1 Hypotheses

Each of the following situations requires a significance test about a population mean $\mu$. State the appropriate null hypothesis $H_0$ and alternative hypothesis $H_a$ in each case:

(a) Census Bureau data shows that the mean household income in the area served by a shopping mall is $72,500 per year. A market research firm questions shoppers at the mall to find out whether the mean household income of mall shoppers is higher than that of the general population.

(b) Last year, your company’s service technicians took an average of 1.8 hours to respond to trouble calls from business customers who had purchased service contracts. Do this year’s data show a different average response time?

2 Metric Conversion

Shortly after metric units were introduced in Australia, a group of 44 students was asked to guess, to the nearest meter, the width of the lecture hall in which they were sitting.

The table shows the ordered results of the students’ guesses.

<table>
<thead>
<tr>
<th>8</th>
<th>9</th>
<th>10</th>
<th>10</th>
<th>10</th>
<th>10</th>
<th>10</th>
<th>11</th>
<th>11</th>
<th>11</th>
<th>11</th>
<th>12</th>
<th>12</th>
<th>13</th>
<th>13</th>
<th>14</th>
<th>14</th>
<th>14</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>17</td>
<td>17</td>
<td>17</td>
<td>17</td>
<td>18</td>
<td>18</td>
<td>20</td>
<td>22</td>
</tr>
<tr>
<td>25</td>
<td>27</td>
<td>35</td>
<td>38</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The sum of the guesses adds to 705 meters.

(a) (3 points) Based on the data, give the following summaries:

- Minimum: ____________
- Mean: ____________
- Median: ____________
- Mode: ____________
- Maximum: ____________
- Range: ____________

(b) (1 point) Explain the difference between the median and the mean value.

(c) (3 points) The above data has an estimated variance of 51.0. Compute a 90% confidence interval for the true width of the room. What factors would make your confidence interval smaller?

(d) A second group of 69 students were asked to guess the width of the same room in feet, measured to the nearest foot. (1 foot = 0.305 meter). Their average guess was 43.7 ft with a standard deviation of 7.85 ft.

(a) (1 point) Transform the above estimates, i.e. average guess and standard deviation, from feet to meter.

(b) (5 points) Does the data support that the students’ guesses in ft are significantly different from the guesses in m? Show all five steps of a hypothesis test.
3 Spending Habits

A questionnaire of spending habits was given to a random sample of college students. Each student was asked to record and report the amount of money they spent on textbooks in a semester. The sample of 130 students resulted in an average of $422 with standard deviation of $57.

(a) Give a 90% confidence interval for the mean amount of money spent by college students on textbooks.

(b) Is it true that 90% of the students spent the amount of money found in the interval from part (a)? Explain your answer.

(c) What is the margin of error for the 90% confidence interval?

(d) How many students should you sample if you want a margin of error of $5 for a 90% confidence interval?

4 Pre and Post Test Results

Assume a group of six students is taking two tests: one at the beginning of the semester, the other one at the end of it.

<table>
<thead>
<tr>
<th>Student ID</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test 1</td>
<td>67</td>
<td>72</td>
<td>64</td>
<td>60</td>
<td>70</td>
<td>71</td>
</tr>
<tr>
<td>Test 2</td>
<td>68</td>
<td>71</td>
<td>78</td>
<td>81</td>
<td>84</td>
<td>71</td>
</tr>
</tbody>
</table>

Based on the results above, does the data support that there is an improvement over the course of the semester? Show all steps of a hypothesis test. (5 points)