Formulas

\[
\text{Mean} = \bar{x} = \frac{\text{sum of all values}}{\text{total number of values}}
\]

\[
\text{Range} = \text{highest value} - \text{lowest value}
\]

\[
\text{Standard Deviation} = \sqrt{\frac{\text{sum of (deviations from the mean)}^2}{\text{total number of data values} - 1}}
\]

68-95-99.7 Rule

\[
z = \frac{\text{data value} - \text{mean}}{\text{standard deviation}} = \frac{x - \mu}{\sigma}
\]

<table>
<thead>
<tr>
<th>z-score</th>
<th>Percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3.5</td>
<td>.02</td>
</tr>
<tr>
<td>-3.0</td>
<td>.13</td>
</tr>
<tr>
<td>-2.9</td>
<td>.19</td>
</tr>
<tr>
<td>-2.8</td>
<td>.26</td>
</tr>
<tr>
<td>-2.7</td>
<td>.35</td>
</tr>
<tr>
<td>-2.6</td>
<td>.47</td>
</tr>
<tr>
<td>-2.5</td>
<td>.62</td>
</tr>
<tr>
<td>-2.4</td>
<td>.82</td>
</tr>
<tr>
<td>-2.3</td>
<td>1.07</td>
</tr>
<tr>
<td>-2.2</td>
<td>1.39</td>
</tr>
<tr>
<td>-2.1</td>
<td>1.79</td>
</tr>
<tr>
<td>-2.0</td>
<td>2.28</td>
</tr>
<tr>
<td>-1.9</td>
<td>2.87</td>
</tr>
<tr>
<td>-1.8</td>
<td>3.59</td>
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<tr>
<td>-1.7</td>
<td>4.46</td>
</tr>
<tr>
<td>-1.6</td>
<td>5.48</td>
</tr>
<tr>
<td>-1.5</td>
<td>6.68</td>
</tr>
<tr>
<td>-1.4</td>
<td>8.08</td>
</tr>
<tr>
<td>-1.3</td>
<td>9.68</td>
</tr>
<tr>
<td>-1.2</td>
<td>11.51</td>
</tr>
<tr>
<td>-1.1</td>
<td>13.57</td>
</tr>
</tbody>
</table>

\[
\begin{array}{c|c|c|c|c|c|c}
\text{Percentile} & \text{Percentile} & \text{Percentile} & \text{Percentile} & \text{Percentile} & \text{Percentile} & \text{Percentile} \\
0.00 & 50.00 & 1.0 & 84.13 & 3.5 & 99.98
\end{array}
\]
P(A) = \frac{\text{number of ways } A \text{ can occur}}{\text{total number of possible outcomes}}

P(A) + P(\text{not } A) = 1 \quad \quad \quad P(\text{not } A) = 1 - P(A)

P(A \text{ and } B) = P(A) \times P(B) \quad \quad \quad P(A \text{ and } B) = P(A) \times P(B \text{ given } A)

P(A \text{ or } B) = P(A) + P(B) \quad \quad \quad P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)

P(A \text{ at least once}) + P(A \text{ zero times}) = 1

P(A \text{ happens at least once in } n \text{ trials}) = 1 - P(A \text{ happens zero times in } n \text{ trials})
\quad = 1 - \left[ P(A \text{ happens zero times in one trial}) \right]^n

\text{Expected Value} = \left( \text{value of } 1^{\text{st}} \text{ event} \right) \times \left( \text{probability of } 1^{\text{st}} \text{ event} \right) + \left( \text{value of } 2^{\text{nd}} \text{ event} \right) \times \left( \text{probability of } 2^{\text{nd}} \text{ event} \right) + \ldots

\text{Standard Deck of Cards}

<table>
<thead>
<tr>
<th>Colors</th>
<th>Suits</th>
<th>Number Cards</th>
<th>Face Cards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>Clubs</td>
<td>2 3 4 5 6 7 8 9 10</td>
<td>J Q K A</td>
</tr>
<tr>
<td></td>
<td>Spades</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red</td>
<td>Hearts</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diamonds</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
No questions will be answered during this exam.

If you consider a question to be ambiguous, state your assumptions in the margin and do the best you can to provide the correct answer.

You have **90 minutes (1.5 hours)** to complete this test.

**General Directions:**

- Any communication with any person (other than the instructor or a designated proctor) during this exam of any form, including written, signed, verbal, or digital, is understood to be a violation of academic integrity.

