**Hypothesis Tests**
COR1-GB.1305 – Statistics and Data Analysis

# Introduction

1. An analyst claims to have a reliable model for Twitter's quarterly revenues. His model predicted that the most recent quarterly revenues could be described as a normal random variable with mean \$1.5B and standard deviation \$0.1B. In actuality, the revenues were \$1.0B. Is there evidence of a problem with the analyst's model? Why or why not?

2. Prof. Perry has a coin, which he claims to be fair (50% chance of "heads," and 50% chance of "tails"). He flips the coin 10 times, and gets "heads" all 10 times. Do you believe him that the coin is fair? Why or why not?

## Test on a Population Mean

3. (Adapted from Stine and Foster, 4M 16.2). Does stock in IBM return a different amount on average than T-Bills? We will attempt to answer this question by using a dataset of the 264 monthly returns from IBM between 1990 and 2011. Over this period, the mean of the monthly IBM returns was 1.26% and the standard deviation was 8.27%. We will take as given that the expected monthly returns from investing in T-Bills is 0.3%.

   (a) What is the sample? What are the sample mean and standard deviation?

   (b) What is the relevant population? What are the interpretations of population mean and standard deviation?

   (c) What are the null and alternative hypotheses for testing whether or not IBM gives a different expected return from T-Bills (0.3%)?

(d) Use an appropriate test statistic to summarize the evidence against the null hypothesis.

(e) If the null hypothesis were true (there were no difference in expected monthly returns between IBM and T-Bills) what would be the chance of observing data at least as extreme as observed?

(f) Is there compelling evidence (at significance level 5%) of a difference in expected monthly returns between IBM and T-Bills?

(g) What assumptions do you need for the test to be valid? Are these assumptions plausible?

## Test Statistic and Observed Significance Level ($p$-value)

4. In each of the following examples, for the hypothesis test with

$$H_0 : \mu = \mu_0$$
$$H_a : \mu \neq \mu_0$$

find the test statistic ($t$) and the $p$-value.

(a) $\mu_0 = 5$; $\bar{x} = 7$; $s = 10$; $n = 36$.

(b) $\mu_0 = 90$; $\bar{x} = 50$; $s = 200$; $n = 64$.

(c) $\mu_0 = 50$; $\bar{x} = 49.4$; $s = 2$; $n = 100$.

5. For each example from problem 4:

(a) Indicate whether a level 5% test would reject $H_0$.

(b) Indicate whether a level 1% test would reject $H_0$.