Dr. Peggy Kern's Capstone Statistics
Practice #1: Measures of Central Tendency & Spread - ANSWERS

1. Select the measure of central tendency (mean, median, mode) that would be most appropriate for describing each of the following sets of data:
   a. Heart rates for a group of women before they start their first aerobics class.
      Mean – a ratio number, we'd expect a fairly normal distribution

   b. Types of phobias exhibited by patients attending a phobia clinic.
      Mode – categorical variable

   c. Amounts of time people spend solving a mathematical problem, with some unable to solve it.
      Median – those who can't solve it will skew the distribution

   d. Height in inches of a group of boys in 1st grade.
      Mean – pretty normal value

2. For each set below, circle the letter of the more variable group.
   a. Set 1
      i. **20, 40, 80, 10, 50, 60**
      ii. 160, 140, 150, 140, 160, 150
   b. Set 2
      i. The length of airport runways in the US
      ii. **The length of highways in the US**
   c. Set 3
      i. **The ages of University professors**
      ii. The ages of typical University students

3. Compute the standard deviation (s) for the data below.

2 3 2 0 1 0 2

	X	X-M	$(X-M)^2$
	2	.57	.32
	3	1.57	2.46
	2	.57	.32
	0	-1.43	2.04
	1	-.43	.18
	0	-1.43	2.04
	2	.57	.32
N	7		
Σ	10	0	7.68
M	1.43	0	

Note that due to rounding, this might be slightly off from 0, like -.01

$S = \sqrt{[(\sum(X-M)^2)/N]} = \sqrt{(7.68/7)} = 1.05$

4. A veterinarian is interested in the life span of golden retrievers. She recorded the age at death (in years) of the retrievers treated in her clinic. The ages were 12, 9, 11, 10, 8, 14, 12, 1, 9, and 12.
    a. Calculate the mean, median, and mode for age at death.
    Ordering the numbers: 1, 8, 9, 9, 10, 11, 12, 12, 12, 14
    Mean = (1+8+9+9+10+11+12+12+12+14)/10 = **9.8**
    Median = **10.5** (1/2 way between 10 and 11 – the 5th & 6th positions)
    Mode = **12** (most often number)

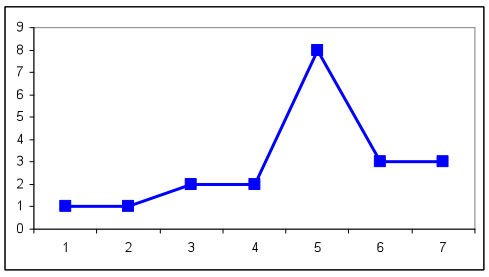
    b. What is the minimum, maximum, and range of the ages?
    Using the ordered numbers, we see:
    Minimum = **1**
    Maximum = **14**
    Range = 14 – 1 = **13**

    c. After examining her records, she determined that the dog that had died at 1 year was killed by a car. Recalculate the mean, median, and mode without that dog's data.
    Mean = 10.78
    Median = 11
    Mode = 12

    d. Which measure of central tendency in part b changed the most, compared to the values calculated in part a?
    The mean changed the most (it is most affected by extreme scores)

5. Nancy is interested in how happy people are. She gives a questionnaire to a group of people, asking them to rate how happy they feel on a 1 to 7 scale (1 = very depressed, 7 = very happy). She gets the following set of scores: 5, 6, 7, 3, 5, 6, 1, 5, 7, 6, 5, 2, 5, 5, 4, 3, 5, 7, 4, 5.
    a. On a scratch piece of paper, create a raw frequency distribution of these scores. Make a frequency polygon graph of the distribution (nothing needed here, but it's helpful to do this)

1	1
2	1
3	2
4	2
5	8
6	3
7	3



    b. On average, how happy are the people?
    Mean – add scores (5+6+7+3+…+5) & divide by N (20)
    M = 4.80 (round to 2 decimal points)

    c. If 4 is considered an average level of happiness, would you say this sample is above average, average, or below average in happiness?
    Above average

d. What is the middle score? What score is reported most often?

Middle = median score.

First, order scores in order (1, 2, 3, 3, 4, 4, 5, 5, 5, 5, 5, 5, 5, 5, 6, 6, 6, 7, 7, 7)

Use the formula to find the position of where to look: (N+1)* .5 = (20+1)*.5 = 10.5th position

Count it out – falls between 5 and 5

So Median = 5

Most often = Mode = **5**

e. What is the range of happiness scores?

Range = Maximum – Minimum

The ordered scores makes it easy to see the highest and lowest scores:

Minimum = 1, Maximum = 7

Range = Max – Min → 7 – 1 = **6**

f. What is the inter quartile range?

Interquartile range = Q3 – Q1

First, order the scores (1, 2, 3, 3, 4, 4, 5, 5, 5, 5, 5, 5, 5, 5, 6, 6, 6, 7, 7, 7)

Use the formula to find the position of where to look

Q1 = (N+1)*.25 = (20+1)*.25 = 5.25 (so between the 5th and 6th number) = 4

Q3 = (N+1)*.72 = (20+1)*.75 = 15.75 (so between the 15th & 16th number) = 6

IQ range = Q3 – Q1 = 6 – 2 = **2**

g. Calculate the standard deviation and variance of these scores.

It's easiest to start with the variance, and then take the square root to get the standard deviation.

X	X - M	$(X - M)^2$
1	-3.8	14.44
2	-2.8	7.84
3	-1.8	3.24
3	-1.8	3.24
4	-0.8	0.64
4	-0.8	0.64
5	0.2	0.04
5	0.2	0.04
5	0.2	0.04
5	0.2	0.04
5	0.2	0.04
5	0.2	0.04
5	0.2	0.04
5	0.2	0.04
6	1.2	1.44
6	1.2	1.44
6	1.2	1.44
7	2.2	4.84

7	2.2	4.84
7	2.2	4.84
$\sum$	0.00	49.2

49.2/20 = 2.46 → this is the variance
Square root (2.46) = 1.57 → this is the standard deviation
So variance = 2.46; SD = 1.57

h. Based on the data, write a brief descriptive report (1 or 2 sentences max), including a descriptive table.
There's no one correct answer for the description. Here's one possibility:
Happiness scores were collected from 20 people. The sample was slightly above average in happiness (M = 4.80, SD = 1.57, median = 5, range = 1 to 7).

Descriptive Table:

Variable	N	Mean	SD	Min	Max
Happiness	20	4.80	1.57	1.00	7.00