POL 51: The Scientific Study of Politics
Fall Quarter 2008
Final Exam: FORM B

Multiple Choice (1 point each; write answers in BLUE BOOK)

1. In a distribution of data, if $\overline{X} < median$, the data can be described as being:
a. Normally distributed
b. Right Skewed
c. Unimodal
d. Left Skewed ←
e. All of the above.

2. The standard deviation is to the mean what the _______________ is to the median.
a. normal distribution
b. sampling distribution
c. interquartile range ←
d. correlation coefficient
e. percentile.

3. Which is true about the *t*-distribution?
a. It has slightly "fatter" tails than the *z*-distribution.
b. We use the *t* when *s* is used instead of σ for the standard error.
c. As *n* increases, the *t* distribution closely approximates the *z*-distribution.
d. The probability area (density) is a function of the degrees of freedom.
e. All of the above. ←

4. Under what condition does the median do a better job than the mean, $\overline{X}$, of describing central tendency?
a. When the data are highly skewed. ←
b. When the data are bimodally distributed.
c. When the data are normally distributed.
d. Never: $\overline{X}$ always is the preferred statistic.
e. a,b, and c are all true.

5. Which is *not* true about the *z*-distribution?
a. It is symmetrical about the 0 point.
b. It has a standard deviation of 1.
c. Computation of probability area depends on sample size. ←
d. It is a standardized version of the normal distribution.

6. If the *p*-value for a two-tail test is reported to be .05 ($\alpha = .05$) from statistical software output, the *p*-value for a one-tail test would be?
a. .20
b. .05
c. .10 as well
d. .025.←

7. A 95 percent confidence interval is computed. Imagine that $\mu = 0$. Suppose this interval does not contain $\mu = 0$. Which of the following is an *incorrect* statement about this confidence interval?

a. “I am 95 percent confident that this confidence interval does not contain $mu = 0$. ←

b. “In repeated samples, 95 percent of all samples would produce an interval like this one.”
c. “In repeated samples, only about 5 percent of all samples would produce an interval containing $\mu = 0$.
d. Each of the above statements are correct.

8. Consider this hypothesis: H_α: Women more favorably evaluate Democratic candidates than when compared to men. Which is true about this hypothesis:
a. It is a normative statement about gender and liberal ideology.
b. It is a non-directional hypothesis.
c. It is a directional hypothesis.←
d. None of the above are true.

9. A sampling distribution is best described as:
a. The degree to which the distribution of sample elements are representative of the population.
b. The distribution of statistics from repeated samples of size n from the same population.←
c. The number of cases that end up in the final sample.
d. The confidence interval around a statistic.

10. Which is *not* true about one-tailed hypothesis tests?
a. They rely on probability area in either the upper or the lower tail of a distribution.
b. They are less conservative tests than two-tailed tests.
c. For the same α level as a two-tail test, it is harder to reject the null with a one-tail test.←
d. They should only be used in conjunction with directional hypotheses.

Scenarios (Please read the following scenarios and answer the subsequent questions):

1. In congressional elections, “competitive” elections are generally thought of as elections where the winner receives 55 percent or less of the two-party vote share. Anything above this point and the race is not considered competitive. Suppose a researcher takes a sample of 25 congressional districts from around the country and finds that the estimated mean (i.e. $\bar{X}$) is 59 percent and the estimated standard deviation (i.e. s) is 10 percent. Using this information, answer the following questions:

a. For this problem, state the appropriate null and alternative hypotheses? Why did you specify the alternative in the way you did? (10 points)

H_0**:** $\bar{X} = (\mu = 55)$
H_α**:** $\bar{X} > (\mu = 55)$
I specified it in this way because we are testing whether or not these districts significantly depart from the “competitive” range. (Note, some students may tell a compelling story as to why there is a two-tailed alternative. If they make the case, do not dock them points.)

b. For this problem, compute the t-statistic? (5 points)

$t = \frac{59-55}{10/\sqrt{25}} = 4/2 = 2$; The estimated t is 2.00.

c. Using an α-level of .05, can you reject the null hypothesis? Why or why not? (5 points)

The critical t for 24 degrees-of-freedom is 1.711. Since the estimated t exceeds the critical value for t, we can reject the null at the .05 level.

d. What substantive conclusions would you draw from this test? (10 points)

I would conclude that for my given α-level, the mean for the sampled districts is significantly greater than the hypothetical value of 55. Thus, these districts fall into the "non-competitive" category.

e. Suppose that you use an α-level of .025. What would your conclusion be regarding your hypothesis test? (5 points)

The one-tailed critical t for .025 is 2.064 (on 24 d.f.). Since the estimated t is less than the critical value needed to reject the null, we would not reject the null with this probability level.

