

## Statistics 7 – Practice Quiz 2

- A factory owner is interested in the effect of room temperature on the performance of tasks requiring manual dexterity. She chooses temperatures  $70^{\circ}F$  and  $90^{\circ}F$  as treatments. The response variable is the number of correct insertions, during a 30-minute period, in an elaborate peg-and-hole apparatus that requires the use of both hands simultaneously. Each subject is trained on the apparatus and then asked to make as many insertions as possible in 30 minutes of continuous effort.

  - Outline a completely randomized design to compare dexterity at  $70^{\circ}$  and  $90^{\circ}$ . Suppose that twenty subjects  $S_1, S_2, \dots, S_{20}$  are available for the experiment. Assume only one worker can be tested each day.
  - Because individuals differ greatly in dexterity, the factory owner decides to conduct a special kind of randomized block design called a matched pairs design. Describe in detail the design of a matched pairs design in which each subject serves as his or her own control. (Use only the first ten subjects.)
  - Which of two designs would you prefer, the completely randomized design or the matched pairs design?
  - Plants in different parts of the country are kept at different temperatures. Instead of the study above, the factory owner collects information on manual dexterity from workers at various plants. Is this an experiment, survey, or observational study? Briefly justify your answer.
- When the new euro coins were introduced in Europe in 2002, two Polish mathematicians spun a Belgian euro coin 250 times. They got 140 heads. Newspapers reported this result widely. Is it significant evidence that the coin is not balanced when spun? State hypotheses, give the test statistics, and calculate a p-value.
- To study the effect of calcium in the diet on blood pressure, a researcher divided 54 healthy Asian males at random into two groups. One group received calcium; the other a placebo. At the beginning of the study, the researchers measured many variables on the subjects. The mean of the seated systolic blood pressure of the 27 men in the placebo group was  $\bar{x} = 114.9$  and the standard deviation was  $s = 9.3$ .

  - Is this an experiment, a survey, or an observational study? Briefly explain.
  - Give a 95% confidence interval for the mean blood pressure in the population from which the subjects were recruited.
  - Briefly, but carefully, explain what this confidence interval means.
  - What assumptions about the population and the study design are required by the procedure that you used in part (b)?
- Margo and her grandmother have been selling Pizza on Balboa Island in their family shop called Geppetto's for fifty years. Margo's nephews, Mario and Guido make the pizza while Margo keeps the books. Recently business has been so good that Margo is considering opening new Geppetto's restaurants around the country. First, however, she wants to investigate the popularity of her pizza with various local tastes. She sends Mario to Macon, Georgia and Guido to Chicago, Illinois with instructions for them each to get a random sample of 20 pizza eaters near Pizza Hut restaurants. They are to give each subject a slice of Geppetto's pizza and a slice of Pizza Hut pizza and ask the subject to score each pizza on a scale of one to ten. The results appear in the table below.

| City    | Geppetto's Pizza | Pizza Hut        | Difference       |
|---------|------------------|------------------|------------------|
| Chicago | mean=8.4, sd=3.1 | mean=6.6, sd=2.7 | mean=1.8, sd=2.1 |
| Macon   | mean=6.3, sd=4.0 | mean=4.9, sd=3.6 | mean=1.4, sd=3.0 |

- Margo is confident that people will prefer her pizza to Pizza Hut, but she needs evidence before she puts her money on the line. Does it appear that pizza eaters in Chicago prefer Geppetto's pizza? State a formal significance test, compute a test statistic and a p-value, and state your conclusion.

- (b) What is the name of the test you used in part (a)? Why did you choose it? Did you need to make any assumptions? Are they reasonable?
- (c) Are there regional difference in how people rate Geppetto's Pizza? Focus on the rating for Geppetto's pizza and construct a 95% confidence interval for the difference of the mean rating in Chicago minus the mean rating in Macon. What do you conclude?
- (d) Margo is a shrewd business woman. She knows that even if people like her pizza, they will only buy it if they like it more than her competitor's pizza. Thus, Margo wants to open her first new store in the city where pizza eaters prefer her pizza by the largest margin. Is there any evidence that either Macon or Chicago is a better place for Margo to open her first new shop? State a formal significance test, conduct an  $\alpha = 0.05$  level test, and state your conclusion.