Answer key

Practice Exam 1B

Question 1

Classify each of the following variables as **quantitative** or **categorical**.

a. the musical chords in a song (quantitative/categorical)

b. calories in a banana (quatitative/categorical)

c. the wattage of a lightbulb (quatitative/categorical)

d. the elevation of a mountain (quantitative/categorical)

e. whether someone makes a freethrow (quantitative/categorical)

f. the number of freethrows made in a game (quantitative/categorical)

Question 2

A survey of 500 randomly selected registered nurses in New England asked whether they prefer using butterfly needles to draw blood.

a. Identify the **individuals** in the study.

registered nurses in New England

b. Identify the **variable** being collected.

whether they prefer butterfly needles

c. Is the variable **quantitative** or **categorical**?

categorical

d. What is the **sample size**?

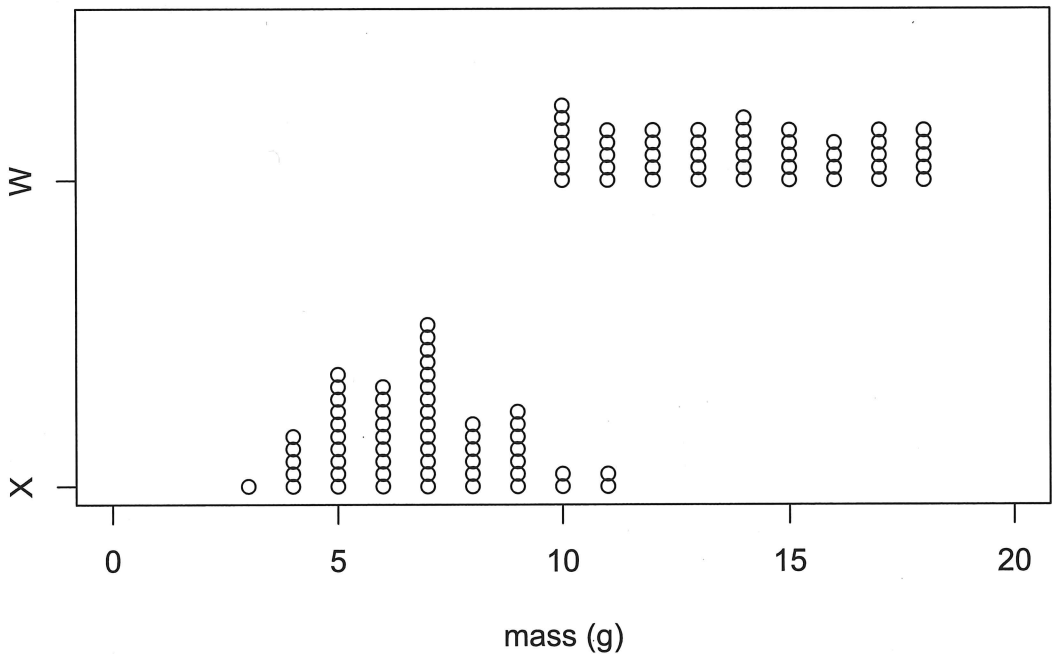
500

e. What is the implied **population** of this study?

all registered nurses in New England.

Question 3

Two samples were taken from two different populations (W and X). Each individual's mass was measured to the nearest gram.



The sample sizes are 47 and 56 for W and X respectively. Please compare the shape, center, and spread by completing the table below. Also, provide a statement that summarizes the table.

