Possible Solutions for Exam 1
K Foster, Principles of Statistics
Eco 290, CCNY, Spring 2011

1. (15 points) These questions are on Blackboard; please submit your answers there.
    a. For a Standard Normal distribution what is area to the right of 0.2? A. 0.5000 B. 0.8415 C. 0.**4207** D. 0.4602
    b. For a Standard Normal distribution what is area to the right of 0.9? A. 0.3264 B. 0.**1841** C. 0.8159 D. 0.3681
    c. For a Standard Normal distribution what is area to the right of 2.0? A. 0.**0228** B. 0.8749 C. 0.1587 D. 0.0510
    d. For a Standard Normal distribution what is area to the left of 0.5? A. 0.0107 B. 0.0472 C. 0.**6915** D. 0.3130
    e. For a Standard Normal distribution what is area to the left of -1.6? A. 0.1093 B. 0.**0548** C. 0.1769 D. 0.9479
    f. For a Standard Normal distribution what is area in both tails farther from the mean than -2.2? A. 0.0916 B. 0.9868 C. 0.6005 D. 0.**0278**
    g. For a Standard Normal distribution what is area in both tails farther from the mean than 1.1? A. 0.0714 B. 0.**2713** C. 0.4979 D. 0.1354
    h. For a Standard Normal distribution what is area in both tails farther from the mean than 0.8? A. 0.**4237** B. 0.3364 C. 0.8474 D. 0.0546
    i. For a Standard Normal distribution what is area closer to the mean than 2.4? A. 0.**9836** B. 0.0318 C. 0.9254 D. 0.1151
    j. For a Standard Normal distribution what values leaves probability 0.778 in both tails? ± 0.**2819** ± 1.0705 ± 0.8950 ± 0.1745
    k. For a Standard Normal distribution what values leaves probability 0.281 in both tails? ± 0.9100 ± 1.6564 ± **1.0781** ± 2.1560

2. (20 points) These questions are on Blackboard; please submit your answers there.
    a. For a Normal Distribution with mean 12 and standard deviation 1.2, what is area to the right of 14.9? Standardize (14.9 – 12)/1.2 = 2.41 so A. 0.7069 B. 0.**0082** C. 0.0164 D. 0.1151
    b. For a Normal Distribution with mean -5 and standard deviation 1.8, what is area to the left of -7.7? Standardize, (-7.7-(-5))/1.8 = -1.5, A. 0.0027 B. 0.9973 C. 0.7734 D. 0.**0668**
    c. For a Normal Distribution with mean -5 and standard deviation 3.0, what is area to the left of -11.6? Standardize (-11.6-(-5))/3 = -2.2, A. 0.0278 B. 0.9861 C. 0.1587 D. 0.**0139**
    d. For a Normal Distribution with mean 4 and standard deviation 0.9, what is area in both tails farther from the mean than 2.1? (2.1 - 4)/.9 A. 0.1587 B. 0.**0357** C. 0.9821 D. 0.7772
    e. For a Normal Distribution with mean 7 and standard deviation 7.1, what is area in both tails farther from the mean than 16.9? (16.9-7)/7.1 A. 0.3230 B. 0.**1615** C. 0.1721 D. 0.1587
    f. For a Normal Distribution with mean 3 and standard deviation 3.4, what values leaves probability 0.05 in both tails? A. (–4.6208, 10.6208), B. **(–3.6639, 9.6639)**, C. (–2.5925, 8.5925), D. (–1.6449, 1.6449)
    g. For a Normal Distribution with mean 8 and standard deviation 8.7, what values leaves probability 0.351 in both tails? A. (3.943, 12.057), B. (12.6124, 3.3876), C. (–4.5574, 12.4426), D. **(–0.1141, 16.1141)**
    h. For a Normal Distribution with mean -11 and standard deviation 0.2, what values leaves probability 0.291 in both tails? A. (-10.9586, -11.0414), B. (-5.7112, -5.2888), C. (-56.0559, -53.9441), D. **(-11.2112, -10.7888)**

3. (20 points) Bloomberg News reported on a US audit of mortgages, showing that the average number of "seriously delinquent" loans originated by Countrywide (now owned by Bank of America) was 6.76%, versus a general average of 3.59% made by all other originators. There were 4050 loans made by Countrywide. (H. Son, D. Kopecki, D. Griffin, Oct. 5, 2011, "BofA May Face Fraud Claims for Soured Loans," Bloomberg News.)
    a. Test the null hypothesis that Countrywide's delinquent loan rate was actually not different from 3.59%; how likely is it that Countrywide was just unlucky? (What is the p-value?)
    The standard deviation of the delinquent rate is .0676*(1 - .0676) = .2511, so the standard error of the mean is that divided by the square root of 4050, so .0039. The difference of 6.76% - 3.59% is 8 standard errors away, so it is extremely unlikely that Countrywide was just unlucky (p-value is zero to first several digits).
    b. Create a 95% confidence interval for Countrywide's delinquency rate. What is the 90% confidence interval? The 99% interval?
    A 95% confidence interval is .0676 ± 1.96*.0039 = (5.99%,7.53%); the 90% interval uses 1.64 so .0676 ± 1.64*.0039 = (6.11%,7.41%); the 99% interval uses 2.58 so .0676 ± 2.58*.0039 = (5.74%,7.78%).
    c. What reasons, other than fraud, could explain why Countrywide's loans might have a higher delinquency rate?
    Answers will vary.

4. (20 points) Using the PUMS data (available from Blackboard) on people in New York City, consider educational attainment.
    a. What fraction of people 25-55 have a college degree (associate, bachelor, or advanced)?
    Find that 46.2% of people in NYC age 25-55 have a college degree of some sort.
    b. Sampling people aged 25-55, what is the probability of finding someone with some college degree? With a bachelor or higher degree?
    So the probability of sampling someone with a college degree should be 46.2%; of finding someone with a bachelor or higher degree, 39.1%.
    c. What is the conditional probability that a person, age 25-55 and having some college degree, has a family income below the poverty line? Below 150% of the poverty line?
    A person with a college degree has only a 6.17% chance of being below the poverty line (versus a 20.92% chance if they have less education); a person with a college degree has a 9.76% chance of being below 150% of the poverty line (versus 31.95% if they do not have a degree).
    d. Form a hypothesis test for whether the chance of being in poverty (under 100% of poverty line) is independent of degree. What is the p-value? What is a 95% confidence interval for the difference?
    The difference in poverty rate is .2092 - .0617 = .1475 with standard error of just .0018, so it is extremely unlikely (p-value near zero) that this is by chance. A 95% confidence interval for the difference is .1475 ± .0018*1.96 = .1475 ± .0035 = (.1440,.1510).
    e. Why do you think that we would find these results? Explain (perhaps with some further empirical results from the same data set).
    Answers will vary.