MAT212 Final (Spring 2003)

Including new material on sections 13.6 and Linear Regression

Name:

Directions:

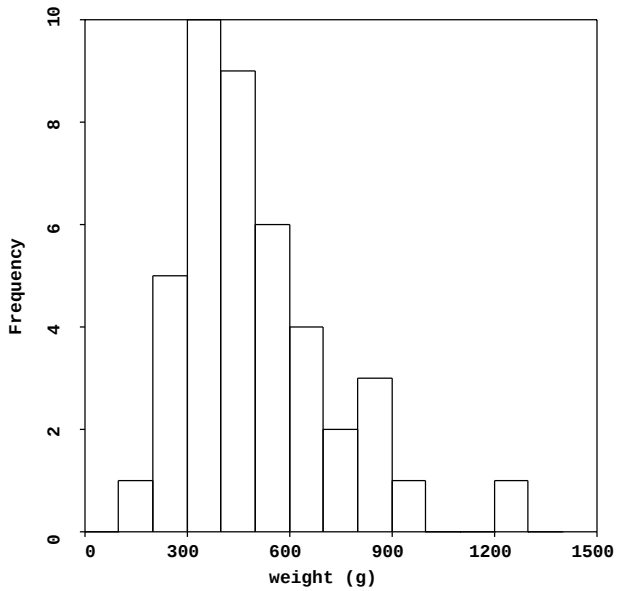
- Points for each problem are in parentheses. All answers to be graded must be on this test. Show all work to receive any credit.
- Table values (normal and t) are attached to your test, as are certain Minitab results relevant to particular problems. When using the tables, specify how you obtained a result.
- Remember to attach your linear regression homework to this test, once you've finished, as well as your "formula (etc.) sheet". Good luck!

Problem 1. As a fish farmer ("aquaculturist"), you discover in the literature a claim that weights of catfish raised in tanks like yours are normally distributed with a mean weight of 2 pounds, and a standard deviation of .4 pounds. Supposing this is true:

1. Your local grocery store will only buy your fish that weigh between 1.5 and 3 pounds. Assuming that your fish possess the distribution described above, find the percentage of your fish that have weights between these values. (10 points)

2. You can't even give away catfish in the bottom 5% of the distribution – they're just too small. What is the smallest fish (give its weight) that may be sold? (10 points)

Problem 2. You study your rainbow trout weight distributions for evidence of a relationship similar to that of the catfish of Problem 1. A sample of 42 fish produces the following histogram:



1. Characterize the distribution based on this histogram (8)

2. Which is the best estimate of the median: 400, 600, or 800 grams? Explain why. (4)

3. Is the median a consistent estimator? Is it unbiased? (4)

4. Is the median of the sample an example of a statistic or a parameter? Why? (4)

Problem 3. *Refer to the Minitab analyses when appropriate on this problem.* You also measure the lengths of your trout sample. Length is known to have a standard deviation of 55 millimeters. Estimate with 95% confidence the true mean length (in millimeters) among all farm-raised rainbow trout. (15)

Problem 4. *Refer to the Minitab analyses when appropriate on this problem.* A new strain of rainbow trout has just hit the market. You buy some and try them for a year, hoping that they will improve your weight yield. You carefully match 42 fish, so that the only difference in their upbringing is their strain – old versus new, weight versus nweight.

1. Estimate with with 95% confidence the difference in mean weights between the two strains. (18)

2. State when the procedure used in part A is valid. (5)

Problem 5. Your salmon have been weighing in at a mean of 5 pounds. Through selective breeding you have produced a salmon that seems to be averaging a little more to you. You select 15 salmon randomly from your tanks, and find that their mean weight is 5.6 lbs, with a standard deviation of 1.2 pounds.

1. Is there evidence that the new salmon is heavier than the old? Test using a 5% significance level. (16 points)

2. Under what conditions will your test be valid? (4 points)

Problem 6. A test question on a national exam was given to two groups of similarly prepared, but racially distinct, students (the "blues" and the "greens"). Bias due to race, ethnicity, and other issues is a problem in such exams, so we need to assure that certain groups of students are not either advantaged nor disadvantaged. The results of the comparison are as follows. Is there evidence of a

Group	Blues	Greens
correct	448	265
incorrect	552	235

difference in the proportions of correct answers between the two groups? Test using a .01 level of significance. (18)

Problem 7. A recycling program in a town would require 25% participation in order to be financially self-supporting. You conduct a random sample of 150 homeowners in the area, and find that 42 state that they would be willing to participate.

1. Is there evidence to support implementing this program from a financial standpoint? Test using $\alpha = .01$. (14)

2. Describe a Type I Error and its consequences in terms of this problem. Would the townspeople want a large or small value of α? Explain. (6)

Problem 8. A random sample of 30 receipts for your company's sales over its two-year history produces a mean of \$400 and a standard deviation of \$200.

1. Estimate with 90% probability the mean of the sales distribution for your company. (10)

2. If sales are distributed such that 55% of the sales are above the true mean, what is the probability that more than half the receipts in a sample of 100 sales receipts will be above the true mean? (10)

Problem 9. Broiler (poultry) farm waste disposal practices are thought to be affecting the quality of groundwater in north-central Florida. In this study, 18 monitoring wells were installed at five Florida broiler farms and monitored quarterly from March 1992 through January 1993. Collected data included concentrations of potassium and nitrates (mg/L). We suspect that the two are linearly related, and so conduct a linear regression.

1. Give the Least Squares prediction equation and interpret the coefficients in terms of this problem. (4)

2. Is there evidence that the nitrates are linearly related to the potassium concentrations? Use $\alpha = .05$. (8)

3. Fully describe the strength of the linear relationship. (4)

4. If appropriate, use 95% confidence to predict the nitrates for a water sample with a concentration of 1 mg/L. (4)

5. If appropriate, use 95% confidence to predict the nitrates for a water sample with a concentration of 4 mg/L. (4)