$\lceil 0.25 \times 47 \rceil = 12$

$\lceil 0.75 \times 47 \rceil = 36$

$\lceil 0.25 \times 56 \rceil = 14$

$\lceil 0.75 \times 42 \rceil = 42$

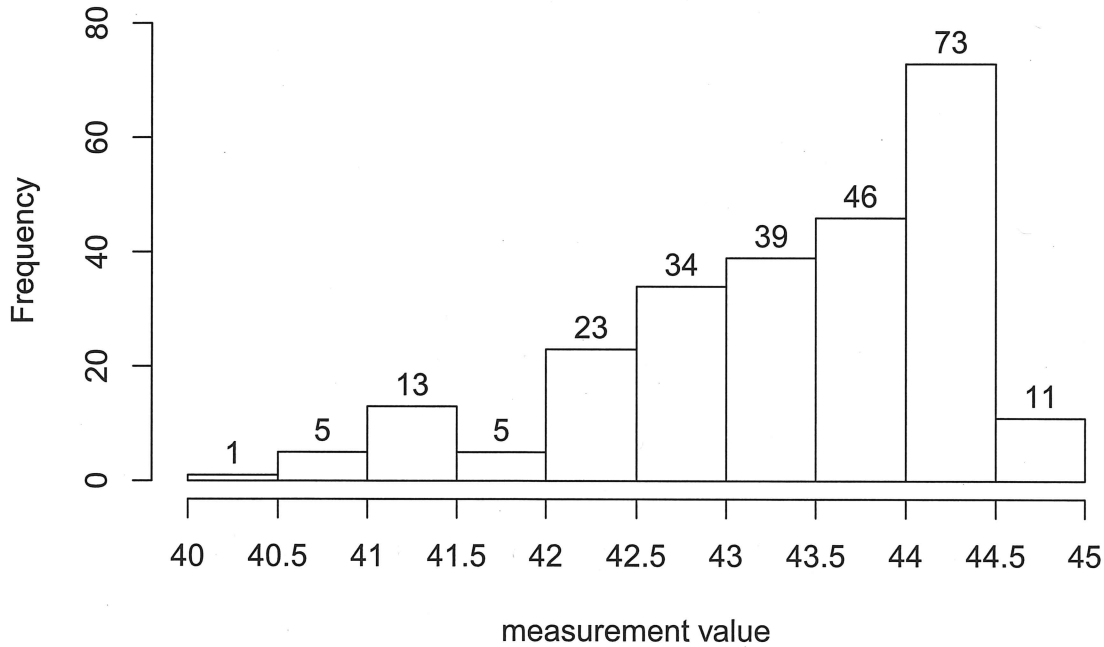
Characteristic	Distribution W	Distribution X
shape	uniform	bell
center (median)	14	7
overall spread (as interval)	(10, 18)	(3, 11)
typical spread (as interval)	(11, 16)	(5, 8)

Statement:

Distribution W has a higher center, same range, but larger typical range.

Question 4

A continuous random variable was measured 250 times. The resulting histogram is shown below.



a. Describe the overall shape of the distribution.

Skew left

b. Estimate the range of the distribution.

5

c. What percent of the measurements are greater than 41.5?

$\frac{5+23+34+39+46+73+11}{250} = \boxed{0.924}$

d. What percent of the measurements are less than 43?

$\frac{1+5+13+5+23+34}{250} = \boxed{0.324}$

e. What percent of the measurements are between 41.5 and 43?

$\frac{5+23+34}{250} = \boxed{0.248}$

f. What percent of the measurements are within 1 from 42.5? In other words, what percent of measurements satisfy $|x - 42.5| \leq 1$?

$\frac{5+23+34+39}{250} = \boxed{0.404}$

g. What percent of measurements greater than 41.5 are less than 43?

$\boxed{0.268}$

$\frac{5+23+34}{5+23+34+39+46+73+11}$

h. Estimate the value of the 18.8th percentile. In other words, determine a value such that 18.8% of the measurements are less than or equal to it.

