Formula Sheet for Exam #1

1. Proportion of cases (p) experiencing an event:

$$p = \frac{\text{\# of cases experiencing the event}}{\text{total \# of cases}}$$

   Note: this is also interpreted as the *probability* that an event occurs. Probabilities lie on a 0 to 1 scale where 0 means the event never occurs and 1 means the event always occurs; a 0.5 probability means that the chance the event occurs is the same as the chance that it doesn't occur.

2. Percent of cases experiencing an event:

$$p \times 100$$

   Note that this takes proportions which lie on a 0 to 1 range and places them on a 0 to 100 range instead.

3. Crime rate/murder rate calculations:

$$\frac{\text{\# of crimes}}{\text{population size}} \times 100{,}000$$

   This is interpreted as the number of crimes or murders per 100,000 population.

4. Mode: the most frequently occurring category or value of a variable.

5. Median: The median is calculated 2 different ways depending on whether the number of scores is even or odd. In both cases, the first step is to put the scores in order. And the second step is to identify the midpoint of the sorted distribution which is given by:

$$\text{Midpoint of Sorted Distribution} = \frac{N+1}{2}$$

   where N is the number of cases.

   - If the number of scores is odd, then the median is the score that has an equal number of cases below it and above it. It is also the score that is in the position given by the midpoint formula above.
   - If the number of scores is even, you use the midpoint formula (above) to identify the two middle scores by subtracting $\frac{1}{2}$ and adding $\frac{1}{2}$ to the midpoint of the sorted distribution. Once you have the two middle scores, you add them together and divide the sum by 2 to get the median.

6. Average or Mean: the sum of the scores divided by the number of scores.

$$\overline{X} = \frac{\sum_{i=1}^{N} x_i}{N}$$

where N is the number of cases and x_i are each of the individual scores on the variable being studied.

7. Proportion of cases in the modal (or most frequently occurring) category or variable value:

$$\frac{\text{Number of cases in modal category}}{\text{Total Number of Cases}}$$

Note: this can be converted to a percentage by multiplying by 100.

8. Variation Ratio:

$$1 - \frac{\text{Number of cases in modal category}}{\text{Total Number of Cases}}$$

Note that the variation ratio is just 1 minus the proportion of cases in the modal category. It can also be converted to a percentage by multiplying by 100.

9. Diversity Index (D):

$$D = 1 - \sum p^2$$

Note that for each category of the variable, you get p for that category by calculating the proportion of cases in that category. Once you have the p's for each category, you square each of them, sum the squares, and then subtract the sum of the squares from 1 to get D.

10. Index of Qualitative Variation:

$$\text{IQV} = \left(\frac{k}{k-1} \times D\right) \times 100$$

where D is the diversity index and k is the number of categories the variable has. *Note:* remember that you should do operations inside parentheses before doing operations outside parentheses.

11. Range of a variable:

$$\text{Range}(y) = y_{\text{max}} - y_{\text{min}}$$

where y_{max} is the maximum value of y and y_{min} is the minimum value of y.

12. Central Tendency Difference Scores:

$$\Delta_i = x_i - \text{CT}$$

where CT is a measure of central tendency (i.e., the mode, median, or mean). Note that when the measure of central tendency is the mean that the sum of the difference scores will always equal 0.

13. Sum of the squared central tendency difference scores:

$$\Delta_{sq} = \sum_{i=1}^{N} (x_i - CT)^2$$

where N is the number of cases and CT is a measure of central tendency.

14. Variance:

$$s^2 = \frac{\sum_{i=1}^{N} (x_i - \overline{X})^2}{N}$$

where N is the number of cases and $\overline{X}$ is the mean.

15. Standard deviation:

$$s = \sqrt{s^2} = \sqrt{\frac{\sum_{i=1}^{N} (x_i - \overline{X})^2}{N}}$$

where s^2 is the variance, N is the number of cases and $\overline{X}$ is the mean.

16. Coefficient of relative variation:

$$\text{CRV} = \frac{s}{\overline{X}}$$

where s is the standard deviation and $\overline{X}$ is the mean.

17. Mean (absolute) deviation:

$$\text{MAD} = \frac{\sum_{i=1}^{N} |x_i - \overline{X}|}{N}$$

where N is the number of cases and $\overline{X}$ is the mean. Remember that the abolute value operator, $|x|$, means that if x is a negative number, you are to drop the negative sign (example, $|-3| = 3$ and $|3| = 3$).