2. A researcher is interested in how competitive the Democratic party is in Senate elections that occur in California. Our researcher notes that the average Democratic vote share for Senate races in California in the 1970s is 55 percent and the average Democratic vote share for Senate races in California in the 1990s is also 55 percent. The researcher concludes the Democratic party was "equally competitive" in both decades because the average vote share is the same.

a. Do you see any problems with this conclusion as stated? Why or why not? (10 points)

The problem here is that no information is given on variability around the mean. Thus, we cannot put the statistic in any kind of context. Also, barring no other information, sometimes the median does a better job of describing central tendency than does the mean. In short, we need more information in order to make the claim that is made here. If the means are the same but the standard deviations differ, then what the average score tells us would be sensitive to these differences.

A more careful researcher examines the data. She computes the *national* average Democratic vote share for all Senate races for the decade of the 1970s. This researcher finds that the average Democratic vote share is 52 percent in the 1970s and the standard deviation is 1.5 percent. Next, the same researcher computes the average Democratic vote share for the decade of the 1990s and finds that the average for this decade is 52 percent with a standard deviation of 3.33 percent. The researcher concludes that the two periods are distinct. She states: "gaining 55 percent of the vote in the 1970s was much more difficult than gaining 55 percent of the vote in the 1990s."

b. How does the researcher come to this conclusion? In your answer, be sure to discuss the probability of obtaining 55 percent in the two decades. (15 points)

We have all the information we need to compute the z-scores. These standardize the data in terms of standard deviations and therefore makes it easier to compare across time periods. If I compute the z-score for the 1970s, I obtain $(55-52)/1.5 = 2$; that is, I have z-score that is 2 for California in the 1970s. For the 1990s, the z-score

is $(55-52)/3.33 = .90$**; that is, my** z**-score is .90. The score for the 1970s is *far* more extreme than for the 1990s. This implies that the probability of observing a vote share of 55 percent or higher in this era is approximately .0228. This is a very small probability and implies it is probabilistically less likely to observe a 55 percent vote share in this period compared to the 1990s. For the 1990s, the probability is about .1841. It is clear the probability is much higher of observing a 55 percent in the latter period compared to the earlier period. In the 1970s, the data are tightly clustered around 52; in the 1990s, there is greater dispersion or variability.**

3. A researcher hypothesizes that attitudes toward immigrants will be higher among individuals who reside in southern border states (border with Mexico) compared to individuals not from southern border states. A random sample of individuals is taken from southern border states as well as non-border states; the total sample size is 1000. Respondents are asked to rate immigrants on a 100-point feeling thermometer, where 100 denotes most favorable attitudes; 50 denotes "middle of the road" attitudes; and 0 denotes least favorable attitudes. The following results are obtained:

For respondents from non-border states: $\overline{X} = 46$
For respondents from border states: $\overline{X} = 50$
assume the $SEDM = 2.1$

a. For this problem, state the appropriate null and alternative hypotheses? Why did you specify the alternative in the way you did? (10 points)

H_o**:** $\bar{X}_{BS} = \bar{X}_{nonBS}$
H_a**:** $\bar{X}_{BS} > \bar{X}_{nonBS}$
The hypothesis is stated this way because the researcher is interested in testing whether or not border-state respondents proffer more positive evaluations of immigrants than when compared to non-border state respondents.

b. Compute the two-group t-statistic using the information given. (5 points)

Using the formula for the two-group t**-test, we have** $(50-46)/2.1 = 1.905$**. That is, my** t**-statistic is 1.91 (rounding up).**

c. Using an α-level of .025, would the research reject the null hypothesis? Why or why not? (5 points)

For this α**-level, the critical** t **is 1.96 for a one-tailed test. Since my** t**-statistic is less than the critical** t**, I would fail to reject the null hypothesis.**

d. Based on this test, what conclusions would you draw? (10 points)

Based on the criteria established for this test, I conclude that the difference in ratings between border state and non-border state respondents are not significantly different from each other.

