Statistics

Review for Test 1

1. Let \( S = \{a, b, c, d, e, f, g, h\} \) be a sample space for a uniform probability model (that is, each outcome is equally likely). Let \( F = \{a, b, c, d, e\} \) and \( E = \{a, c, e, g\} \) be two events.

   (a) What is the event \( E \text{ and } F \)?
   (b) What is the event \( E \text{ and } \phi \)?
   (c) What is the event \( E \text{ or } F \)?
   (d) What is the event \( \text{not } E \)?
   (e) What is \( P(E) \)?
   (f) What is \( P(\phi) \)?
   (g) What is \( P(E \text{ and } F) \)?
   (h) What is \( P(\text{not } E) \)?
   (i) Find a new event \( G \) that is mutually exclusive with \( E \).

2. Suppose you know that \( A \) and \( B \) are events for a probability experiment, with \( P(A) = 0.3 \), \( P(B) = 0.8 \), and \( P(A \text{ or } B) = 0.8 \).

   (a) What is \( P(A \text{ and } B) \)?
   (b) What is \( P(\text{not } A) \)?
   (c) Are \( A \) and \( B \) mutually exclusive?

3. Which of these numbers could not possibly be probabilities: 0.463, 0.01, 1.01, -0.41?

4. In a class of 20 students, a list was made of hobbies and the number of students who chose that as a favorite hobby.

<table>
<thead>
<tr>
<th>Hobby</th>
<th>no. of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Music</td>
<td>8</td>
</tr>
<tr>
<td>Reading</td>
<td>5</td>
</tr>
<tr>
<td>Juggling</td>
<td>2</td>
</tr>
<tr>
<td>Unicycling</td>
<td>1</td>
</tr>
<tr>
<td>Bicycling</td>
<td>4</td>
</tr>
</tbody>
</table>

   A student is randomly selected from this class. Calculate the probabilities of each of the following.

   (a) The student chose unicycling.
   (b) The student likes reading or music the best.
c) The student did not pick juggling.

5. Two fair dice are rolled and the results are added together. Let the random variable \( X \) assign that sum to the roll.

(a) \( P(X = 7) = \)
(b) \( P(X = 9) = \)
(c) \( P(X = 14) = \)
(d) \( P(X > 6) = \)
(e) \( P(3 \leq X < 7) = \)
(f) What is the expected value of \( X \)?

6. Calculate the expected value for a random variable with the following probability distribution.

\[
\begin{array}{c|cccc}
 x & -2 & 3 & 5 & 11 \\
P(X = x) & 0.5 & 0.2 & 0.2 & 0.1 \\
\end{array}
\]

7. Jason wishes to determine if a particular flower color is more attractive to a certain species of bee. He finds a flower with a great deal of color variation and exposes half of the bees (in his sample) to the red flower, and the other half to the pink flower. He then determines the percentage of pollination for each group. He concludes that all of the bees of this species prefer the pink flowers.

(a) Is this a designed or observational experiment?
(b) Is this an example of descriptive or inferential statistics?
(c) Is the variable qualitative or quantitative?

8. Toni wishes to determine the proportion of the female population who are actually attracted to men who can juggle. She breaks the population of females into three groups; high school aged, college aged, and beyond college aged (although...actually...you’re never too old to go to college). She then proportionally samples 150 females. She concludes that females are attracted to jugglers.

(a) Is this a designed or observational experiment?
(b) Is this an example of descriptive or inferential statistics?
(c) Is the variable qualitative or quantitative (careful...is a proportion qualitative or quantitative)?
(d) What type of sampling did she use?
(e) What other types of sampling are there?

9. What are the three components of a good designed experiment?
10. Taryn visits the 2010 International Juggling Convention (who wouldn’t want to do that) and collects data on the ages at which all of the participants learned to juggle. She constructs the following age class table.

<table>
<thead>
<tr>
<th>Age</th>
<th>frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 &lt; 10</td>
<td>4</td>
</tr>
<tr>
<td>10 &lt; 20</td>
<td>21</td>
</tr>
<tr>
<td>20 &lt; 30</td>
<td>11</td>
</tr>
<tr>
<td>30 &lt; 40</td>
<td>6</td>
</tr>
<tr>
<td>≥ 40</td>
<td>8</td>
</tr>
</tbody>
</table>

(a) What is the frequency of the class that contains 23 year olds?
(b) What is the frequency of the class that contains 30 year olds?
(c) What is the relative frequency of the class with the upper cutpoint of 30?
(d) What is the midpoint for the class with a frequency of 21?

11. Jeremy collects data on the homework grades on a particular statistics assignment. The scores for the 25 students are given below.
1, 2, 3, 4, 4, 4, 5, 5, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 7, 7, 7, 8, 8, 9, 10

(a) Construct a frequency histogram for this data.
(b) Is the distribution left-skewed, right-skewed, or symmetric?
(c) Find the quartiles for this data.
(d) What is the IQR for the data?
(e) Construct a boxplot.
(f) What is the mode?
(g) What is the range?

12. Six individuals participated in the *juggling marathon* at the International Juggling Convention. Since Taryn was there, she wrote down the times (in hours) that each continuously juggled. The times are given below.
0.25, 5, 5.5, 6, 6, 6.25

(a) Using a boxplot, determine if there are any outliers for this data.
(b) What $\mu$?
(c) What is the standard deviation $\sigma$?
(d) What is the sample standard deviation $s$?
(e) What is the sample variance?
(f) Compute $\Sigma x$.
(g) Using the mean and standard deviation, standardize all of this data. What is the mean and standard deviation of this set of standardized data?

13. Find a data set consisting of 5 elements with a mean of 7 and a standard deviation of 0.
14. In a certain population, it is known that 45% of the individuals like tuna. Ten people are randomly selected. The number of people (of that sample of 10) that like tuna are counted.

(a) What is a success?
(b) What is \( n \)?
(c) What is \( p \)?
(d) What is the expected number that like tuna?
(e) What is the standard deviation?
(f) What is the probability that exactly 4 like tuna?
(g) What is the probability that none of them like tuna?
(h) What is the probability that at least one of them likes tuna?

15. A fair coin is flipped 10 times. The number of heads that occurs is counted.

(a) What is a success?
(b) What is \( n \)?
(c) What is \( p \)?
(d) What is the expected number of successes?
(e) What is the standard deviation?
(f) What is \( P(X = 4) \)?
(g) What is \( P(X > 7) \)?