This is a study guide. What you do on it does not directly enter your grade. It is here to help you to prepare for test 3. As you work through this study guide, keep your draft cheat sheet handy, and add definitions, formulas, etc. to it. A printed version of this study guide will be distributed in class on study guide day, the last class meeting before the test.

1. Assume that event A occurs with probability 0.32 and event B occurs with probability 0.35. Assume that A and B are disjoint events.
   The probability that both events occur (A and B) is __________________% 

2. This problem deals with drawing a card at random from a deck of 54 cards (the usual 52 cards plus two jokers, one black and one red).

   If you are unfamiliar with card decks, this deck contains:
   -13 black spade cards labeled 2, 3, 4, ...., 9,10, Jack, King, Queen, Ace
   -13 black club cards labeled 2, 3, 4, ...., 9,10, Jack, King, Queen, Ace
   -13 red heart cards labeled 2, 3, 4, ...., 9,10, Jack, King, Queen, Ace
   -13 red diamond cards labeled 2, 3, 4, ...., 9,10, Jack, King, Queen, Ace
   - one red joker
   - one black joker

   If a card is chosen at random from this deck, what is the probability that the card chosen is red?
   __________________% Round to the nearest 00.0%

3. Choose at random a young adult aged 19 to 22 years. Ask their age and where they live (with their parents, in their own place, or in some other place such as a college dormitory). Here is the probability model for the 12 possible answers:

<table>
<thead>
<tr>
<th>Age in Year</th>
<th>19</th>
<th>20</th>
<th>21</th>
<th>22</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lives with Parents</td>
<td>0.13</td>
<td>0.13</td>
<td>0.15</td>
<td>0.13</td>
</tr>
<tr>
<td>Own Place</td>
<td>0.06</td>
<td>0.05</td>
<td>0.06</td>
<td>0.14</td>
</tr>
<tr>
<td>Other</td>
<td>0.03</td>
<td>0.03</td>
<td>0.06</td>
<td>0.03</td>
</tr>
</tbody>
</table>

   What is the probability that the person is 19 years old?
   __________________%
4. Choose at random a young adult aged 19 to 22 years. Ask their age and where they live (with their parents, in their own place, or in some other place such as a college dormitory). Here is the probability model for the 12 possible answers:

<table>
<thead>
<tr>
<th>Age in Year</th>
<th>19</th>
<th>20</th>
<th>21</th>
<th>22</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lives with Parents</td>
<td>0.1</td>
<td>0.1</td>
<td>0.12</td>
<td>0.1</td>
</tr>
<tr>
<td>Own Place</td>
<td>0.02</td>
<td>0.07</td>
<td>0.08</td>
<td>0.21</td>
</tr>
<tr>
<td>Other</td>
<td>0.06</td>
<td>0.06</td>
<td>0.02</td>
<td>0.06</td>
</tr>
</tbody>
</table>

List the outcomes that make up the event $A = \{\text{The person chosen is either 19 years old or lives in his or her own place, or both}\}$.

- The outcomes that make up the event $A$ are the outcomes in the first column.
- The outcome that makes up the event $A$ is adults aged 19 that live in their own place.
- The outcomes that make up the event $A$ are the outcomes in the first column and the second row.
- The outcomes that make up the event $A$ are the adults aged 19 that live in their own place or adults aged 20 to 22 that live in their own place.
- The outcomes that make up the event $A$ are the outcomes in the second row.
- None of the above

What is $P(A)$? __________________%

5. Let $X$ be a random number between 0 and 1 produced by the idealized random number generator. Find the following probability:

$P(X > 0.72)$ __________________%
6. A population of values has a normal distribution with $\mu = 88.4$ and $\sigma = 49$. You intend to draw a random sample of size $n = 102$.

Find the probability that a single randomly selected value is greater than 86.5.
$P(X > 86.5) = \underline{\text{______________}}$ Round to 4 decimal places.

Find the probability that the sample mean is greater than 86.5.
$P(\bar{X} > 86.5) = \underline{\text{______________}}$ Round to 4 decimal places.

Enter your answers as numbers accurate to 4 decimal places. Answers obtained using exact $z$-scores or $z$-scores rounded to 2 decimal places are accepted.

7. A population of values has a normal distribution with $\mu = 123.8$ and $\sigma = 52.5$. You intend to draw a random sample of size $n = 92$.

Find the probability that a sample of size $n = 92$ randomly selected with a mean between 124.9 and 136.4.
$P(124.9 < \bar{X} < 136.4) = \underline{\text{______________}}$ Round to 4 decimal places.

Answers obtained using exact $z$-scores or $z$-scores rounded to 2 decimal places are accepted.

8. A particular fruit's weights are normally distributed, with a mean of 389 grams and a standard deviation of 17 grams.

If you pick 6 fruit at random, what is the probability that their mean weight will be between 393 grams and 408 grams.

$\underline{\text{______________}}$ Round to 4 decimal places.

Answers obtained using exact $z$-scores or $z$-scores rounded to 2 decimal places are accepted.

9. A company produces steel rods. The lengths of the steel rods are normally distributed with a mean of 258.4-cm and a standard deviation of 2.1-cm. For shipment, 6 steel rods are bundled together.

Find the probability that the average length of rods in a randomly selected bundle of steel rods is less than 260.4-cm.
$P(\bar{X} < 260.4\text{-cm}) = \underline{\text{______________}}$ Round to 4 decimal places.

Answers obtained using exact $z$-scores or $z$-scores rounded to 2 decimal places are accepted.
10. A distribution of values is normal with a mean of 100 and a standard deviation of 21. From this distribution, you are drawing samples of size 22.

