

Round off rule

- Never round off intermediate calculations
- Always round z-scores to 2 decimal places
- When calculating statistics, Round to one decimal place more than is given

Math 160 — Chs. 2—6 Review

Name: Key

1. (2 points) Determine whether the given value is a statistic or a parameter. The 22-Hour Fitness Club surveys 40 randomly selected members and found that the average weight of those questioned is 157 lb.

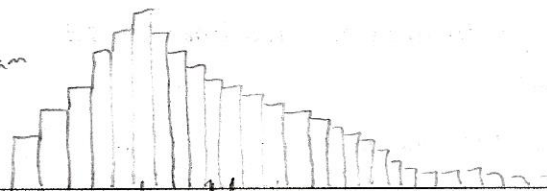
1. Statistic

2. (2 points) A medical researcher measures the decrease in blood pressure of heart patients from a pharmaceutical treatment. What kind of variable is the researcher studying?

2. Quantitative

3. (2 points) Sketch a histogram below for which the median would be less than the mean.

skewed
right histogram



3. _____

mean - balancing point (wt)
median - splits the area of the histogram in half.

4. (3 points) List the original data from the stemplot in an ordered list sorted in a descending fashion.

Stem	Leaves
2	1 7
3	1 1 3 5
4	1 3 3 7 9
5	3 4

54, 53, 49, 47, 43, 43, 41, 35, 33, 31, 31, 27, 21

5. (3 points) **Construct the dotplot for the given data.** Attendance records for a preschool class with 15 students show the number of days each student was absent during the year. The days absent for each student were as follows.

0 2 3 4 2 3 4 6 7 2 3 4 6 9 8

Range $9 - 0 = 9$



6. (3 points) **Use the data to create a stemplot.** The midterm test scores for the university's seventh-period graduate chemistry class are listed below.

	85	77	93	91	74	65	68	97	88	59	74	83	85	72	63	79
								max		min						
tens	ones															
Stem	leaf															
9	3 1 7															
8	5 8 3 5															
7	7 4 4 2 9															
6	5 8 3															
5	9															

59, 63, 65, 68, 72, 74, 74, 77,
79, 83, 85, 85, 88, 91, 93, 97

Use the data from question 6 to answer questions 7—13.

7. (1 point) What is the range? $97 - 59$

7. 38

8. (1 point) What is the value of the median?

$$\frac{77 + 79}{2} = 78$$

8. 78

9. (1 point) What is the value of quartile 1?

$$\frac{68 + 72}{2}$$

9. 70

10. (1 point) What is the value of quartile 3?

$$\frac{85 + 88}{2}$$

10. 86.5

11. (1 point) What value provides the lower fence for the data?

$$\text{Lower fence} = Q1 - 1.5(Q3 - Q1) = 70 - 1.5(16.5)$$

Lower fence 45.25

11. upper fence 111.25

$$\rightarrow \text{upper fence} = Q3 + 1.5(Q3 - Q1) = 86.5 + 1.5(16.5)$$

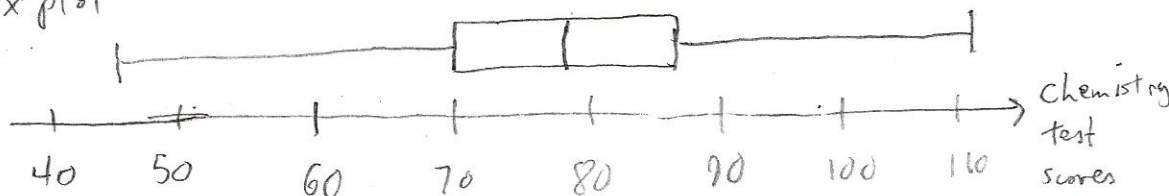
12. (1 point) What value provides the upper fence for the data?

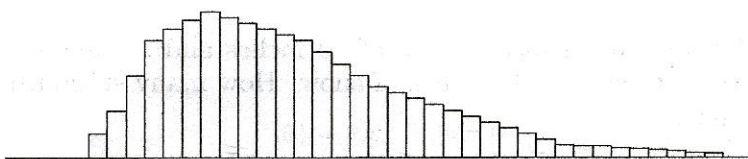
There are no outliers, 12. _____

since no data value is below 45.25 or above 111.25

13. (1 point) Are there any outliers? Explain your reasoning to obtain full credit.

Box plot





14. (1 point) Is the distribution in the histogram above skewed left, skewed right, or is normal?

