Read each question very carefully. You are permitted to use a calculator on all portions of this exam. You are NOT allowed to use any textbook, notes, cellphone, or laptop on either portion of the exam. No part of this exam may be removed from the examination room.

In order to receive full credit for the free response portion of the exam, you must:
1. Show legible and logical (relevant) justification which supports your final answer.
2. Use complete and correct mathematical notation.
3. Include proper units, if necessary.

You have 1 hour 30 minutes to complete the entire exam.

On my honor, I have neither given nor received inappropriate or unauthorized information during this exam.

Student’s Signature: ____________________________________________

Free Response

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible Points</th>
<th>Points Earned</th>
</tr>
</thead>
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<td></td>
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<tr>
<td>1b</td>
<td>8</td>
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<td>6</td>
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<td>3b</td>
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<td>3c</td>
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<td>Multiple Choice</td>
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<td>Test Total</td>
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</tbody>
</table>
Multiple Choice: (Questions 1 - 17) Answer the following questions on the scantron provided using a #2 pencil. Bubble the response that best answers the question. Each multiple choice correct response is worth 3 points. For your record, also circle your choice on your exam since the scantron will not be returned to you. Only the responses recorded on your scantron will be graded.

1. The stem and leaf display below shows the service times (in seconds) for a sample of 25 customers at Frank’s Hotdogs.

   Leaf Unit = 1.0
   
   8 |0113467789
   9 | 1233
   10 | 245
   11 |34
   12 |05
   13 |23
   14 |
   15 |9
   16 |
   17 |
   18 |
   19 |
   20 |0

The smallest value in the data set corresponds to what value?

   A) 80 seconds  
   B) 8 seconds  
   C) 0 seconds  
   D) 0.8 seconds  
   E) 0.08 seconds

2. Which of the following variables would have a distribution that is left skewed?
   A) Number of meals eaten a day by students  
   B) Weights of strawberries  
   C) Scores on an easy test  
   D) Scores on a hard test  
   E) None of the above variables would have a distribution that is left skewed.

3. Classify the following variable as either Nominal, Ordinal, Interval, or Ratio:

   Amount of gas (in gallons) purchased by a gas station customer

   A) Nominal  
   B) Ordinal  
   C) Interval  
   D) Ratio
4. A statistics class consists of 30 males and 20 females. Ten of the males and ten of the females are also currently enrolled in a science course. A student is selected at random from those enrolled in this statistics class. Given that the selected student is female, what is the probability that the selected student is enrolled in a science course?

A) 0.1  
B) 0.2  
C) 0.4  
D) 0.5  
E) 0.6

5. A data set consists of five numbers:

\[
\begin{array}{cccc}
-6.0 & -4.5 & 0 & 5.0 \\
\end{array}
\]

(an unknown 5\textsuperscript{th} number)

For these five data points, which of the following statistics can \textit{never} be greater than zero?

A) The mean  
B) The sample standard deviation  
C) The interquartile range  
D) The median  
E) The upper quartile

6. Fishermen fishing for spiny lobster are allowed to keep only lobsters with a carapace length of 3.25 inches or longer. (The carapace length is measured from the rear edge of the eye socket to the rear edge of the body shell.) Any lobster smaller than 3.25 inches must be returned to the sea. Suppose that lobster carapace lengths have a distribution that is mound shaped and approximately symmetric with a mean of 5.50 inches and a standard deviation of 2.25 inches. Using the Empirical Rule approximately what proportion of lobsters will have to be returned to the sea?

A) 16%  
B) 32%  
C) 50%  
D) 68%  
E) 84%

7. Classify the following variable as either Nominal, Ordinal, Interval, or Ratio:

A student’s type of residence (dorm, apartment, house)

A) Nominal  
B) Ordinal  
C) Interval  
D) Ratio
8. In a survey of 100 students selected at random from those enrolled at a small liberal arts college, the following data was obtained. Each student was asked how much time he or she spent on the Internet during a typical day, and gender was also noted.

<table>
<thead>
<tr>
<th></th>
<th>None</th>
<th>Less than 1 hour</th>
<th>1 hour or more</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>15</td>
<td>20</td>
<td>30</td>
<td>65</td>
</tr>
<tr>
<td>Female</td>
<td>10</td>
<td>15</td>
<td>10</td>
<td>35</td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td>35</td>
<td>40</td>
<td>100</td>
</tr>
</tbody>
</table>

Assume that this data is representative of students at this college.

If a randomly selected student is male, what is the approximate probability that he spends 1 hour or more on the Internet in a typical day?

A) 30/30  
B) 30/40  
C) 30/65  
D) 35/65  
E) 30/100

9. Under what conditions is it true that $P(A \text{ or } B) = P(A) + P(B)$?

A) A and B must be mutually exclusive  
B) A and B cannot be mutually exclusive  
C) A and B must be independent  
D) A and B must be both mutually exclusive and independent  
E) No conditions are required. It is always true that $P(A \text{ or } B) = P(A) + P(B)$

10. Classify the following variable as either Discrete, Continuous or Neither:

   Number of items purchases by a grocery store customer

A) Discrete  
B) Continuous  
C) Neither
11. In a study of birds in a national park, three species (labeled A, B, and C) were observed. Each bird in a sample of size 36 was classified by species. The species data were then used to construct the pie chart below. Approximately how many birds in the sample were species C?

