Statistics 101L – Laboratory 4

In this lab we will investigate whether we can use a Normal model to describe the distribution of ACT Composite scores.

Below is a table of Percentile Ranks for Enhanced ACT Composite scores for freshmen entering ISU in Fall 2012.

<table>
<thead>
<tr>
<th>ACT Composite</th>
<th>16</th>
<th>17</th>
<th>18</th>
<th>19</th>
<th>20</th>
<th>21</th>
<th>22</th>
<th>23</th>
<th>24</th>
<th>25</th>
<th>26</th>
<th>27</th>
<th>28</th>
<th>29</th>
<th>30</th>
<th>31</th>
<th>32</th>
<th>33</th>
<th>34</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentile Rank</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>11</td>
<td>17</td>
<td>22</td>
<td>34</td>
<td>43</td>
<td>53</td>
<td>62</td>
<td>70</td>
<td>79</td>
<td>86</td>
<td>91</td>
<td>94</td>
<td>97</td>
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The Percentile Rank is interpreted in the following way; 53% of all ACT Composite scores are 25 or below. Similarly, 43% of all ACT Composite scores are 24 or below. From this we know that $53 – 43 = 10\%$ of all ACT Composite scores are equal to 25.

1. Create a new table indicating the percentage of all ACT Composite scores that are equal to each of the values 16, 17, …, 34.
2. Construct a histogram based on the information from the table you create in 1. To do this using JMP first create a data table with two columns. One column is for the ACT scores and the second column is for the corresponding percentages. Use Analyze – Distribution and put the ACT scores as the Y, Columns and percentage as the Freq. You will probably have to use the Axis Settings and the “grabber” to create a “nice looking” histogram. Include a probability axis on the histogram. You can also have JMP create a Normal Quantile Plot.
3. Describe the shape of the histogram.
4. Consider a Normal model for the ACT Composite score with $\mu=24.9$ and $\sigma=3.8$. Sketch this model on top of you histogram. If you have used JMP to create the histogram you can chose to Fit Distribution – Normal. JMP will estimate a mean and standard deviation but you can change these to 24.5 and 4.0, respectively by going to the red triangle pull-down menu next to Fitted Normal and choosing Fix Parameters and entering User Defined Values. Turn in the JMP output.
5. Construct a table similar to the percentile rank table above except use the Normal model with $\mu=24.9$ and $\sigma=3.8$ to compute the probability of being less than or equal to each of the ACT values 16, 17, …, 34. Use the web site [http://davidmlane.com/hyperstat/z_table.html](http://davidmlane.com/hyperstat/z_table.html) to compute these probabilities. Rounded the probabilities to 2 decimal places and report them as percentages.
6. How do the percentages computed in 5 compare to the Percentile Ranks in the table above?
7. Based on your answers above do you think that a Normal model with $\mu=24.9$ and $\sigma=3.8$ is a reasonable model for ACT Composite scores? Explain briefly.
101L – Laboratory 4
Answer Sheet

Names: ________________________  ________________________

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1. Percentage

5. Normal model %
\(\mu=24.9\) and \(\sigma=3.8\)

3. Describe the shape of the histogram

6. Compare Percentile Ranks to Normal model percentages.

7. Is a Normal model with \(\mu=24.9\) and \(\sigma=3.8\) a reasonable model for ACT Composite scores? Explain briefly.