- All devices, such as computers, cell phones, cameras, and PDAs, must be turned off while the student is in the testing room.

- You may use any scientific calculator except a TI-89 or a TI-NSpire CAS.

- No part of this test may be removed from the examination room.

On my honor, I have neither given nor received inappropriate or unauthorized information at any time before or during this test.

**Student’s Signature:**

Do not write below this line.

<table>
<thead>
<tr>
<th>Question</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Scantron</th>
</tr>
</thead>
<tbody>
<tr>
<td>Points</td>
<td>7</td>
<td>8</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>Earned</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Free Response Total</td>
<td>40</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Multiple Choice Total</td>
<td>60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Score</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Multiple Choice Portion

There are 20 multiple choice questions. Each question is worth 3 points and has one correct answer. Use a number 2 pencil and bubble in the letter of your response on the Scantron sheet. For your own record, also circle your choice on your test since the Scantron will not be returned to you. Only the responses recorded on your Scantron sheet will be graded.

1. Calculate the standard deviation for the following data: 1, 1, 3, 5, 8. Round your answer to two decimal places.
   A) Standard Deviation = 1.00
   B) Standard Deviation = 8.80
   C) Standard Deviation = 3.50
   D) Standard Deviation = 2.97
   E) Standard Deviation = 3.60

2. How many different choices do you have in total if you buy a new Apple product that is available in 6 colors and 2 styles?
   A) 12
   B) 6
   C) 2
   D) 8
   E) 3

3. The quiz scores for a class are given below. Find the mean, median, and mode of the quiz scores.
   4, 4, 5.5, 6, 7, 7.5, 8, 8.5, 9, 10
   A) mean = 7, median = 7.5, mode = 4
   B) mean = 6.95, median = 7, mode = 10
   C) mean = 6.95, median = 7.25, mode = 4
   D) mean = 6.25, median = 7.25, mode = 10
   E) mean = 7.25, median = 7, mode = 7.5
4. There are 5 white balls, 6 black balls and 7 yellow balls in a box. Suppose you randomly select one ball from the box. Find the probability of choosing a ball that is not black.

A) 1/2
B) 7/18
C) 2/3
D) 1/6
E) 1/3

5. Which of the distributions is skewed to the left?

A)  B)  C)
D)  E)

6. A roulette wheel has 38 numbers: 18 black numbers, 18 red numbers, and the numbers 0 and 00 in green. Assume that all possible outcomes have equal probability. If patrons in a casino spin the wheel 100,000 times, how many times would you expect to see a red number? Round your answer to the nearest hundred.

A) 50,000
B) 2,600
C) 47,400
D) 46,200
E) 100,000
7. Suppose you randomly draw 4 cards one at a time from a standard 52-card deck and the deck is shuffled each time after the drawn card is returned. What is the approximated probability that your first card is a Diamond, your second card is a Spade, and your third and fourth cards are both Clubs? 
(HINT: See formula sheet for standard deck of cards.)
Give your answer as a decimal rounded to four decimal places, if necessary.

A) 0.0039
B) 0.0154
C) 0.25
D) 0.0769
E) 0.0125

8. An insurance policy sells for $1000. Based on past data, an average of 1 in 50 policyholders will file a $10,000 claim, an average of 1 in 100 policyholders will file for $25,000, and an average of 1 in 250 policyholders will file for $60,000. So on average, the company expects to profit how much per policy? 
(HINT: You may find completing the following table helpful, but it is not required.)

<table>
<thead>
<tr>
<th>Event</th>
<th>Value</th>
<th>Probability</th>
<th>Value × Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A) $1690
B) $1290
C) $1190
D) $310
E) $1210
9. Which of the following statements is true about the normal distribution?

A) The distribution has multiple peaks.
B) The distribution is skewed to the left.
C) The mean is greater than the median.
D) Data values are spread evenly around the mean.
E) Large deviations from the mean are common.

10. Which measure of the center of a distribution is most affected by an outlier?

A) Median
B) Upper Quartile
C) Mode
D) Lower Quartile
E) Mean

11. Select the choice below to fill in the blanks in the following statement.

A false negative occurs when the test ______ returns a result of ______.

