Practice Exam 1A

Question 1

Determine whether the following phrases represent **quantitative** or **categorical** measurements.

a. the weights of various gophers (quantitative/categorical)
b. whether various humans like cottage cheese (quatitative/categorical)
c. the seed preferences of various gold finches (quatitative/categorical)
d. the volumes of various balloons (quantitative/categorical)
e. the frequencies of igneous rocks in various collections (quantitative/categorical)
f. whether various rocks are igneous (quantitative/categorical)

Question 2

At Willard Brook State Forest, a researcher measured the heights of 100 *Trillium undulatum* (Painted Trillium).

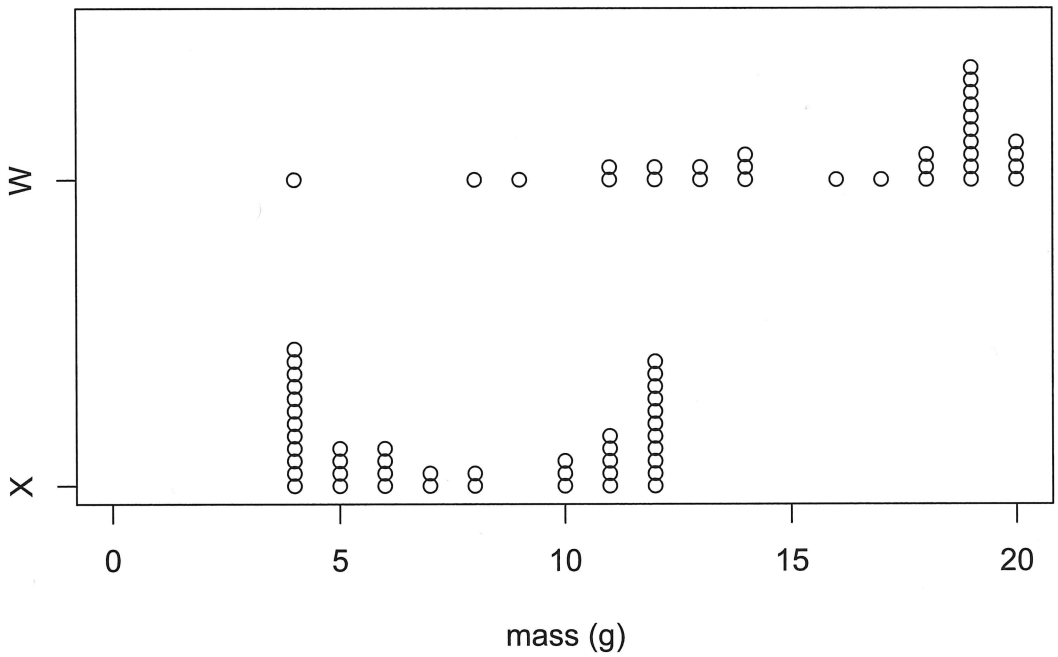
a. Identify the **individuals** in the study. The 100 painted trilliums
b. Identify the **variable** being collected. height
c. Is the variable **quantitative** or **categorical**?
d. What is the **sample size**? 100
e. What is the implied **population** of this study? All of the painted trilliums in Willard Brook.

W: Q_1: $i = \lceil 31/4 \rceil = 8$ Q_3: $i = \lceil \frac{3 \cdot 31}{4} \rceil = 24$

X: Q_1: $i = \lceil 43/4 \rceil = 11$ Q_3: $i = \lceil 43 \cdot 3/4 \rceil = 33$

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 31 and 43 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.

index of median $= \boxed{\frac{n+1}{2}}$

Characteristic	Distribution W	Distribution X
shape	Skew left	symmetric bimodal
center (median)	~~[illegible]~~ 18	7
overall spread (as interval)	(4, 20)	(4, 12)
typical spread (as interval)	(13, 19)	(4, 12)

