



## What's My Line?



In looking over your recent work (including the last test, the last quiz, your problem sets since then, your “Chi-Square: What’s Fair” labs, and even some of your projects), I notice that many of you are still unclear about how to test hypotheses and how to interpret the results of hypothesis testing. With a partner or two (but no more than three people may work together), work through the situations below; write out (and turn in at the end of the period) the following for *each* situation. Don’t start the second situation until both of you fully understand the first. No numbers are given, so you don’t need calculators or computers. Turn in as much as you finish in one period; quality is much more important than quantity for this exercise.

- State the null and alternative hypotheses using *mathematical statements* (inequalities or equations).
- Identify what kind of test you would use (to include whether the test should be one-sided or two-sided, and degrees of freedom, if necessary). Identify any necessary assumptions.
- Write a sentence to describe the conclusion you would reach if the  $p$ -value were larger than a fixed significance level (0.05, for example).
- Write a sentence to describe the conclusion you would reach if the  $p$ -value were smaller than a fixed significance level.
- Sketch a distribution and *shade in* the area that is equivalent to the  $p$ -value. Some sketches will show symmetric distributions, but some will NOT. Some will have finite domains, some will have domains of  $(-\infty, \infty)$ , some will have domains of  $(0, \infty)$

Situation 1: Cows in one dairy herd give an average of  $X$  pounds of milk per cow per day, while cows in another herd average  $Y$  pounds of milk per cow per day.

Situation 2: A random sample of U.S. households participated in a Neilson television rating survey last week. At 9:15 PM on Thursday night, of all households reporting watching television,  $N$  households were watching broadcast television networks (which can be seen without cable or satellite), and  $M$  households were watching cable-only networks. Are cable-only networks more widely viewed than broadcast networks?

Situation 3: In the Neilson rating survey, the numbers of households watching each of the five major broadcast networks (ABC, CBS, Fox, NBC, and UPN) were counted. Advertisers want to know how much they should pay for ads on each network during the time slot.

Situation 4: To gauge the effectiveness of a particular teacher, some school districts propose “entry” and “exit” tests for each student, spaced a unit (or marking period, etc.) apart. If a teacher is effective, all students will show improvement. The district sets a benchmark at 20 points average improvement as indicating satisfactory teacher quality.

Situation 5: Political activists claim that abortion clinics are more likely to be picketed in states where the death penalty is legal. For a given year, should they examine the total number of picketed clinics in a state, or “normalize” the data by finding the number of picketed clinics per 100,000 people in the state? (answer this question in addition to the five bullet prompts).

Situation 6: A random sample of UIUC students recorded their gender and whether they took SAT only, ACT only, SAT and ACT, or neither of these, prior to coming to the university. Do the results vary by gender?

Situation 7: Each state is represented in the U.S. Congress by two Senators and by a number of Representatives based on its population. The nation sometimes appears to divide into regional interests; is the representation of each of, say, four regions “fair”?