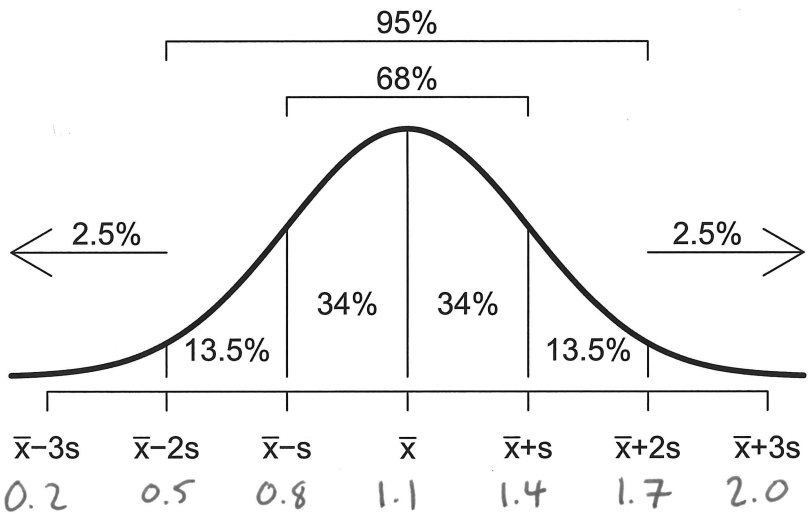
$(0.188)(250) = 47$

$\boxed{42.5}$

$1+5+13+5+23 = 47$

Question 5

The figure below summarizes the *standard deviation rule* for normal distributions. In the figure, $\bar{x}$ is the mean and s is the standard deviation. The percentages show the fraction of measurements that fall within various intervals.



A specific distribution is approximately normal with mean $\bar{x} = 1.1$ and standard deviation $s = 0.3$.

a. What percent of the measurements are greater than 1.1?

50%

b. What percent of the measurements are less than 1.4?

84%

c. What measurement is greater than 2.5% of the measurements?

0.5

d. What measurement is less than 84% of the measurements?

0.8

e. What percent of the measurements are between 0.8 and 1.4?

68%

Question 6

From a very large population, a small sample of measurements was taken.

80	58	62	67	56	55	56

$n = 7$

Please calculate the (Bessel corrected) sample standard deviation using the following formula:

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

You must fill out the table and show your work (but you can double check with a calculator).

x	$x - \bar{x}$	$(x - \bar{x})^2$
80	18	324
58	-4	16
62	0	0
67	5	25
56	-6	36
55	-7	49
56	-6	36

$\sum x = 434$

$\sum (x-\bar{x})^2 = 486$

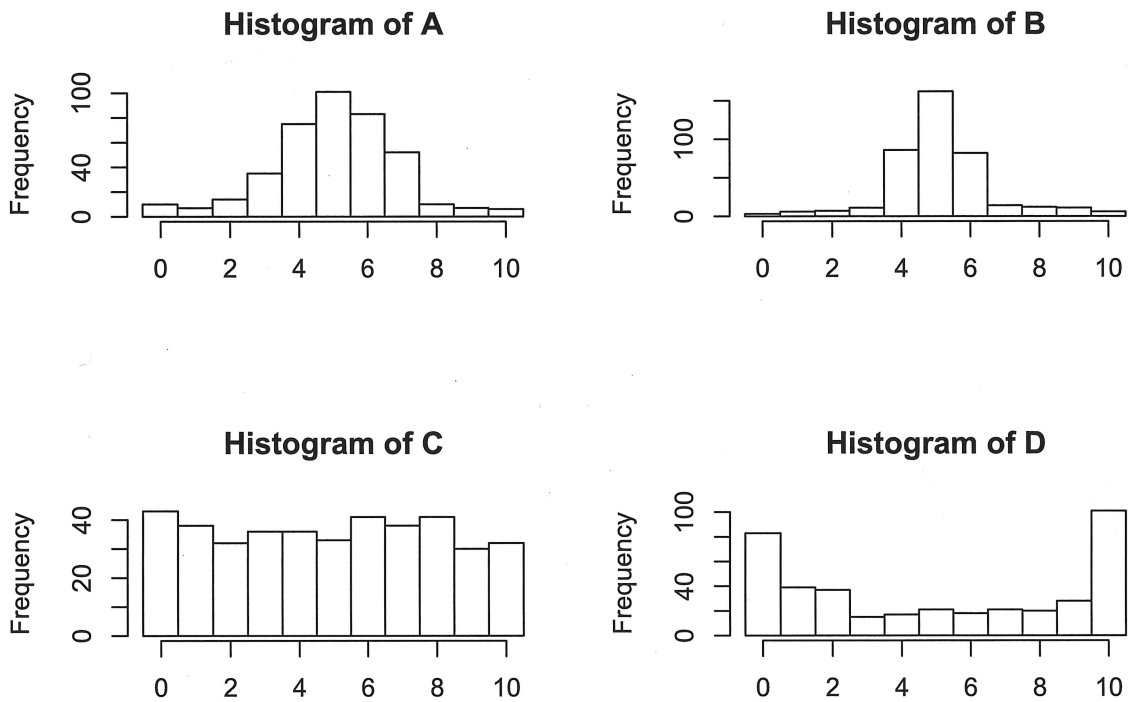
$\bar{x} = \frac{\sum x}{n} = \frac{434}{7} = 62$

