Last Name:

First Name:

There are 5 questions on 12 pages with varying point values for a total of 88 possible points. The last page is a formula sheet and Normal table: once the test begins you may carefully tear out that last page (it will not be collected). You may use a non-programmable calculator. You have 110 minutes.

Please keep these papers face-up and closed on your desk until the start of the test is announced. Put your writing instruments down immediately when the end of the test is announced.

Unless otherwise specified, you choose the significance level. (In circumstances where there are no special considerations, you may use the conventional 5% significance level.)

- Write your answers clearly, concisely, and completely below each question.

- ***Make sure to show your work and reasoning***. ***Make sure your graphs are fully labeled***.

- A guide for your response ends each question: it tells what is expected: e.g. a quantitative analysis, a graph, and/or sentences. For example, "How strong is the evidence that demand is elastic? Answer with a quantitative analysis and 1 – 2 sentences." To best demonstrate your understanding, follow the guide and focus on directly answering the question asked.

  o Make sure to write actual sentences (not short-hand or bullet lists).

  o Apply your skills to the specific situation presented with the question.

  o Reproducing examples or discussion from our course materials is not an effective strategy because these will not address the specific situation asked about.

  o Extraneous analysis does not earn positive marks if it is correct and earns negative marks if incorrect: focus on the question that is asked.

- For questions with multiple parts, attempt each part even if you had trouble with earlier parts.

Student #:

	Q1	Q2	Q3	Q4	Q5	Raw Total	Your Mark (out of 100%)
Point Value:	*20*	*22*	*12*	*20*	*14*	*88*	
Points Earned:							

(1) [20 pts] A report "Focus Canada 2013: Canadian public opinion about climate change" begins:

> As part of its ongoing *Focus Canada* public opinion research program, the *Environics Institute* partnered with the *David Suzuki Foundation* this fall to ask Canadians about the issue of climate change, to determine how perceptions have changed (or not) over the past 12 months. The survey is based on telephone interviews conducted with 2,003 Canadians between October 1 and 17, 2013. A sample of this size drawn from the population produces results accurate to within plus or minus 2.2 percentage points in 19 out of 20 samples. [Published November 18, 2013, http://www.environicsinstitute.org/uploads/news/focus%20canada%202013%20-%20public%20opinion%20on%20climate%20change%20-%20english.pdf]

Regarding science, survey respondents are given three choices: **1.** Science is conclusive that global warming is happening and is caused mostly by human activity; **2.** Science is conclusive that global warming is happening but not yet conclusive that it is caused by human activity; or **3.** Science is not yet conclusive that global warming is happening.

(a) [5 pts] 12 percent selected **3.** A 95% confidence interval is correctly obtained as 0.12 ± 0.014 where, in percentage terms, the lower confidence limit is 10.6% and the upper confidence limit is 13.4%. *Fully interpret* this CI for someone who has not seen the report. Answer in 1 precise sentence.

(b) [5 pts] Why is the margin of error in Part **(a)** (1.4 percentage points) smaller than what the above summary says (2.2 percentage points)? Answer with a quantitative analysis and 1 – 2 sentences.

(c) [10 pts] In the subsample of Alberta residents, only 47% selected **1.** The table to the right is from *Statistics Canada* and shows the Canadian population distribution. Provide a quantitative measure of the strength of the evidence that less than half of Alberta residents believe that "**1.** Science is conclusive that global warming is happening and is caused mostly by human activity." Interpret your quantitative measure. Answer with a quantitative analysis and 1 – 2 sentences.