14. Skewed Right

15. (2 points) Andrew asked five of his friends how many cousins they had. The results are listed below. Find the mean number of cousins. Your answer should include writing down which formula you are using.

$$\bar{y} = \frac{\sum y}{n} = \frac{7+14+4+3+8}{5} = \frac{36}{5} = 7.2$$

15. 7.2

16. (1 point) What formula should be used to calculate the standard deviation?

$$s = \sqrt{\frac{\sum (y - \bar{y})^2}{n-1}}$$

16. _____

17. (2 points) What is the value of the standard deviation?

y	y - $\bar{y}$	(y - $\bar{y}$) ²
7	7 - 7.2	(0.2) ² = 0.04
14	14 - 7.2	6.8 ² = 46.24
4	4 - 7.2	(-3.2) ² = 10.24
3	3 - 7.2	(-4.2) ² = 17.64
8	8 - 7.2	(0.8) ² = 0.64

Now,

$$\sum (y - \bar{y})^2 = 0.04 + 46.24 + 10.24 + 17.64 + 0.64 = 74.8$$

$$\text{Then } s = \sqrt{\frac{\sum (y - \bar{y})^2}{n-1}} = \sqrt{\frac{74.8}{4}} = \sqrt{18.7} \approx 4.3$$

17. 4.3

A survey of autos parked in student and staff lots at the college classified the brands by country of origin. The results from the survey are given in the table (right). Use these results to answer questions 17 - 19.

Origin	Driver		
	Student	Staff	
American	107	105	212
European	33	12	45
Asian	55	47	102
			195 + 164 = 359 total

18. (2 points) What percent of all the cars surveyed were foreign?

$$\frac{(45+102)}{359} \cdot 100$$

18. 41%

19. (2 points) What percent of European cars were owned by staff?

$$\frac{12}{45} \cdot 100$$

19. 27%

20. (2 points) What percent of the staff owned foreign cars?

$$\frac{12+47}{164} \cdot 100$$

20. 36%

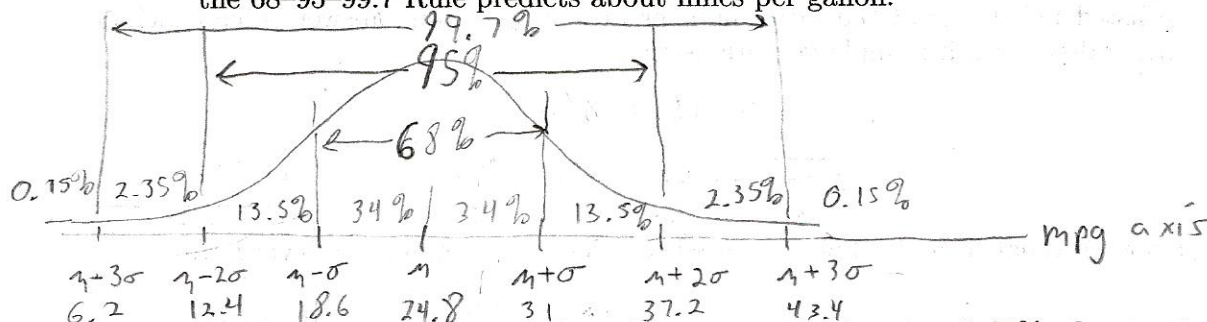
To find what percent of a normal model lies between 2 z-scores, use the "normalcdf" command on your calculator. [2nd] [vars] [2] copies and pastes the normalcdf command over to your home screen.

21. (2 points) The annual snowfall in a town has a mean of 40 inches and a standard deviation of 11 inches. Last year there were 65 inches of snow. How many standard deviations from the mean is that?

Given: $\mu = 40$, $\sigma = 11$, $y = 65$. $z = \frac{y - \mu}{\sigma} = \frac{65 - 40}{11} = 2.27$

22. Environmental Protection Agency fuel economy estimates for automobile models tested recently predicted a mean of 24.8 mpg and a standard deviation of 6.2 mpg for highway driving. Assume that a Normal Model can be applied.

- (a) (3 points) Draw the model for auto fuel economy. Clearly label it, showing what the 68-95-99.7 Rule predicts about miles per gallon.



- (b) (2 points) In what interval would you expect the central 68% of autos to be found?

Between 18.6 and 31 mpg

(b) [18.6 mpg, 31 mpg]

- (c) (2 points) About what percent of autos should get more than 31 mpg?

$13.5\% + 2.35\% + 0.15\%$

(c) 16%

- (d) (2 points) About what percent of autos should get between 31 and 37.2 mpg?

(d) 13.5%

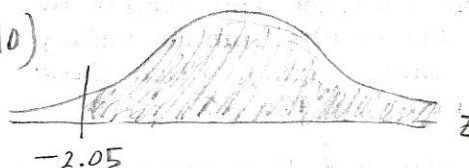
23. What percent of a Standard Normal model is found in each region?

- (a) (2 points) $z > -2.05$

(a) 97.98%

[2nd] [vars] [2] normalcdf(-2.05, 10) = 0.9798

- (b) (2 points) $z < 2.25$



(b) 98.78%

normalcdf(-10, 2.25) = 0.98777

- (c) (2 points) $z > -2.05$

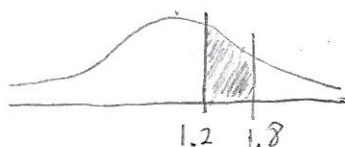


(c) _____

Same as (a)

- (d) (2 points) $1.2 < z < 1.8$

(d) 7.91%



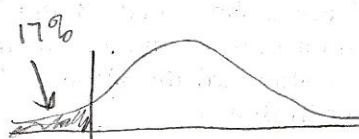
normalcdf(1.2, 1.8) = 0.0791

The "invnorm" command on your calculator will return a z-score associated with a given percentile. For example, $\text{invnorm}(0.70)$ returns 0.52, the z-score associated with the 70th percentile (i.e., 70% of the z-scores fall below 0.52).

