Learning Goal: Recognize Type I and Type II errors.

Our conclusion in a hypothesis test is based on probability. Because of this, there is a chance that our conclusion is wrong.

1) What can go wrong?

   a) Indicate which cells in the table are correct decisions.

|		*Our actions*	
		We reject Ho (in favor of Ha)	We fail to reject Ho (not enough evidence in favor of Ha)
Unknown reality	Ho is true.		
	Ho is false. (Ha is true)		

   b) If Ho is true, but we reject it, this is Type I error.
      If Ho if false, but we fail to reject it, this is a Type II error.
      Label each type of error in the table.

2) In testing for bacterial counts on meat, we have the following hypotheses
   Ho: Meat is not spoiled.   Ha: Meat is spoiled.

   Describe Type I and Type II errors in this context.

3) In the early 1900s researchers used Zener cards to try to identify people with ESP. A person would try to identify the symbol on a hidden card.

   Someone who is just guessing has a 1 in 5 chance of a correct guess, which is 0.20. Imagine a person correctly identified 5 symbols out of 10 tries.

   Image courtesy of http://en.wikipedia.org/wiki/Extrasensory_perception.
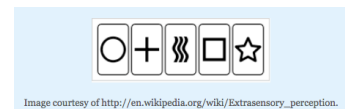
   Ho: person is guessing (p=0.20) (does not have ESP)
   Ha: person is not guessing (p>0.20) (may have ESP)

   With 10 tries, the distribution associated with guessing gives a P-value of 0.009 for this person.

a) What do we conclude based on the P-value?

b) Which type of error is possible here?

4) Thousands of women every year use home pregnancy tests, which are sold in drug stores and supermarkets. Home pregnancy tests give a result of positive (pregnant) or negative (not pregnant). A systematic review published in 1998 showed that home pregnancy test kits, when used by experienced technicians, are almost as accurate as professional laboratory testing (97.4%). When used by consumers, however, the accuracy fell to 75%: the review authors noted that many users misunderstood or failed to follow the instructions included in the kits. Improper usage may cause both false positives (Type I error) and false negatives (Type II error).

Describe both types of error relative to the hypotheses below. Use the terms "false positive" and "false negative."
Ho: woman is not pregnant
Ha: woman is pregnant