problems. But they are extremely close to the 35%.*

7. A random sample of 500 GMU students is interviewed concerning GMU students' dining preferences. Of those selected, 325 are in favor of adding more vegetarian options.

- a) What is the population being studied?

All GMU students.

- b) What sample of the population is used in the study?

The 500 students included in the sample.

- c) What is the percentage of the sample of students who favor more vegetarian options? *65%* $\frac{325}{500} = 65\%$

- d) Find the margin of error for the proportion of students favoring more vegetarian options: *4.5%*

$$ME = \frac{1}{\sqrt{500}} \approx 4.47 \approx 4.5\%$$

- e) Find the 95% confidence interval for the percentage of all students who would favor more vegetarian options: *60.5% ≤ p ≤ 69.5%*

95% confidence interval: 65% ± 4.5% or 60.5% ≤ p ≤ 69.5%

- f) Could an advocate of more vegetarian options be justified in claiming on the basis of this poll that 80% of GMU students are in favor of adding vegetarian options? Explain.

No. With 95% confidence, the advocate could claim that up to 69.5% of GMU students are in favor of adding more vegetarian options. But 80% is very far outside the 95% confidence interval (more than 2 s.d.'s above)