[2nd] [vars] [3] pastes the invnorm function over to your home screen.

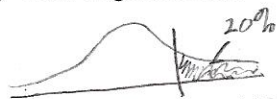
24. In a Standard Normal model, what value(s) of z cut(s) off the region described? Use a picture.

(a) (2 points) The lowest 17%



(a) -0.95

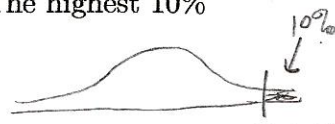
(b) (2 points) The highest 20%



$$z = \text{invnorm}(0.17) = -0.95$$

(b) $z = 0.84$

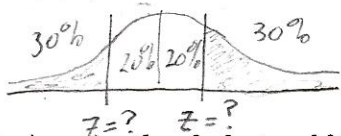
(c) (2 points) The highest 10%



$$z = \text{invnorm}(1 - 0.20) = 0.84$$

(c) $z = 1.28$

(d) (2 points) The middle 40%



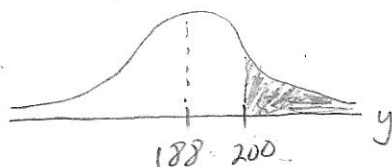
$$z = \text{invnorm}(0.30) = -0.52$$

(d) ± 0.52

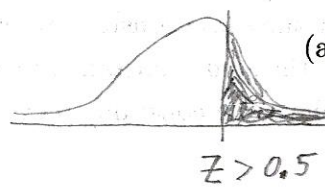
Because of symmetry the other value of z is 0.52

25. Assume the cholesterol levels of adult American women can be described by a Normal model with a mean of 188 mg/dL and a standard deviation of 24 mg/dL.

(a) (2 points) What percent of adult women do you expect to have cholesterol levels over 200 mg/dL? Standardize



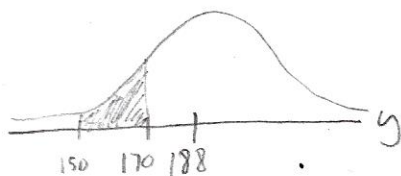
$$z = \frac{y - \mu}{\sigma} = \frac{200 - 188}{24} = 0.5$$



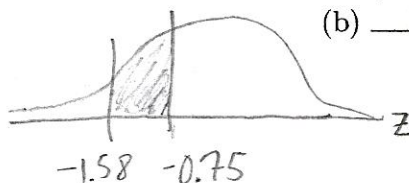
(a) 30.85%

What percent takes up $z > 0.5$?
normalcdf(0.5, 10)

(b) (2 points) What percent of adult women do you expect to have cholesterol levels between 150 and 170 mg/dL?



Transform to z axis



(b) normalcdf(-1.58, -0.75)
0.1696

$$z = \frac{150 - 188}{24} = -1.58$$

$$z = \frac{170 - 188}{24} = -0.75$$

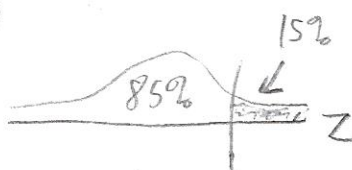
(c) (2 points) Above what value are the highest 15% of woman's cholesterol levels?

Solution

① Find the value of z associated with the top 15%.

② Use $z = \frac{y - \mu}{\sigma}$ to solve for the unknown value of y , the cholesterol level representing the cutoff.

①



$$z = \text{invnorm}(0.85) = 1.04$$

(c) 213 mg/dL

$$\textcircled{2} \quad z = \frac{y - \mu}{\sigma}$$

$$1.04 = \frac{y - 188}{24}$$

$$24.96 = y - 188$$

$$y = 24.96 + 188 = 212.96$$

26. (3 points) An incoming freshman took her college's placement exams in Spanish and Mathematics. In Spanish she scored 83 and in math 87. The overall results on the Spanish exam had a mean of 72 and a standard deviation of 8; while the mean math score was 68, with a standard deviation of 12. On which exam did she do better compared with other freshman?

	Math	Spanish
Average	68	72
Standard deviation	12	8
freshman	83	87

26. Spanish

Answer: Compare the Z-scores

Math	Spanish
$Z = \frac{y - \mu}{\sigma}$ $= \frac{83 - 68}{12}$ $= 1.25$	$Z = \frac{y - \mu}{\sigma}$ $= \frac{87 - 72}{8}$ $= 1.88$

27. (4 points) What happens to the mean and standard deviation of a data set when you (note: you need four answers here):

- (a) Add the same constant to every data value
- (b) Subtract the same constant to every data value
- (c) Multiply the same constant to every data value
- (d) Divide the same constant to every data value

- a) Adds that constant to the mean. The histogram is shifted horizontally ^(right) in the positive direction. The std. dev. is unchanged.
- b) Subtracts that constant to the mean. The histogram is shifted left. The std. dev. is left unchanged
- c) Both the mean and std. dev. are multiplied by that same constant.
- d) Both the mean and st. dev. are divided by the constant