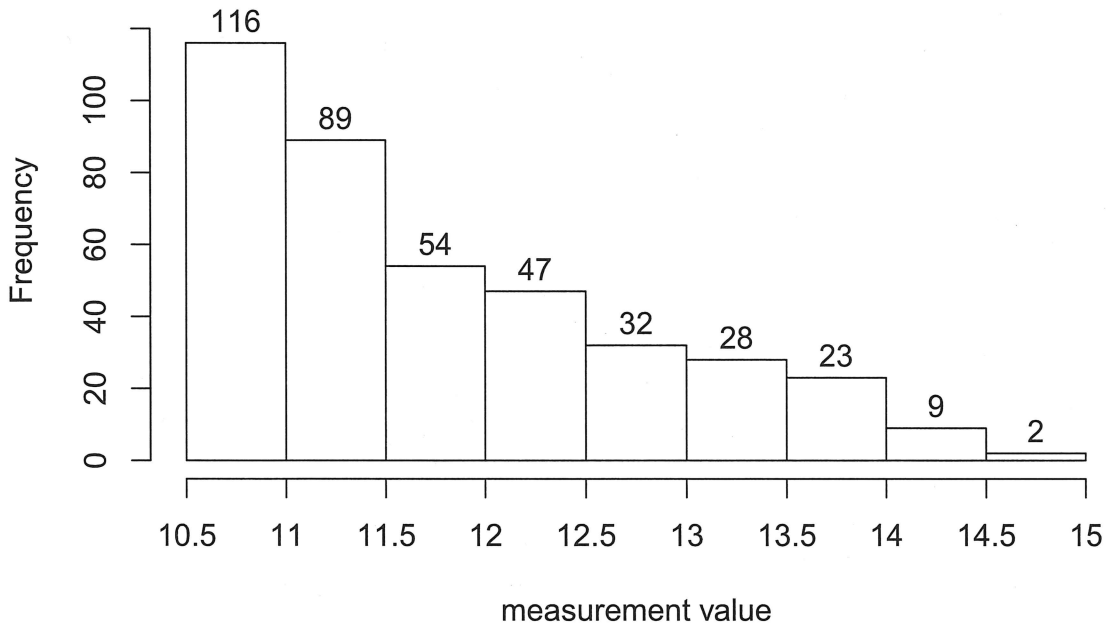
use (Q_1, Q_3) →

Statement (describe which characteristics are similar and which are different):

W has a higher center, larger overall spread, but smaller typical spread.

Question 4

A continuous random variable was measured 400 times. The resulting histogram is shown below.



a. Describe the overall shape of the distribution. (symmetric mound, skew left, skew right, uniform, or bimodal) Skew right
b. Estimate the range of the distribution (range = max-min). $15 - 10.5 = \boxed{4.5}$
c. What percent of the measurements are less than 13?
d. What percent of the measurements are less than 12?
e. What percent of the measurements are between 12 and 13?
f. What percent of the measurements are within 0.5 from 12.5? In other words, what percent of measurements satisfy $|x - 12.5| \leq 0.5$?
g. What percent of measurements less than 13 are less than 12?
h. Estimate the value of the 29th percentile. In other words, determine a value such that 29% of the measurements are less than or equal to it.