$s = \sqrt{\frac{486}{7-1}} = \sqrt{\frac{486}{6}} = \sqrt{81} = 9$

$\boxed{s = 9}$

Question 7

Four different variables were each measured 400 times. The resulting histograms are shown below.



a. Which variable's distribution has the largest standard deviation? Explain.

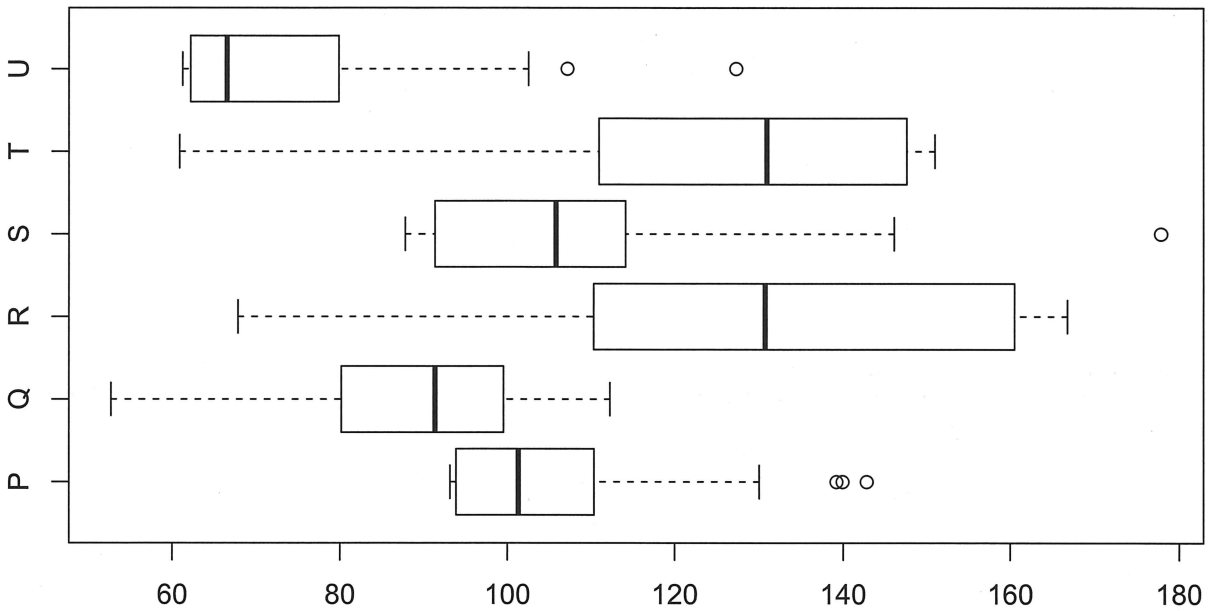
D. D has the most measurements far from center.

b. Which variable's distribution has the smallest standard deviation? Explain.

B. B has the most measurements near the center.

Question 8

Six random variables were each measured 25 times. The resulting boxplots are shown.



a. Which **two** variables had the largest measurements?

