Table Number:_____ Group Name: _____

Group Members:_____ _____ _____

# Types of Errors

In hypothesis testing we need to decide that either $H_0$ or $H_a$ is true. Obviously we would like to make the correct decision, but we can sometimes make the wrong decision. How would you describe each of the following errors in words in terms of the following situation?

$H_0$: The defendant is innocent; $H_a$: The defendant is guilty (not innocent).

1) We decide that $H_a$ is true, but this is the wrong decision because $H_0$ is true.

2) We decided that $H_0$ is true, but it is the wrong decision because $H_0$ is not true.

We call these situations a **type I error** and **type II error** respectively. Of course we would like to keep the chances of making a mistake very small. We usually express our decision in terms of the null hypothesis, $H_0$. (We either reject or fail to reject $H_0$.) In the same way, we usually focus on the probability of making type I error (rejecting the null hypothesis when it is true). This is because the null hypothesis reflects a 'status quo' or neutrality situation, and if we reject it we are making a statement saying that something is better or preferred, or worse, or different, depending on the situation.

Consider the following two hypotheses that could be used to examine the quality control process in a parachute factory.

$H_0$: The parachutes being produced will not open.

$H_A$: The parachutes being produced will open.

Describe what a type I error would be given these hypotheses. What are the practical implications of making a type I error?

Describe what a type II error would be given these hypotheses. What are the practical implications of making a type II error?

In many situations, making either error doesn't have much practical significance. In the two situations above, though, making one type of error is much more costly than making the other.

Here's another example: When the effectiveness of one medication is studied, ($H_0$: Medicine A is no more effective than current medications), a ' type I error' would mean that the new medicine is concluded to be better when it actually is no more effective. Type I error is usually considered a serious error and we like to have some control over it.

**Reference**

Seier, E., & Robe, C. (2002). Ducks and green – an introduction to the ideas of hypothesis testing. *Teaching Statistics, 24*(3), 82-86.