Exam 1 Key

Concepts: (2 Points Each) For each of the following, give a one or two sentence explanation that best answers the question.

1. What are the two types of statistics? Give a short definition of each. Page 5
2. What are the two types of data? What is the main difference between these types? Give examples of each. Pages 12 and 13
3. In a data set that is skewed to the right what is the relation between the mean \( \mu \) and the median \( M \)? Page 59
4. What is the relation between the standard deviation and the variance? Page 69
5. What are the two types of random variables and what is the main difference between the two? Page 191
6. What does it mean for two events to be independent? Page 151
7. State Chebyshev’s Rule. Page 73
8. State the Empirical Rule. Page 74
9. What does \( \binom{n}{k} \) count? Page 208
10. What is the main difference between a binomial random variable and a hypergeometric random variable? Page 225

Calculations: (10 Points Each) Calculate the following, using at least 3 significant digits for any approximate solution and if your answer is in exact form you may leave it in exact form.

1. Find \( \sum_{i=2}^{6} i^2 \): 90
2. For the following set of data find the mean, median and standard deviation.
   Data: 12, 32, 13, 23, 43, 21, 22.
   Median = 22, Mean = 23.71428571, Standard Deviation = 10.82765419
3. In preparation for an experiment on human subjects a researcher has divided 149 people into two groups, Group A and Group B. The age of each participant was recorded and the two-way table summarizing the age/group distribution is given below.

<table>
<thead>
<tr>
<th></th>
<th>18-30</th>
<th>31-50</th>
<th>51+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>23</td>
<td>37</td>
<td>12</td>
</tr>
<tr>
<td>Group B</td>
<td>14</td>
<td>21</td>
<td>42</td>
</tr>
</tbody>
</table>

(a) If a person is chosen at random what is the probably that they are in Group B and are in the 18-30 age group? \( \frac{14}{149} = 0.0939597315 \)
(b) If a person is chosen at random what is the probably that they are in Group B or are in the 51+ age group? \( \frac{89}{149} = 0.5973154362 \)
(c) If a person is chosen at random what is the probably that they are in Group B given that they are in the 31-50 age group? \( \frac{21}{58} = 0.3620689655 \)
(d) If a person is chosen at random what is the probably that they are in the 18-30 age group given that they are in Group A? \( \frac{23}{72} = 0.3194444444 \)
(e) Are the events of being in Group A and being in the 31–50 age group independent? Why or why not? \( P(A) = \frac{72}{149} = 0.4832214765 \) and \( P(A|31–50) = \frac{37}{58} = 0.6379310345 \) hence the events are dependent.

4. It is known that 20% of all Americans have a cup of coffee in the morning. We randomly selected 10 people and counted the number, \( x \), that drink coffee in the morning. Find the following probabilities. Do \( a - d \) using the tables or equivalent function on your calculator and do \( e \) by using the appropriate formula.

(a) \( P(x < 3) = 0.677995526 \)
(b) \( P(2 < x < 5) = 0.2894069764 \)
(c) \( P(3 \leq x \leq 5) = 0.3158310916 \)
(d) \( P(x > 3) = 0.1208738816 \)
(e) \( P(x = 4) = 0.088080384 \)

5. The average number of patients that visit the emergency room at the Salisbury Hospital in any given hour is 5.2. Let \( x \) represent the number of patients that visit the emergency room at the Salisbury Hospital next Monday evening between 7 PM and 8 PM. Find the following probabilities. Do \( a - d \) using the tables or equivalent function on your calculator and do \( e \) by using the appropriate formula.

(a) \( P(x = 5) = 0.174785003 \)
(b) \( P(x < 7) = 0.7323933408 \)
(c) \( P(x \leq 3) = 0.2380654987 \)
(d) \( P(3 \leq x \leq 6) = 0.6236066904 \)
(e) \( P(x = 3) = 0.129788483 \)

Minitab Output Interpretation: (10 Points Each)

1. Answer the following questions for the box plot below.

(a) What is the lower quartile? 10
(b) What is the median? 15
(c) What is the upper quartile? 22
(d) What is the IQR? 12
(e) Is the data set skewed? If so which way? Yes, right
(f) Where are the inner fences? **0 and 39**

(g) What data values are considered suspect outliers? **44, 47**

(h) What data values are considered highly suspect outliers? **70**

2. Answer the following questions for the histogram below.

![Histogram of Otis](image)

(a) Describe the distribution. **Symmetrical and mound shaped.**

(b) What is the approximate mean? **105**

(c) Which class is the modal class? **102.5 - 107.5**

(d) Using the Empirical Rule, estimate the standard deviation? **16**

(e) Does the Empirical Rule apply to this data set? Why or why not? **Yes, the distribution is symmetrical and mound shaped.**

(f) Using one sixth of the range for the estimate of the standard deviation, what would the standard deviation be? **10**

(g) Which do you think is more accurate, the Empirical Rule estimate or the one sixth of the range estimate? Why? **Empirical Rule**

3. The following descriptive statistics were taken from an experiment that studied eye coordination. Answer the following questions.

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>N*</th>
<th>Mean</th>
<th>SE Mean</th>
<th>StDev</th>
<th>Minimum</th>
<th>Q1</th>
<th>Median</th>
<th>Q3</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye</td>
<td>179</td>
<td>0</td>
<td>6.425</td>
<td>0.185</td>
<td>2.481</td>
<td>0.00000</td>
<td>5.000</td>
<td>7.000</td>
<td>8.000</td>
<td>9.000</td>
</tr>
</tbody>
</table>

(a) What is the mean? **6.425**

(b) What is the standard deviation? **2.481**

(c) Is the data set skewed? If so which way? **Yes, slightly left**

(d) Assuming the distribution is mound-shaped, what range will hold approximately 68% of the data? **[3.944, 8.906]**

(e) Assuming the distribution is mound-shaped, what range will hold approximately 95% of the data? **[1.463, 11.387]**

(f) What is the z-score of the measurement 7.3? **0.3526803708**

(g) What is the z-score of the measurement 0? **-2.58968158**