MAT 122
FINAL EXAMINATION (v1)
4 May 2009
Prof. V. Fatica

SIGN THIS COVER PAGE AND ENTER YOUR SUID NUMBER BELOW.

Name______________________________________________

SUID________________________________________________

READ AND FOLLOW THESE INSTRUCTIONS

There are six (6) questions on this examination. Check that your exam booklet is complete. Answer the questions in the spaces provided in this exam booklet. Show work where possible; partial credit requires some correct and appropriate work. Calculators and formula cards are allowed. Other materials are not allowed. If you need scratch paper, ask one of the exam proctors.

Do not write below this line.

Question 1 (10) ________
Question 2 (10) ________
Question 3 (10) ________
Question 4 (10) ________
Question 5 (10) ________
Question 6 (10) ________
Total (60) ________
1. A certain soft-drink bottling machine is supposed to put 12 ounces of product into each bottle. In a recent quality control inspection, a sample of the contents of 25 bottles from this machine had a mean of 11.86 ounces and a standard deviation of .24 ounces. At the .05 level of significance test the claim that the mean contents of all bottles from that machine is less than 12 ounces.
2. It is rumored that at least 25% of the students in a certain statistics professor’s class get an “A”. In an examination of 300 student records 62 A’s were found. Using these observations, test the rumored claim at the .05 level of significance.
3. In a recent government survey of 800 randomly selected households in California, 74 were found to be living below the national poverty level standard. In a similar survey of 300 households in Vermont, 21 were found to be living below the poverty level standard. Use the data from these surveys and a significance level of .05 to test the claim that the proportion of families living below the poverty level is the same in both states.
4. At an archaeological excavation, diggers found the fossil remains of 10 prehistoric creatures. They recorded the depth (x) in feet at which each fossil was found and later, paired these depth with ages of the bones (y) in tens of thousands of years (the ages were determined by Carbon-14 dating). The data and the results of some preliminary statistical calculations appear below.

<table>
<thead>
<tr>
<th>x (depth, feet)</th>
<th>125</th>
<th>137</th>
<th>147</th>
<th>166</th>
<th>182</th>
<th>185</th>
<th>188</th>
<th>195</th>
<th>201</th>
<th>205</th>
</tr>
</thead>
<tbody>
<tr>
<td>y (age, yrsx10,000)</td>
<td>85</td>
<td>86</td>
<td>88</td>
<td>92</td>
<td>95</td>
<td>103</td>
<td>100</td>
<td>103</td>
<td>100</td>
<td>120</td>
</tr>
</tbody>
</table>

\[ \sum x = 1731 \quad \sum y = 972 \quad \sum x^2 = 306703 \quad \sum y^2 = 95472 \quad \sum xy = 170545 \]

(a) Perform a hypothesis test using \( \alpha = .05 \) to determine if there exists a significant linear correlation between the depths and the ages (you should find one).

(b) Find the equation of the regression line.

(c) Use the regression line to give a point estimate of the age (in years) of a fossil found at a depth of 215 feet.
5. According to the 2000 census, the American population is approximately 77% white, 11% black, 4% Asian, and 8% other. A certain employer of a large number of workers claims a "diversified workforce"; i.e., a workforce that resembles the whole American population. When public relations officers sampled 1000 workers in this company, they found 792 white, 112 black, 52 Asian, and 44 other workers. Conduct a hypothesis test using $\alpha = .05$ to test the "goodness of fit" of the distribution in the sample to the distribution in the American population at large. Did the PR people find evidence that their claim of a diversified workforce is not justified?
6. In each of 10 consecutive weeks, quality control inspectors sampled 100 automobile tires produced by a certain machine (1000 tires in all) looking for ones that were deficient in some way. The numbers of deficient tires found in the 10 samples were: 4, 5, 4, 6, 3, 9, 3, 5, 6, 5.

Construct a control chart for the proportion of deficient tires produced by this machine during the 10 weeks. Is there any evidence that this process is not statistically stable? If yes, give reasons.