

## Group Project 4:

Answer these questions on a separate sheet of paper.

For each of the following scenarios, find one or more errors which invalidate the methods or conclusions.

1. A farmer wants to measure the weight of avocados on the fourth weekend of March. She walks through her avocado orchard, plucks 200 avocados off 40 different trees, and weighs them. She finds that the average weight of an avocado plucked on that date is .2 kg. She then calculates a confidence interval and asserts that with 95% confidence the average weight of an avocado in the fourth weekend of March is between .15 and .25 kg.

2. An orchestra surveys its members about what kind of music they listen to for recreation. It is discovered that 10% of the orchestra members listen to Mongolian Long Song. The orchestra calculates a confidence interval for the proportion and reports that between 8% and 12% of the orchestra members listen to Mongolian Long Song.

3. A well-known opera cliché says that “It’s not over ’til the fat lady sings”. Researchers at Wagner University take a SRS of 18 operas and count the number of times in each opera that a fat lady sings. They discover that on average a fat lady sings 20 times in each opera with standard deviation 8. The researchers report that on average, a fat lady sings between 16.3 and 23.7 times in an opera.

6. The last son, P.D.Q. Bach, of J.S. Bach is famous for his dreadful music. Sociologists want to determine if, on average, people think that P.D.Q. Bach is worse than a CD of Dogs Barking Christmas carols. They take a SRS of people who listen to music, play both recordings, and have the subjects assign awfulness rankings. The variable  $x_1$  represents the awfulness of PDQ Bach and the variable  $x_2$  represents the awfulness of Dogs Barking Christmas Carols. They use hypotheses

$$H_0 : \mu_1 = \mu_2$$

$$H_a : \mu_1 > \mu_2$$

They calculate that  $P = .1$  and write that they reject the null hypothesis; that is, they have evidence that people think PDQ is worse than Dogs Barking Christmas Carols

7. Economists want to test the hypothesis that there is less variation among the incomes of people with low incomes than there is among the incomes of those with high incomes. They take a SRS of 200 people with incomes below \$20,000/year and a SRS of 200 people with incomes above \$100,000/year. They discover that the standard deviation of the incomes of the sample with low incomes is \$5000/year and that for those with high incomes it is \$215000/year. The economists apply the F-test to the null hypothesis that there is no difference in standard deviations, obtain a small P value, and reject the null hypothesis.

Answer the following questions using either a confidence interval or a hypothesis test, as the situation demands. Be sure to set up your hypothesis tests carefully. Questions 8 - 12 use the following data regarding the performance of Malaysian 8<sup>th</sup> graders on a mathematics standardized test.

	Sex	N	Mean	Standard Deviation
Overall Score	Girl	3071	512	70.73
	Boy	2243	504	74.20
Number	Girl	3071	529	67.60
	Boy	2243	518	72.56
Algebra	Girl	3071	501	68.54
	Boy	2243	488	72.77
Measurement	Girl	3071	505	76.99
	Boy	2243	502	81.50
Geometry	Girl	3071	495	75.06
	Boy	2243	494	80.38
Data	Girl	3071	507	56.61
	Boy	2243	503	60.15

From: "Gender Differences in Mathematics Learning in Malaysia" by Awang and Ismail.

8. Estimate (with 98% confidence) the average overall score for all 8<sup>th</sup> grade Malaysian girls.
9. Estimate (with 90% confidence) the average difference between the boys' scores and the girls' overall scores.
10. Is there evidence that girls do better in geometry than boys?
11. Is there evidence that Malaysian boys have better algebra scores than the international average algebra score of 462?
12. Is there greater variation in how all 8<sup>th</sup> grade Malaysian boys do in Measurement than there is in how all 8<sup>th</sup> grade Malaysian girls do in measurement? For your answer to be valid, what conditions must be met?
13. Suppose that 20 girls (SRS) are each paired with a boy (from a SRS) of similar academic ability. Suppose that the average score of a girl on a statistics test is 400 (with  $s = 50$ ) and the average score of a boy on a statistics test is 405 (with  $s = 70$ ). The mean difference (girl - boy) is -0.25 (with standard deviation 15). Is there any evidence that boys are better at this statistics test than girls are?
14. Explain the results of your test in 13) to someone with no training in statistics.