S, R

b. Which variable had the smallest measurement?

Q

c. Which **two** variables had medians more than 120?

T, R

d. Which **two** variables had 25th percentiles less than ~~0.5?~~ 85?

Q, U

e. Which variable had the highest percentage of its measurements below 90?

U

f. Which variable had the smallest IQR?

P

g. Which variable had the largest IQR?

R

Question 9

Two random variables (A and B) are both approximately normal (bell-shaped). Their means and standard deviations are shown in the table.

variable	mean	standard deviation
A	6.5	5.1
B	3.4	4.3

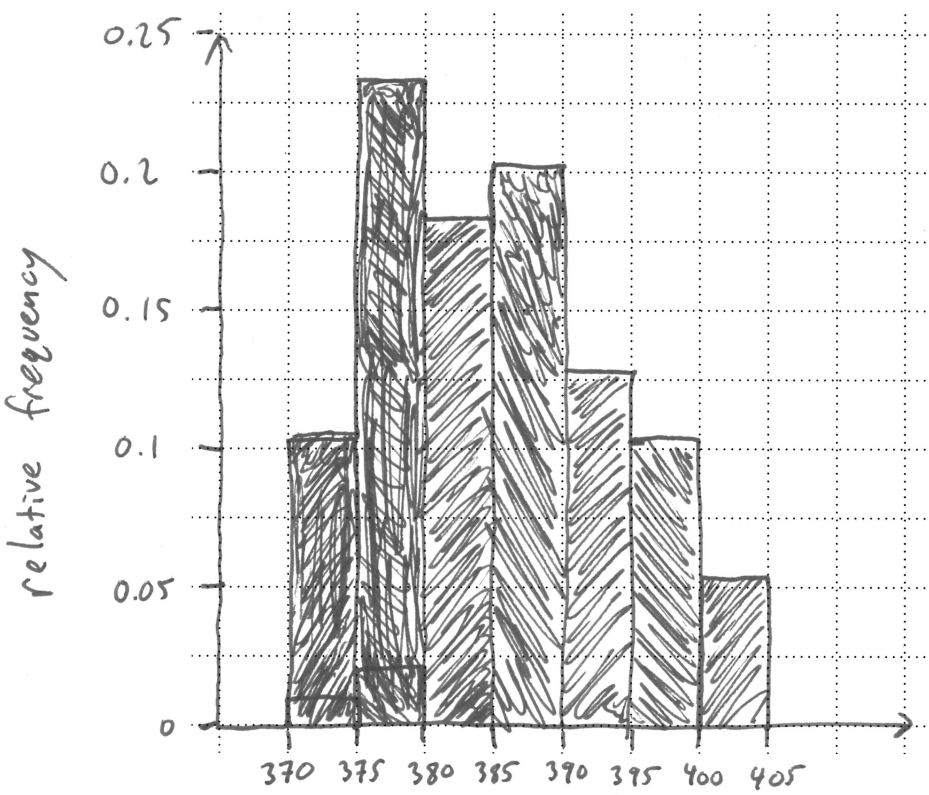
For each variable, provide an interval of typical measurements.

A (1.4, 11.6)

B (-0.9, 7.7)

Question 10

Please make a *relative-frequency table* and a *relative-frequency histogram* from the following (sorted) continuous data by using the supplied classes.

370.73	371.31	372.29	372.5	375.65	376.43	377.3	377.57	377.9	378.77
379.13	379.44	379.68	380.98	381.9	382.71	382.74	382.84	383.5	383.8
386.21	386.23	386.71	387.2	387.71	388.62	388.72	389.74	390.27	391
391.44	392.55	393.18	395.16	397.23	397.7	399.34	401.63	403.62	

class	frequency	relative frequency
370 - 375	4	4/39 = 0.103
375 - 380	9	0.231
380 - 385	7	0.179
385 - 390	8	0.205
390 - 395	5	0.128
395 - 400	4	0.103
400 - 405	2	0.051