2013 Population, by province and territory

	persons (thousands)
Canada	35,158.3
Atlantic Provinces (4)	2368.8
Quebec	8,155.3
Ontario	13,538.0
Manitoba/Saskatchewan	2373.3
Alberta	4,025.1
British Columbia	4,582.0
Territories (3)	115.8

(2) [22 pts] Recall Karlan, Dean, and John A. List. 2007. "Does Price Matter in Charitable Giving? Evidence from a Large-Scale Natural Field Experiment." *American Economic Review*, 97(5): 1774 – 1793. Their study is in the U.S.: "Red States" lean towards the Republican party and "Blue States" towards the Democratic party. Consider these excerpts from the abstract and tables of results:

> We conducted a natural field experiment to further our understanding of the economics of charity. Using direct mail solicitations to over 50,000 prior donors of a nonprofit organization, we tested the effectiveness of a matching grant on charitable giving. We find that the match offer increases both the revenue per solicitation and the response rate. Larger match ratios – $3:$1 and $2:$1 – relative to a smaller match ratio – $1:$1 – had no additional impact, however.

	Control	1:1 Ratio	2:1 Ratio	3:1 Ratio
PANEL A: All States				
Response Rate	0.018 (0.001)	0.021 (0.001)	0.023 (0.001)	0.023 (0.001)
Observations	16,687	11,133	11,134	11,129
PANEL B: Blue States				
Response Rate	0.020 (0.001)	0.021 (0.002)	0.022 (0.002)	0.021 (0.002)
Observations	10,029	6,634	6,569	6,574
PANEL C: Red States				
Response Rate	0.015 (0.001)	0.021 (0.002)	0.024 (0.002)	0.026 (0.002)
Observations	6,648	4,490	4,557	4,547

(a) [6 pts] What do the numbers in parentheses mean? Use the results for a <u>3:1 Ratio in Blue States</u> to show how 0.002 is calculated. Answer with a quantitative analysis and 2 – 3 sentences.

(b) [8 pts] Is there a statistically significant difference at a 10% significance level in the response rate comparing a $1:$1 match with a $3:$1 match in Red States? Answer with a quantitative analysis and 1 sentence.

(c) [8 pts] What is a good estimate (including its margin of error) of how much moving from <u>no match to a $3:$1 match affects the response rate in Red States</u>? How should you interpret it? Answer with a quantitative analysis and 1 – 2 sentences.

(3) [12 pts] The natural proportion of male babies is 0.512. How many males in a random sample of 1,000 births would convince you of selection for males? Answer with a quantitative analysis, a fully-labeled graph of the *sampling distribution* that shows your answer, and 2 – 4 sentences.

(4) [20 pts] CNN reports annual profits in billions ($U.S.) for Fortune 500 companies. Below are a STATA summary and histogram. (http://money.cnn.com/magazines/fortune/fortune500/2013/full_list/)

```
                               profits_2013_bn
         -------------------------------------------------------------
               Percentiles        Smallest
          1%       -3.185          -12.65
          5%       -.6452          -4.326
         10%      -.04145          -4.242          Obs                    500
         25%        .2034          -4.068

         50%       .62645                          Mean             1.640658
                                    Largest        Std. Dev.        4.092281
         75%       1.6325           21.284
         90%      3.88845           26.179         Variance         16.74676
         95%       6.7335           41.733
         99%     18.0585            44.88
```
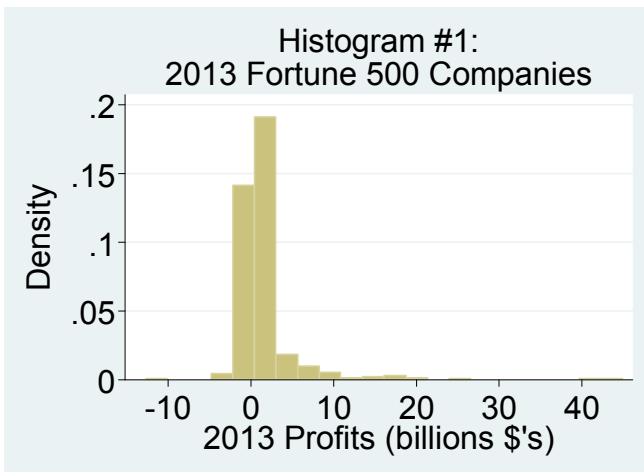
Histogram #1:
2013 Fortune 500 Companies

