Problem 1

A state public health agency has observed what seems to be an unusually high incidence of childhood cancer in the town where a nuclear plant operates. It is known that about five out of every 10,000 children who do not live near a nuclear power plant will be diagnosed with cancer, but in this town of 7,980 residents there have been seven cancer diagnoses.

In this problem you will set up and conduct a hypothesis test to examine this anomaly:

1. What is the appropriate null hypothesis? (Hint: Remember, our null hypothesis generally corresponds to a simpler model or state of the world – no detectable differences between samples, no bias in the coinflips, no relationships between variables, no differences between groups, etc.)

2. What test statistic will you use to test the null hypothesis? How do you define when you will consider the test statistic "extreme"?

3. Simulate the distribution of your test statistic under the null hypothesis and plot it using a histogram. How does it compare to the test statistic actually observed?

4. Compute the p-value and comment on the strength of evidence against the null hypothesis.

Problem 2

Since 2000, the returns to a fund tracking the NASDAQ composite index have followed a normal distribution with mean 0.56% and standard deviation 6.3%. The monthly return in October 2008 was -17.7%. Is this outcome more or less extreme than the drop in the S&P 500 in October 2008? (Refer to the example in the lecture slides for our model of S&P returns.) Justify your answer with a calculation.