

## **POL 138 Quantitative Reasoning in Political Science**

### **KEY Practice Final Exam Part 2**

#### **Directions**

This pdf file contains the items for the Final Exam Part 2. On a separate page, HANDWRITE your responses to each item below. Number your responses from 1 through 6 so that I know which response goes with which item. Please handwrite clearly so that it is easy for me to read. Also, on your submission, if this applies to you, write: "For completing this exam, I did not receive help from others and did not use artificial intelligence that can generate a response to prompts". Submit a photo/scan of a hard copy of the file with your responses, and please combine multiple scans and photos into a single file, so that it is easier for me to download the file.

#### **Reminder about academic honesty**

For exams, **students are not permitted to work with others, students are not permitted to use artificial intelligence such as ChatGPT that can generate a response to prompts, and students are not permitted to use materials other than the materials indicated below.** Students are permitted to use a calculator or statistical software, course notes and course videos, the student's handwritten notes, and other hard copy or electronic materials or internet sites other than artificial intelligence such as ChatGPT that can generate a response to prompts. Students are also permitted to ask the instructor to clarify exam items.

## Item 1

Suppose that we are assessing whether there is a "pink tax", in which the version of a product marketed to women unfairly costs more than the equivalent version of the product marketed to men. Our analysis involves only two products: a \$10 pack of 10 men's razor blades, and a \$6 pack of 5 women's razor blades. The men's razor blades cost an average of \$1.00 each, but the women's razor blades cost an average \$1.20 each. Indicate one thing that we should consider before concluding that, in comparing these two products, this 20 cent difference in average price per razor blade is sufficient evidence that the razor blades marketed to women unfairly cost more on average than the razor blades marketed to men cost (2 points). Then explain why (4 points).

**One potential response that would receive full credit: Before concluding that the 20 cent difference in average price per razor blade is sufficient evidence that the razor blades marketed to women unfairly cost more on average than the razor blades marketed to men cost, we should consider the fact that the women's razor blades might be higher quality than the women's razor blades (such as stronger materials or a sharper blade) and thus the 20 cent difference is fair.**

**Another idea is that, because men typically shave more often than women, it's reasonable for the men's package to have more razor blades, and it's also reasonable to discount purchases in bulk (i.e., giving a discount for buying more razor blades per pack), so that it's fair that men pay less than women for each razor blade.**

## Item 2

Explain what information a p-value provides (3 points). Then indicate which p-value represents no evidence against the null hypothesis (1 point), which p-value represents infinitely strong evidence against the null hypothesis (1 point), and what the conventional p-value threshold is in political science (1 point).

**A p-value is a measure of the strength of evidence that an analysis has provided against the null hypothesis. A p-value of 1 represents no evidence against the null hypothesis, a p-value of 0 represents infinitely strong evidence against the null hypothesis, and  $p=0.05$  is the conventional p-value threshold in political science.**

## Item 3

Suppose that an analysis indicated that, in head-to-head matchups between major party candidates in the United States, the candidate who raises more money wins in 90% of elections. Suppose also that the p-value is  $p < 0.05$  for a test of the null hypothesis that the candidate that raised more money was just as likely to win election as the candidate that raised less money. Explain whether this would be sufficient evidence at the conventional level of political science to conclude that raising more money than the other candidate causes a candidate to be more likely to win an election (6 points).

**Not sufficient evidence, because there are alternate explanations that should be addressed. For example, maybe the candidate that raises more money was more likely to be an incumbent, and this incumbency caused the candidate to be more likely to win an election.**

## Item 4

Suppose that an analysis indicated that, in the United States, political candidates who wear an American flag pin are more likely to win their election, compared to political candidates who do not wear an American flag pin. Suppose that the p-value is  $p < 0.05$  for a test of the null hypothesis that political candidates who wear an American flag pin are just as likely to win their election as political candidates who do not wear an American flag pin. Identify one control variable that this analysis should include before we conclude that, at least on average in the United States, wearing an American flag pin causes a political candidate to be more likely to win their election (2 points). Then explain why that control variable would be useful for this analysis (4 points).

**One control variable would be whether the candidate is an incumbent. It's possible that – compared to candidates who don't wear an American flag pin – candidates who wear an American flag pin are more (or less) likely to be an incumbent, and a control variable for incumbency can help isolate the effect of the flag pin from the effect of incumbency.**

## Item 5

Suppose that we conducted a randomized experiment in which a random sample of U.S. residents watched a video of a political candidate's speech. Some participants were randomly assigned to a video in which the candidate wore an American flag pin, and other participants were randomly assigned to a video in which the same candidate did not wear an American flag pin. Everything else was the same between these videos, except for the American flag pin. After the video, all participants indicated on a scale from 0% to 100% the probability that the participant would vote for the candidate. Results indicated that the mean probability was 10 percentage points higher among participants who were randomly assigned to watch the video in which the candidate wore an American flag pin, compared to the mean probability among participants who were randomly assigned watch to the video in which the candidate did not wear an American flag pin, with a p-value of  $p < 0.05$  for a test of the null hypothesis that these mean probabilities equaled each other. Explain (6 points) why this randomized experiment might be better for assessing whether wearing an American flag pin causes a political candidate to be more likely to win their election, compared to the non-experimental research study described in Item 4.

**Everything else was the same between the videos, except for the American flag pin, so the only reasons for a difference between groups would be the American flag pin or random assignment error. The p-value for a test of the null hypothesis was  $p < 0.05$ , so we can eliminate random assignment error as a plausible explanation. Thus, the only plausible explanation remaining is the American flag pin. This randomized experiment is better than the non-experimental research study described in Question 3, because the “flag pin” candidates in the non-experimental research study might not have been all else equal to the “no flag pin” candidates, and these other differences might have caused the observed difference in winning the election.**

## Item 6

Suppose that, for the randomized experiment in Item 5, the p-value was  $p = 0.24$  for the test of the null hypothesis. Explain one way that that null result could occur, if it were true that wearing an

American flag pin causes a political candidate to be more likely to win their election. Possible reasons include random assignment error, restriction of range, a too small sample size, and inattentive participants. Don't merely select one of these reasons: Select a reason (2 points), and then explain how that could cause the null result (4 points).

**One potential response that would receive full credit: The null result could have been caused by a too small sample size. Small sample sizes don't provide much information about the effect that we are testing for, so it's possible that a randomized experiment with a small sample size merely did not detect an effect that exists.**