Instructions: 1. **WORK ALL PROBLEMS.** Please, give details and explanations and **SHOW ALL YOUR WORK** so that partial credits can be given.
2. You may use two pages (both sides) of notes, statistical tables and a calculator.

---

### Points

1. Suppose we want to estimate the proportion of high school seniors in a large city who plan to continue their education at an in-state college or university.
   
   a. How large a sample should be so that we can assert with 95% confidence that the margin of error of the estimation is less than 3%?
   
   (7)

   b. Suppose we have some prior knowledge that the above proportion is about 0.65. With 99% confidence and 5% of margin of error find the sample size.

   (8)

   c. In a survey of 260 students we found out that 170 are planning to continue their education. Find a 98% confidence interval for the proportion of students who plan to continue their education.

   (10)

2. The lead content of measurements taken at six Napa Valley wineries are:
   
   0.08, 0.22, 0.34, 0.31, 0.39, 0.25
   
   The recommended maximum level of lead set by the state is 0.20 mg/liter. Can we conclude that the wineries, on the average, exceed the state limit?

   a. State the null and alternative hypotheses.

   (5)

   b. Test at 0.01 level of significance.

   (15)

   c. Find the p-value.

   (5)

3. The following data represent the amount of time spent by seven randomly selected students to complete a computer programming task. Find a 95% confidence interval for the standard deviation of the time it takes to complete this programming task.

   12, 15, 11, 18, 20, 17, 21
   
   What is the meaning of this confidence interval?

   (20)

4. The American Dental Association is examining the effectiveness of two types of medication for reducing pain during dental work. A pain index is used to measure pain felt by the patient. The sample information is given below:

<table>
<thead>
<tr>
<th>Sample Size</th>
<th>Sample mean</th>
<th>Sample Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medication I</td>
<td>18</td>
<td>6.1</td>
</tr>
<tr>
<td>Medication II</td>
<td>20</td>
<td>8.7</td>
</tr>
</tbody>
</table>
   
   Is there a difference between the mean pain indices of these two medications?

   a. Write down the null and alternative hypotheses.

   (5)

   b. Test the hypothesis at 0.01 level of significance.

   (10)

   c. Find the p-value.

   (5)

   d. Construct a 99% confidence interval for the difference between the two means.

   Does this confidence interval supports the null hypothesis in part a? Explain your answer.