A) Correctly, positive
B) Correctly, negative
C) Correctly, inconclusive
D) Incorrectly, negative
E) Incorrectly, positive
12. The table below shows the result of a polygraph test conducted on 2000 college students. Students were asked if they had ever cheated on a test. All of them denied having cheated. Use the table below to answer the question.

<table>
<thead>
<tr>
<th></th>
<th>Student has actually <strong>cheated</strong></th>
<th>Student has actually <strong>not cheated</strong></th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test finds student <strong>lying</strong></td>
<td>83</td>
<td>199</td>
<td>282</td>
</tr>
<tr>
<td>Test finds student <strong>truthful</strong></td>
<td>14</td>
<td>1704</td>
<td>1718</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>97</td>
<td>1903</td>
<td>2000</td>
</tr>
</tbody>
</table>

Of those students who took the polygraph test and were found to be lying, what is the percentage of students who had actually cheated?

A) 70.6%  
B) 29.4%  
C) 85.6%  
D) 89.5%  
E) 14.4%

13. Given the box plot below, determine the upper quartile of the data set.

![Box Plot]

A) Q3 = 3  
B) Q3 = 6  
C) Q3 = 2  
D) Q3 = 4  
E) Q3 = 7
14. Suppose you randomly draw a card from a standard 52-card deck. What is the probability that you pick a Heart or a Club? 
(HINT: See formula sheet for a standard deck of cards.)
Round your answer to **three decimal places, if necessary**.

A) 0.5  
B) 0.04  
C) 0.25  
D) 0.308  
E) 0.326

15. Consider a study in which a diagnostic test is given to 100,000 people. We know that 0.2% of the people will have a certain disease. This diagnostic test is 95% accurate. How many people of the 100,000 have the disease and, among those, how many were correctly identified by the test?

A) 2000 people have the disease; 1900 were correctly identified by the test.  
B) 20000 people have the disease; 19000 were correctly identified by the test.  
C) 200 people have the disease; 190 were correctly identified by the test.  
D) 200 people have the disease; 200 were correctly identified by the test.  
E) 200 people have the disease; 10 were correctly identified by the test.

16. John estimated his chance of winning his single-player tennis match is 70%. What type of probability is this?

A) Subjective  
B) Empirical  
C) Objective  
D) Conditional  
E) Theoretical
17. The lifespans of lizards in a zoo are normally distributed. The average lizard lives 3.5 years and the standard deviation is 0.4 years. Approximately what percentage of lizards live between 4.3 and 4.7 years?

A) 15.85%
B) 34%
C) 2.35%
D) 0.15%
E) 2.5%

18. The grades for a chemistry midterm at Clemson are normally distributed with a mean of 75 and a standard deviation of 4.25. Stephanie made an 82 on the exam. What is the z-score for Stephanie’s exam grade?
Round your answer to the nearest hundredth.

A) $z = 1.65$
B) $z = 1.04$
C) $z = -1.65$
D) $z = 0.86$
E) $z = -1.04$
19. Characterize the distribution shown below.

![](image)

A) Unsymmetric, bimodal  
B) Right-skewed, unimodal  
C) Left-skewed, unimodal  
D) Right-skewed, bimodal  
E) Symmetric, unimodal

20. What is the probability of choosing the incorrect answers on the first three consecutive questions on a multiple choice test if random guesses are made and each question has 5 possible answers?

A) \( \frac{1}{25} \)  
B) \( \frac{64}{125} \)  
C) \( \frac{16}{125} \)  
D) \( \frac{4}{5} \)  
E) \( \frac{1}{5} \)
Free Response Portion

Show all necessary work. Verify that the answers carry the appropriate units.

Partial credit may be given for work towards the correct solution. However, if answers are shown without necessary work, YOU MAY RECEIVE LITTLE OR NO CREDIT FOR THE CORRECT ANSWER.

1. Suppose students in class had the following grades at the end of the year.

   42, 56, 63, 66, 70, 72, 75, 75, 78, 78, 80, 92, 100

   a. Find the five-number summary for this set of data. Round your answers to one decimal place.

      Min: ______________

      Lower Quartile (Q1): ______________

      Median (Q2): ______________

      Upper Quartile (Q3): ______________

      Max: ______________

   b. Draw a box plot for the data set.

      ![Box Plot](image)

      Student Grades

      Points earned on this question: [___]
      Available points on this question: 7
2. Suppose you took a standardized test and the scores were normally distributed with a mean of 75.25 points and a standard deviation of 7.38 points.