c) $\frac{116+89+54+47+32}{400} = \boxed{0.845}$

d) $\frac{116+89+54}{400} = \boxed{0.65}$

e) $\frac{47+32}{400} = \boxed{0.198}$

f) Same as e, $\boxed{0.198}$

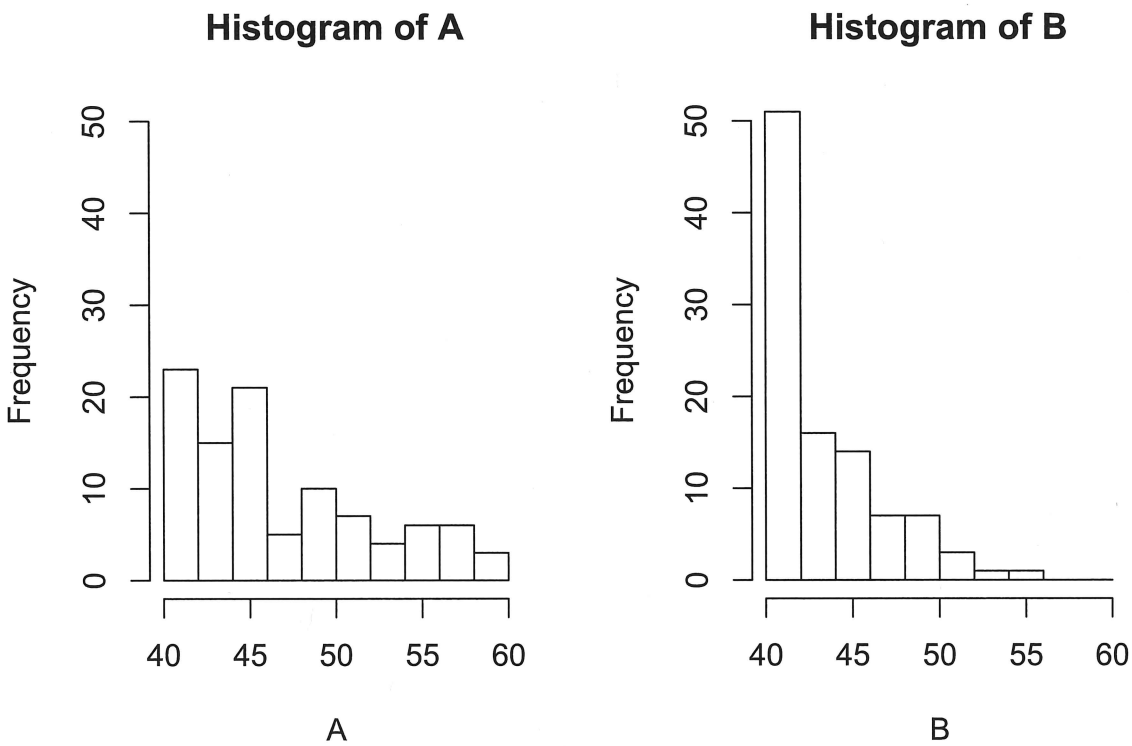
g) $\frac{54+89+116}{32+47+54+89+116} = \boxed{0.77}$

h) $(0.29)(400) = 116 = ?$

$\boxed{x = 11}$

Question 5

Two samples (each of size 100) were taken from two potentially different populations. The results are shown below.



a. Determine which statement you feel best describes the relationship between A and B.
   - (choice 1) The population of A has a higher mean.
   - (choice 2) The population of B has a higher mean.
   - (choice 3) The difference in sample means could just be due to chance.

b. Explain you choice.

The sample sizes are quite large and the distributions look quite different. The sample A has a substantially higher mean.

A has many more measurements over 50.

Almost half of B is under 42, whereas only 22% of A is under 42.

Question 6

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

53	54	58	56	53	56

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	$x - \bar{x}$	$(x - \bar{x})^2$
53	-2	4
54	-1	1
58	3	9
56	1	1
53	-2	4
56	1	1

