# STAT 101
## Assignment 5

1. A manufacturer sells 500 gram packages of coffee. Federal inspectors select 64 packages at random from a month's production. The selected packages have an average weight of 498.5 grams. The manufacturers defend themselves against a charge of short weight by saying that some variation in packed weight is inevitable. They say they use a machine which puts in an average of 500 grams with a standard deviation of 4 grams and that it was just bad luck that the 64 sampled packages had such a low average weight. Is the manufacturers claim credible?

2. The concentration of cadmium in a lake is measured 17 times. The measurements average 211 parts per billion with an SD of 15 parts per billion. Could the real concentration of cadmium be below the standard of 200 ppb?

3. In 1879, over the period from June 5 to July 2, Michelson carried out a number of measurements of the speed of light. The first 20 measurements and last 20 measurements (minus 299000 km/sec) and several summary statistics are recorded below.

| First 20 | Second 20 | Difference |
|---|---|---|
| 850 | 890 | -40 |
| 740 | 840 | -100 |
| 900 | 780 | 120 |
| 1070 | 810 | 260 |
| 930 | 760 | 170 |
| 850 | 810 | 40 |
| 950 | 790 | 160 |
| 980 | 810 | 170 |
| 980 | 820 | 160 |
| 880 | 850 | 30 |
| 1000 | 870 | 130 |
| 980 | 870 | 110 |
| 930 | 810 | 120 |
| 650 | 740 | -90 |
| 760 | 810 | -50 |
| 810 | 940 | -130 |
| 1000 | 950 | 50 |
| 1000 | 800 | 200 |
| 960 | 810 | 150 |
| 960 | 870 | 90 |
| Average=909 | Average=831.5 | Average=77.5 |
| SD=104.9 | SD=54.2 | SD=109.8 |

   Has the bias of the measurements changed between the first 20 and the last 20?

4. The National Assessment of Educational Progress in the US administers nationwide

tests on academic subjects to students and young adults. One item on a mathematics test asked:

Do the following addition: $1/2 + 1/3 =$ .

About 66% of the 17 year olds in the US knew the answer was 5/6 (with 2/5 being the other popular answer). In order to compare their students with the national level a California school board chooses 400 students from their school system at random and finds 243 who get the answer right. Can this departure from the national standard be explained by chance?

5. Discount stores often introduce new merchandise at a special low price to induce people to try it. However, a psychologist predicted that in the long run this practice would reduce sales. An experiment was performed in 1968 to test this. Twenty-five pairs of stores were selected, matched according to such characteristics as location and sales volume. These stores did not advertise and displayed their merchandise in similar ways. A new kind of cookie was introduced in all 50 stores. In each pair of stores one was chosen to introduce the cookies at the special introductory price of 25 cents, the price increasing to 29 cents after 2 weeks; the other store in the pair introduced the cookies at 29 cents a box. (1968 prices here) Total sales of the cookies were computed for each store for the six week period from the time of introduction. In 18 of the 25 pairs the store which introduced the cookies at the regular price turned out to have sold more of the cookies than the other store. How strong is the evidence that introducing the cookies at a discount price lowers total sales?

6. If 3800 spins of a roulette wheel yield 1868 reds does it appear that the probability of red is 18/38?

7. In the table below are the sepal lengths for each of 50 flowers of 2 species of iris. Do Versicolor and Virginica Irises have different average sepal lengths?

| Versicolor | | Virginica | |
|---|---|---|---|
| 7.0 | 6.6 | 6.3 | 7.2 |
| 6.4 | 6.8 | 5.8 | 6.2 |
| 6.9 | 6.7 | 7.1 | 6.1 |
| 5.5 | 6.0 | 6.3 | 6.4 |
| 6.5 | 5.7 | 6.5 | 7.2 |
| 5.7 | 5.5 | 7.6 | 7.4 |
| 6.3 | 5.5 | 4.9 | 7.9 |
| 4.9 | 5.8 | 7.3 | 6.4 |
| 6.6 | 6.0 | 6.7 | 6.3 |
| 5.2 | 5.4 | 7.2 | 6.1 |
| 5.0 | 6.0 | 6.5 | 7.7 |
| 5.9 | 6.7 | 6.4 | 6.3 |
| 6.0 | 6.3 | 6.8 | 6.4 |
| 6.1 | 5.6 | 5.7 | 6.0 |
| 5.6 | 5.5 | 5.8 | 6.9 |
| 6.7 | 5.5 | 6.4 | 6.7 |
| 5.6 | 6.1 | 6.5 | 6.9 |
| 5.8 | 5.8 | 7.7 | 5.8 |
| 6.2 | 5.0 | 7.7 | 6.8 |
| 5.6 | 5.6 | 6.0 | 6.7 |
| 5.9 | 5.7 | 6.9 | 6.7 |
| 6.1 | 5.7 | 5.6 | 6.3 |
| 6.3 | 6.2 | 7.7 | 6.5 |
| 6.1 | 5.1 | 6.3 | 6.2 |
| 6.4 | 5.7 | 6.7 | 5.9 |

8. From text: page 492 # 18.26

9. From text: page 496 # 18.36

10. From text: page 538 # 20.26

11. From text: page 539 # 20.32

12. From text: page 574 # 23.34

13. Three treatments are to be compared for a disease of fruit trees called fire blight: control, removal of affected branches and spraying with antibiotic. Each treatment is tried on 20 trees selected at random and the results are classified into one of three groups: trees that die in the year the disease is diagnosed, trees that die in the 2nd to 4th year after the disease is noticed and trees that survive for more than 4 years. The data are:

| | Control | Pruning | Spraying |
|---|---|---|---|
| 1 Year | 12 | 7 | 4 |
| 2 to 4 years | 5 | 7 | 9 |
| More than 4 years | 3 | 6 | 7 |

Do the three treatment groups differ in effect?

As you do the problem you will need to complete the following table of expected cell counts. Your answer should include this table.

| | Control | Pruning | Spraying |
|---|---|---|---|
| 1 Year | 7.667 | 7.667 | 7.667 |
| 2 to 4 years | | | 7 |
| More than 4 years | | | 5.333 |

It will also be helpful to have the following tables of components of $X^2$. Your answer should include the completed table.

| | Control | Pruning | Spraying |
|---|---|---|---|
| 1 Year | 2.449 | 0.058 | 1.754 |
| 2 to 4 years | 0.571 | | 0.571 |
| More than 4 years | | 0.083 | 0.521 |