**Directions:** Round all z-scores to the nearest z-score in the table.

a. Find your percentile given that your score was 89.5 points.
   Round your final answer to the nearest hundredth.

   Answer: _____________ percentile

b. If 5000 students took the test, how many would you expect to score above 88 points? Round your final answer to the nearest whole number.

   Answer: _____________ students

c. If your friend took the same test and scored in the 40th percentile, what was her test score? Use the closest percentile in the table.
   Round your final answer to the nearest whole number.

   Answer: _____________ points
3. A bag contains 5 green marbles, 6 black marbles, 6 white marbles, and 3 green common stones. You randomly draw one item from the bag. State all answers as decimals rounded to one decimal place, if necessary.

a. What is the probability of drawing a green item?

\[ P(\text{green item}) = \quad \] 

b. What is the probability that you draw a black or a white marble?

\[ P(\text{black marble OR white marble}) = \quad \] 
The events are ... Circle one: Overlapping OR Non-overlapping

c. What is the probability that you draw a green item or a marble?

\[ P(\text{green item OR marble}) = \quad \] 
The events are ... Circle one: Overlapping OR Non-overlapping

Points earned on this question: ________
Available points on this question: 7
4. An extensive study of 120 fun size packs of chocolate was done to determine the average number of white chocolate per pack. The study found that a pack has at most 5 white chocolate. The table below is a summary of the study.

<table>
<thead>
<tr>
<th>Number of white chocolate per pack</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>3</td>
<td>18</td>
<td>53</td>
<td>24</td>
<td>15</td>
<td>7</td>
</tr>
</tbody>
</table>

Complete the table below to find the expected value of white chocolate per pack. Leave probability column as *unreduced fractions*. Round other answers to *three decimal places*.

<table>
<thead>
<tr>
<th>Value (# white chocolate per pack)</th>
<th>Probability</th>
<th>Value × Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Expected Value = ____________ white chocolate per pack

Points earned on this question: ____________
Available points on this question: 8
5. The table below shows the results of a study examining the effectiveness of home schooling as compared to traditional schooling. The same reading test was given to all students regardless of age group (10th grade or 12th grade).

<table>
<thead>
<tr>
<th></th>
<th>Home schooled</th>
<th>Traditional</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Passed</td>
<td>Failed</td>
</tr>
<tr>
<td><strong>10th Grade</strong></td>
<td>78</td>
<td>222</td>
</tr>
<tr>
<td><strong>12th Grade</strong></td>
<td>98</td>
<td>2</td>
</tr>
</tbody>
</table>

a. Complete the table below by calculating the following percentages. For each age group, determine the percentage passing the test for those schooled at home and for those with traditional schooling. Combine the two age groups and then determine the percentage passing the test for those schooled at home and for those with traditional schooling. Round your answers to the nearest tenth of a percent.

<table>
<thead>
<tr>
<th></th>
<th>Home schooled</th>
<th>Traditional</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>10th Grade</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>12th Grade</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>AGE GROUPS COMBINED</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b. Complete the following explanation of why this is an example of Simpson’s Paradox by filling in the blanks below with “HIGHER” or “LOWER”, as appropriate.

A ____________ percentage of home schooled students passed considering the individual age groups (10th grade and 12th grade),

but, a ____________ percentage of home schooled students passed when considering the age groups combined.

c. What design flaw in the study caused Simpson’s Paradox to occur? Circle the Roman Numeral of your choice.

I. The traditional students must have been chosen from the better schools available for the study.

II. There aren’t enough students in the study.

III. The group of home schoolers is comprised of mostly 10th graders, while the group of traditional students is mostly 12th graders.

Points earned on this question: ___________________

Available points on this question: 9
Scantron (1 pt.)

Check to make sure your Scantron form meets the following criteria. If any of the items are NOT satisfied when your Scantron is handed in and/or when your Scantron is processed one point will be subtracted from your test total.

My Scantron:

- is bubbled with firm marks so that the form can be machine read;
- is not damaged and has no stray marks (the form can be machine read);
- has 20 bubbled in answers;
- has MATH 1010 and my Section number written at the top;
- has my Instructor’s name written at the top;
- has Test No. 3 written at the top;
- has Test Version A both written at the top and bubbled in below my CUID;
- and shows my correct XID written in and then bubbled in with a zero in the first column followed by the eight digits.