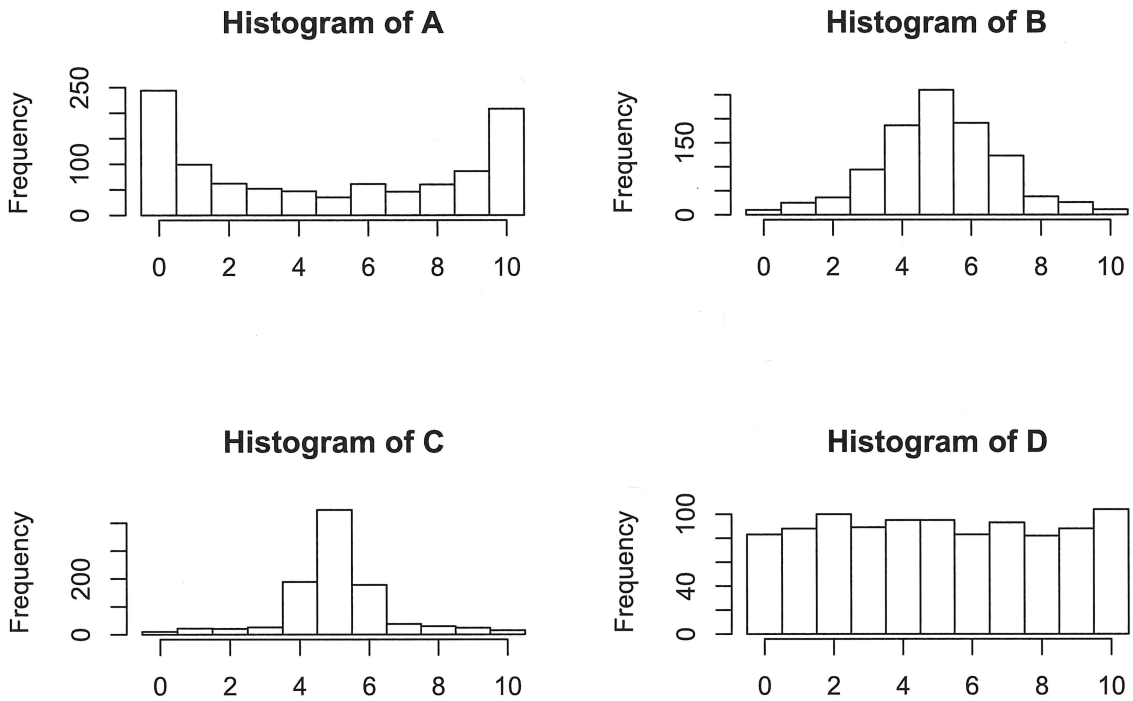
$\sum x = 330$ $\quad$ $\sum (x-\bar{x})^2 = 20$

$\bar{x} = 55$

$$s = \sqrt{\frac{20}{6-1}} = \sqrt{\frac{20}{5}} = 2$$

Question 7

Four different variables were each measured 1000 times. The resulting histograms are shown below.



a. Which variable's distribution has the largest standard deviation? Explain. A. [illegible]

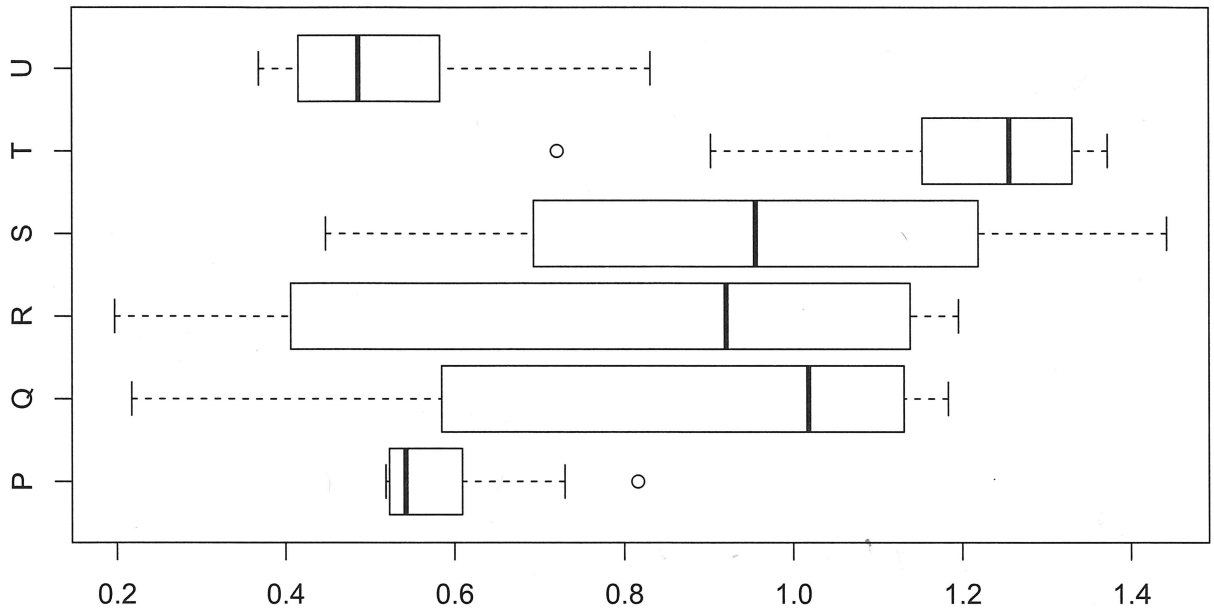
b. Which variable's distribution has the smallest standard deviation? Explain.