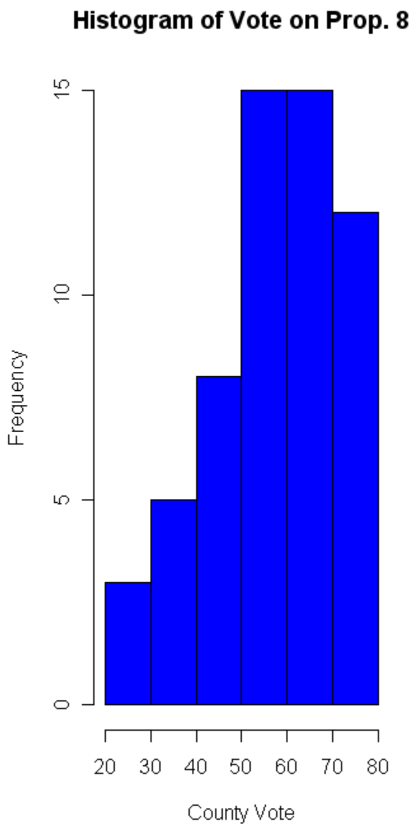
e. If an α-level of .05 were chosen, could the researcher reject the null? (5 points)

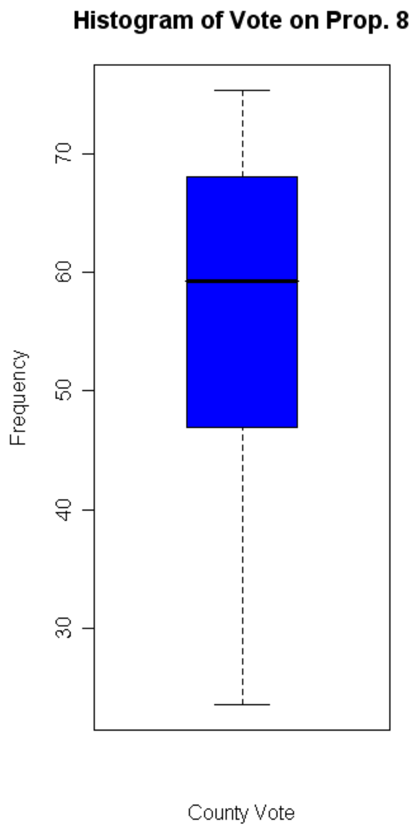
For this level, I would reject the null hypothesis because the critical t **for the test is 1.645. Since my statistic exceeds this value, I could reject the null at the 5 percent**

level (1-tailed).

4. A researcher gives a histogram and a box plot for county votes for "yes" on Proposition 8. The plots are given below. Please describe the main features of the plots in as much detail as you can. (20 points)

The histogram for votes on Prop. 8 is left-skewed implying the county mean is less than the median. This suggests that a handful of counties overwhelmingly voted "no" on this ballot proposition but that a majority of the counties had vote percentages in excess of 50 percent. The box plot shows a wide range between the minimum county vote and the maximum county vote (these are given by the whiskers on the plot). The 25th percentile is below the 50 percent mark; however, the median county vote is very near 60 percent. The 75th percentile is above 65 percent. The plot reveals similar information as the histogram: there is wide variability but most of the "action" occurs well above the 50 percent mark.


Histogram of Vote on Prop. 8
15
10
5
0
Frequency
20
30
40
50
60
70
80
County Vote


Histogram of Vote on Prop. 8
70
60
50
40
30
Frequency
County Vote

Formulae that may be of interest:

Mean:

$$\overline{X} = \frac{\sum_i^n (X_i)}{n} \tag{1}$$

Variance

$$s^2 = \frac{\sum_i^N (X_i - \overline{X})^2}{n-1} \tag{2}$$

Standard Deviation

$$s = \sqrt{(s^2)} \tag{3}$$

z-score

$$z = \frac{X_i - \overline{X}}{s} \tag{4}$$

Median

$$M = \frac{N+1}{2} \tag{5}$$

One-sample *t*

$$t = \frac{\overline{X} - \mu}{s/\sqrt{n}} \tag{6}$$

Two-group *t*

$$t = \frac{\overline{X}_{Dem} - \overline{X}_{Rep}}{SEDM} \tag{7}$$