Consider simulations where a computer draws many samples from the above population of 500 companies. The first simulation draws 40,000 random samples of 10 companies and the second draws 40,000 random samples of 40 companies. Here are histograms of the simulation results:

Histogram #2:
Samples of Size 10

Histogram #3:
Samples of Size 40
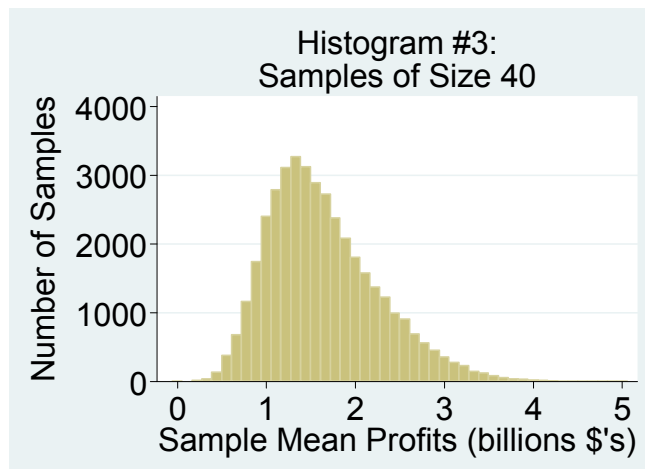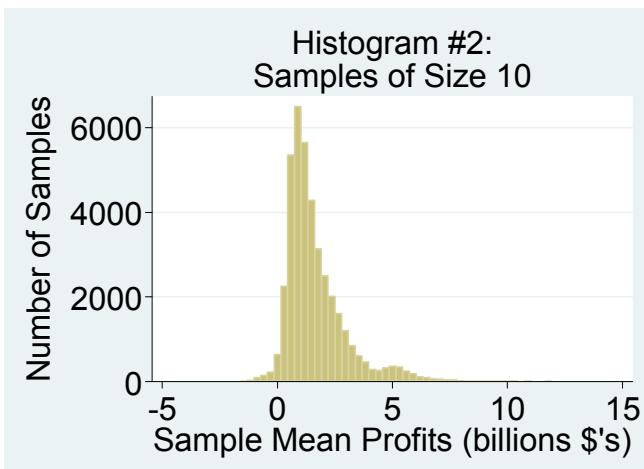
(a) [8 pts] Does the Empirical Rule hold for the profits for Fortune 500 companies? Explain by making specific references to the various numbers in the STATA summary and make sure to specify exactly what the Empirical Rule says. Answer with 3 – 5 sentences.

(b) [6 pts] In this Fortune 500 example does the Central Limit Theorem apply for n = 10? n = 40? Make specific references to all three histograms and make sure to specify what the Central Limit Theorem says. Answer with 3 – 5 sentences.

(c) [6 pts] An analyst randomly samples 40 of the Fortune 500 companies. The sample mean profit is $0.5 billion and s/he is surprised at how low it is. Someone else correctly points out that 216 (43.2 percent) of the Fortune 500 companies have profits of $0.5 billion or lower. Should the analyst have been surprised about how low the sample mean is? Explain making specific references to relevant histograms and numbers. Answer with 2 – 3 sentences.

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(5) [14 pts] You want to show that at least 10 percent of a website's visitors would make a purchase if offered free shipping. To convince a skeptical manager, you choose a 1% significant level ($\alpha = 0.01$). You plan to direct a random sample of 1,000 visitors to the site offering free shipping. If the proportion of all visitors who would make a purchase if offered free shipping is 14 percent, compute the *power* of the implied hypothesis test. Answer with a quantitative analysis and two fully-labeled graphs that illustrate your answer.

EXTRA SPACE: If you use this space, clearly indicate the question number and part and make a clear note in the original space directing the grader here.