

** ANSWER KEY **

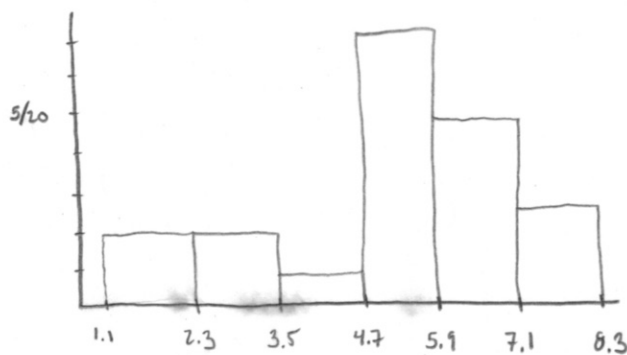
1. Here are 20 measurements (listed from least to greatest).

1.1, 2.0, 2.3, 2.9, 4.0, 4.7, 5.0, 5.1, 5.3, 5.3,

5.3, 5.3, 6.1, 6.4, 6.7, 6.9, 6.9, 7.2, 8.0, ~~8.1~~ 8.2

(a) (8 points) Create a relative frequency histogram below using 6 classes of width 1.2. The first class should be [1.1, 2.3).

| CLASS | FREQUENCY | RELATIVE FREQUENCY |
|------------|-----------|--------------------|
| [1.1, 2.3) | 2 | 2/20 |
| [2.3, 3.5) | 2 | 2/20 |
| [3.5, 4.7) | 1 | 1/20 |
| [4.7, 5.9) | 7 | 7/20 |
| [5.9, 7.1) | 5 | 5/20 |
| [7.1, 8.3) | 3 | 3/20 |



NOTE THAT THE HORIZONTAL AXIS IS LABELLED LIKE A NUMBER LINE.

(b) (4 points) What proportion of the measurements are greater than or equal to 6.0?

$$\frac{8}{20} \text{ or } \frac{2}{5} \text{ or } 40\%$$

(c) (4 points) How would you best describe the distribution: right-skewed, left-skewed, or symmetric?

LEFT SKEWED

2. You are given a sample of $n = 7$ measurements: 8, 7, 10, 13, 8, 13, 11

(a) (4 points) What is the median, m ?

$$7 \quad 8 \quad 8 \quad (10) \quad 11 \quad 13 \quad 13 \quad m = 10$$

(b) (4 points) What is the mean, \bar{x} ?

$$\bar{x} = \frac{\sum x_i}{n} = \frac{7 + 8 + 8 + 10 + 11 + 13 + 13}{7} = \frac{70}{7} = 10$$

(c) (4 points) What is/are the mode/modes, M ?

$$\text{Modes: } 8, 13$$

(d) (4 points) What is the variance, s^2 ?

| x | $x - \bar{x}$ | $(x - \bar{x})^2$ |
|-----|---------------|-------------------|
| 7 | -3 | 9 |
| 8 | -2 | 4 |
| 8 | -2 | 4 |
| 10 | 0 | 0 |
| 11 | 1 | 1 |
| 13 | 3 | 9 |
| 13 | 3 | 9 |

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

$$= \frac{9 + 4 + 4 + 0 + 1 + 9 + 9}{6}$$

$$= \frac{36}{6} = 6$$

(e) (4 points) What is the standard deviation, s ?

$$\sqrt{6}$$

3. (4 points) Suppose a sample of 50 measurements are collected with mean $\bar{x} = 35$ and standard deviation $s = 8$. According to Tchebysheff's theorem, at least what proportion of measurements lie between 11 and 59 (i.e. within 3 standard deviations of the mean)?

$$1 - \frac{1}{k^2} \xrightarrow{k=3} 1 - \frac{1}{3^2} = \frac{8}{9}$$

At least $\frac{8}{9}$ / At least 88.8889% / At least 45 MEASUREMENTS.

4. A Sample space S consists of five simple events with the following probabilities.

$$P(E_1) = P(E_2) = .15 \quad P(E_3) = .4 \quad P(E_4) = .1 \quad P(E_5) = ?$$

- (a) (4 points) Find the probability of the simple events E_5 .

PROBABILITIES OF SIMPLE EVENTS

MUST ADD UP TO 1.

$$.15 + .15 + .4 + .1 + P(E_5) = 1 \Rightarrow P(E_5) = .2$$

- (b) (4 points) Find the probabilities for the following two events.

$$A = \{E_1, E_3, E_4\} \quad B = \{E_2, E_3\}$$

$$P(A) = P(E_1) + P(E_3) + P(E_4) = .15 + .4 + .1 = .65$$

$$P(B) = P(E_2) + P(E_3) = .15 + .4 = .55$$

- (c) (4 points) List the simple events that are either in event A or event B or both.

E_1, E_2, E_3, E_4

- (d) (4 points) List the simple events that are in both event A and event B.

E_3