(a) A has many measurements far from the center.

(b) C has many measurements near the center.

Question 8

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



a. Which variable had the largest measurement? S
b. Which **two** variables had the smallest measurements? R, Q
c. Which **two** variables had medians less than 0.8? P, U
d. Which **two** variables had 25th percentiles less than 0.5? R, U
e. Which variable had the highest percentage of its measurements above 1.0? T
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	55.5	6.2
B	62.3	4.3

Let the *interval of typical measurements* be defined as values within 1 SD from the mean.

$$\text{interval of typical measurements} = (\text{mean} - \text{SD},\ \text{mean} + \text{SD})$$

For each variable, provide an interval of typical measurements.

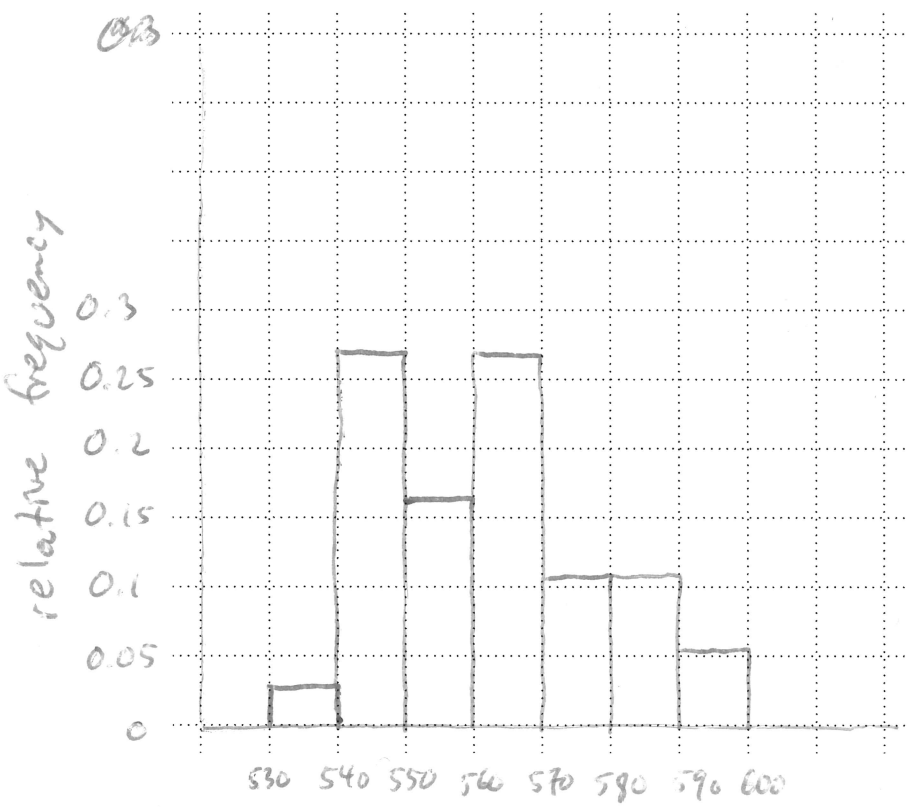
A (49.3, 61.7)

B (58, 66.6)

Question 10

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

539.27	542.28	542.73	543.41	543.49	543.51	545.24	545.91	546.22	546.64
548.03	553.27	554.07	555.14	555.2	557.09	557.71	560.87	561.25	561.37
563.07	563.5	563.56	566.9	567.79	569.65	569.7	572.69	572.78	577.42
577.82	580.75	584.74	587.86	589.47	591.97	594.71			

n = 37

class	frequency	relative frequency
530 - 540	1	1/37 = 0.027
540 - 550	10	10/37 = 0.270
550 - 560	6	0.162
560 - 570	10	0.270
570 - 580	4	0.108
580 - 590	4	0.108
590 - 600	2	0.054