A) 8  
B) 12  
C) 20  
D) 24  
E) 30
12. The lengths (in feet) of 142 roller coasters are summarized in the following histogram.

![Histogram of Length (feet)](image)

What is the proportion of roller coasters with a length less than 2500 feet?

A) 0.500  
B) 0.380  
C) 0.268  
D) 0.232  
E) 0.099

13. Classify the following variable as either Quantitative, Qualitative or Neither:

Price of a textbook

A) Quantitative  
B) Qualitative  
C) Neither
14. Which of the following statements are true?

I. It is impossible for a data set to have a standard deviation that is larger than the mean.
II. If two data sets have different ranges, the data set with the larger range will always have the larger standard deviation.
III. The interquartile range of a data set can never be larger than the range.

A) I only
B) II only
C) III only
D) II and III only
E) I, II, and III

15. In a survey of 100 students selected at random from those enrolled at a small liberal arts college, the following data was obtained. Each student was asked how much time he or she spent on the Internet during a typical day, and gender was also noted.

<table>
<thead>
<tr>
<th></th>
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<th>Less than 1 hour</th>
<th>1 hour or more</th>
<th>Total</th>
</tr>
</thead>
<tbody>
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<td>Male</td>
<td>15</td>
<td>20</td>
<td>30</td>
<td>65</td>
</tr>
<tr>
<td>Female</td>
<td>10</td>
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</tr>
<tr>
<td>Total</td>
<td>25</td>
<td>35</td>
<td>40</td>
<td>100</td>
</tr>
</tbody>
</table>

Assume that this data is representative of students at this college.

What is the approximate probability that a randomly selected student at this college is a female who spends no time on the Internet in a typical day?

A) 10/10
B) 10/15
C) 10/25
D) 10/35
E) 10/100

16. Fifty observations on waiting time (rounded to the nearest minute) for patients at a walk-in medical clinic were used to compute a sample mean waiting time. The two largest observations in the data set were 75 minutes and 120 minutes. It was later determined that there was an error in recording the data and the observation of 120 minutes should have been 12 minutes. How would correcting this error affect the sample mean?

A) The corrected sample mean will be smaller
B) The correction will not change the value of the sample mean.
C) The corrected sample mean will be larger
D) The correct sample mean will be smaller only if the original sample mean (computed with 120 as one of the observations) was greater than 12.
E) It is not possible to determine if the corrected sample mean will be larger or smaller than the original sample mean.
17. Determine if the following is descriptive statistic or an inferential statistic.

Out of a sample of 500 students it is found that 27% drive an American made car.

A) Descriptive Statistic
B) Inferential Statistic
C) Neither
1. Tom Brady is the quarterback for the New England Patriot’s (one of the teams in the 2015 Super Bowl). Below is a list of the number of touchdown passes in a Super Bowl for quarterback Tom Brady (from 2001 – 2014). Consider this data a sample of his super bowl appearances (there may be more in the future).

<table>
<thead>
<tr>
<th># of Touch Down Passes</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>2</td>
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<td>1</td>
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<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

A) **(6 pts)** Calculate the mean number of touchdown passes for Tom Brady in a Super Bowl (2001 – 2014). (Give answer to 4 decimal places) Show work. Give proper notation and units.

B) **(8 pts)** Calculate the standard deviation of the number of touchdown passes for Tom Brady in a Super Bowl (2001-2014). (Give to 4 decimal places) Show work. Give proper notation and units.
2. Each of 311 people who purchased a Honda Civic was classified according to gender and whether the car purchased had a hybrid engine or not.

<table>
<thead>
<tr>
<th></th>
<th>Hybrid</th>
<th>Not Hybrid</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>77</td>
<td>117</td>
<td>194</td>
</tr>
<tr>
<td>Female</td>
<td>34</td>
<td>83</td>
<td>117</td>
</tr>
<tr>
<td>TOTAL</td>
<td>111</td>
<td>200</td>
<td>311</td>
</tr>
</tbody>
</table>

A) (6 pts) Calculate both $P(\text{hybrid} | \text{female})$ and $P(\text{female} | \text{hybrid})$. Give answer in 4 decimal places.

B) (8 pts) Using probabilities determine whether the events being female and having a hybrid are independent of one another. Show all work.
3. The values shown below are the observations on the number of cars rented at a rental car facility on 20 randomly selected days last year.

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>2</th>
<th>6</th>
<th>9</th>
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<td>30</td>
<td>33</td>
<td>37</td>
<td>40</td>
<td>59</td>
<td></td>
</tr>
</tbody>
</table>

A) **(5pts)** Find the five number summary of the dataset. Show work

B) **(4 pts)** Calculate the lower and upper fences for the data above. Show work

C) **(6 pts)** Draw a boxplot for the data above.
4. Identify the following statistical study described as an observational study or an experiment:

The article “Tots TV-Watching May Spur Attention Problems” (San Luis Obispo Tribune) described a study that appeared in the journal. *Pediatrics*. Researchers looked at records of 2500 children who were participating in a long-term health study. They found that 10% of these children had attention disorders at age 7 and that the number of hours of television watched at ages 1 to 3 was associated with an increased risk of having an attention disorder at age 7.

*(5 pts) Give a brief explanation for your choice of observational study or experiment.*

5. *(1 pt)* If your scantron is correctly bubbled with a #2 pencil, with your correct XID, your correct test version, AND the front of your test is completed with your signature on the academic integrity statement, you earn 1 point.

END OF TEST