Criminal Justice 395 (44.395)
Criminal Justice Statistics
Instructor: Dr. Jacob Stowell

PRACTICE FOR FINAL EXAM
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Below are two problem sets drawn from the material we have covered since the last
exam. These are similar to the types of problem sets that might appear on the final
exam. At the end of the handout are the answers you should be working toward. I
suggest that you not look at the answers until you have tried to solve the problems on
your own. Following the problem sets is a list of key concepts from previous exams
that you should also be familiar with for the final exam. Use all of this material (in
addition to the review sheets for the first two midterms) as a guide for preparing for
the final exam.
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1. A panel commissioned by the National Academy of Sciences (NAS) recently
   hypothesized that that there is a strong positive relationship between
   unemployment and violent crime rates. In order to test this hypothesis statistically
   you take a sample of 10 states, and compile information on: 1) the violent crime
   rate (y), and (2) the unemployment rate (x). Below are the data you gathered. Use
   these data, and the other information given, to answer the questions that follow.

Violent Crime Rate (y)	Unemployment Rate (x)
7.9	8.2
10.8	9.4
9.7	13.5
8.4	9.8
9.0	9.3
12.6	16.5
12.3	20.7
9.0	16.0
9.7	13.8
9.0	10.6

   a. Calculate and interpret pearson's r. Provide a written interpretation for this
      correlation coefficient (i.e., strength, direction, and significance are important
      in your interpretation). (Use an alpha-level of .05.)

   b. Do these sample data support or refute the hypothesis offered by the NAS
      panel? Why?

   c. Using the correlation matrix below, calculate the partial correlation ($r_{xy.z}$)
      between unemployment and violent crime partialling out the effect of percent
      foreign born.

Correlation Matrix

	X	Y	Z
Unemployment Rate (X)	1.000	0.721	-0.387
Violent Crime Rate (Y)		1.000	0.182
Percent Foreign-Born			1.000

d. Does controlling for the effect of immigration change your conclusion regarding the relationship between unemployment and violent crime? If so, what does the partial correlation tell us about the underlying association between unemployment and levels of violence?

2. As a researcher for a crime prevention coalition, you are asked to investigate the question of whether there are significant differences in the choice of weapons used in homicides committed by men and women. Based on information obtained from official police records, you have compiled data about 200 homicides into the following table:

	Male	Female	Total
Gun	100	20	120
Knife	39	21	60
Other	11	9	20
Total	150	50	200

a. Calculate chi-square. Using an alpha level of .01, test whether the selection of weapons is consistent for both men and women. That is, do the data suggest that there are significant gender differences in the choice of homicide weapons?

b. Calculate Cramer's V. What does this value tell us about the strength of association between gender and choice of weapon?

3. SELECTED KEY CONCEPTS FROM THIS SECTION
   a. Correlation coefficient
   b. Distinction between "dependent" and "independent" variables.
   c. Difference between "positive" and "negative" relationship between variables.
   d. Statistical significance of χ^2 and r—that is, the steps involved in performing a formal hypothesis tests of significance.
   e. Calculation of chi-square.
   f. Calculation of Cramer's V.
   g. Calculation of zero-order (i.e., pearson's correlation: r_{xy}) and partial correlation coefficients (i.e., $r_{xy.z}$).

4. SELECTED KEY CONCEPTS FROM PREVIOUS SECTIONS
   a. Mean and median, and how to compute them (from standard and grouped frequency distributions).
   b. Standard deviation and variance, and how to compute them.
   c. How to work with areas under the normal curve.
   d. How to determine "critical" z- or t-values.
   e. "Standard error"—what it is and how it is used.

f. Null hypothesis and research hypothesis.
g. "One" and "two" tailed hypothesis tests.
h. Confidence intervals versus hypothesis tests.
i. Alpha (α) and what it means.
j. "critical z-value or t-value" versus "computed z-value or t-value"
k. How to explain the results of a hypothesis test of confidence interval.
l. Probability distributions and their meaning.
m. Difference between sample statistics and population parameters.
n. Central limit theorem.
o. Sampling (or probability) distribution.

ANSWERS TO PROBLEM SETS

1a-b)   The correlation between unemployment and violent crime (r_{xy}) is .721. To determine if this correlation is statistically significant, we use the following steps:

  a. $r_{critical} = .632$
  b. $|r_{xy}| > r_{critical}$

  $|.721| > .632$ = True, so we will reject the null hypothesis of no difference. Thus, the data suggest that not only is there a strong association between unemployment and violent crime, but this relationship is statistically significant at the .05 level. Both pieces of information offer support for the NAS hypothesis of a strong positive association between levels of unemployment and violent crime.

1c-d)   The partial correlation between unemployment and crime, controlling for the effect of immigration ($r_{xy.z}$) is .873. That is, once we partial out the effect of immigration, we see that the correlation between unemployment and violent crime becomes stronger. Based on this result, we can conclude that the strong observed zero-order correlation between these two factors is not due to the shared correlation between unemployment and violence and immigration. This result is consistent with the NAS hypothesis which indicates that there is a strong association between unemployment and crime.

2a)   The computed Chi-square (χ^2) value is 11.91. With an alpha level of .01 and df=2, we will conclude that the selection of murder weapon varies by gender. This conclusion is drawn because the critical χ^2 value (9.210) is less than our computed χ^2 value of 11.91.

2b)   The computed value for Cramer's V is .244. Using conventionally accepted cutoffs, this indicates that, although the relationship is statistically significant, there is only a weak association between gender and choice of homicide weapon.