Find the interval containing the middle-most 64% of sample means: ____________________________

Enter your answer using interval notation. In this context, either inclusive or exclusive intervals would be acceptable. Your numbers should be accurate to 1 decimal places. Answers obtained using exact $z$-scores or $z$-scores rounded to 2 decimal places are accepted.

11. Suppose you roll a special 34-sided die. What is the probability that the number rolled is a "1" OR a "2"?

__________________

12. A test was given to a group of students, the grades and genders of the students are summarized below

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>20</td>
<td>9</td>
<td>11</td>
<td>40</td>
</tr>
<tr>
<td>Female</td>
<td>7</td>
<td>10</td>
<td>8</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>19</td>
<td>19</td>
<td>65</td>
</tr>
</tbody>
</table>

If one student is chosen at random,

Find the probability that the student was female OR got an "A".

__________________
13. A test was given to a group of students, the grades and genders of the students are summarized below

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>13</td>
<td>15</td>
<td>6</td>
<td>34</td>
</tr>
<tr>
<td>Female</td>
<td>3</td>
<td>8</td>
<td>18</td>
<td>29</td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>23</td>
<td>24</td>
<td>63</td>
</tr>
</tbody>
</table>

If one student is chosen at random,

Find the probability that the student was male GIVEN they got a 'B'.

14. A test was given to a group of students. The grades and gender are summarized below

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>2</td>
<td>9</td>
<td>14</td>
<td>25</td>
</tr>
<tr>
<td>Female</td>
<td>6</td>
<td>17</td>
<td>18</td>
<td>41</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>26</td>
<td>32</td>
<td>66</td>
</tr>
</tbody>
</table>

If one student is chosen at random from those who took the test,

Find the probability that the student got a 'C' GIVEN they are female.
15. Giving a test to a group of students, the grades and gender are summarized below

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>3</td>
<td>13</td>
<td>11</td>
<td>27</td>
</tr>
<tr>
<td>Female</td>
<td>20</td>
<td>12</td>
<td>7</td>
<td>39</td>
</tr>
<tr>
<td>Total</td>
<td>23</td>
<td>25</td>
<td>18</td>
<td>66</td>
</tr>
</tbody>
</table>

If one student is chosen at random,

Find the probability that the student was female: ________________

Find the probability that the student was female AND got a "A": ________________

Find the probability that the student was male OR got an "C": ________________

If one student is chosen at random, find the probability that the student was male GIVEN they got a 'C': ________________

16. Suppose a sample of size 47 has a sample mean of 39 and a population standard deviation of 13.4. Based on this, what is the maximal margin of error associated with a 95% confidence interval for the true population mean.

Give your answer as a decimal, to two places

±______________

17. Suppose $n = 502, \bar{x} = 47.4$ and $\sigma = 14.7$.

Find the 99% confidence interval for a sample of size

Enter your answer by giving the lower and upper bounds, accurate to one decimal place (because the sample statistics are reported accurate to one decimal place).

_______________ < $\mu$ < _______________
18. If your claim is in the alternative hypothesis and you fail to reject the null hypothesis, then your conclusion would be:

- __There is not sufficient evidence to warrant rejection of the original claim
- __The sample data support the original claim
- __There is not sufficient sample evidence to support the original claim
- __There is sufficient evidence to warrant rejection of the original claim
19. You wish to test the following claim \( H_a : \mu = 73.4 \) at a significance level of \( \alpha = 0.002 \).

\[
\begin{align*}
H_0 : \mu &= 73.4 \\
H_a : \mu &< 73.4
\end{align*}
\]

You believe the population is normally distributed and you know the standard deviation is \( \sigma = 5.4 \). You obtain a sample mean of \( \bar{M} = 72.4 \) for a sample of size \( n = 32 \).

What is the test statistic for this sample? (Report answer accurate to three decimal places.)

\[
\text{test statistic} = \text{___________________}
\]

What is the p-value for this sample? (Report answer accurate to four decimal places.)

\[
\text{p-value} = \text{___________________}
\]

The p-value is...

- __less than (or equal to) \( \alpha \)
- __greater than \( \alpha \)

This test statistic leads to a decision to...

- __reject the null
- __accept the null
- __fail to reject the null

As such, the final conclusion is that...

- __There is sufficient evidence to warrant rejection of the claim that the population mean is less than 73.4.
- __There is not sufficient evidence to warrant rejection of the claim that the population mean is less than 73.4.
- __The sample data support the claim that the population mean is less than 73.4.
- __There is not sufficient sample evidence to support the claim that the population mean is less than 73.4.
20. You wish to test the following claim \( H_a \) at a significance level of \( \alpha = 0.001 \).

\[
\begin{align*}
H_0 : \mu &= 83.9 \\
H_a : \mu &> 83.9
\end{align*}
\]

You believe the population is normally distributed and you know the standard deviation is \( \sigma = 12.8 \). You obtain a sample mean of \( \bar{x} = 89.9 \) for a sample of size \( n = 47 \).

What is the test statistic for this sample? (Report answer accurate to three decimal places.)

\[\text{test statistic} = \quad \text{________________________} \]

What is the p-value for this sample? (Report answer accurate to four decimal places.)

\[\text{p-value} = \quad \text{________________________} \]

The p-value is...

- ___less than (or equal to) \( \alpha \)
- ___greater than \( \alpha \)

This test statistic leads to a decision to...

- ___reject the null
- ___accept the null
- ___fail to reject the null

As such, the final conclusion is that...

- ___There is sufficient evidence to warrant rejection of the claim that the population mean is greater than 83.9.
- ___There is not sufficient evidence to warrant rejection of the claim that the population mean is greater than 83.9.
- ___The sample data support the claim that the population mean is greater than 83.9.
- ___There is not sufficient sample evidence to support the claim that the population mean is greater than 83.9.
21. You want to obtain a sample to estimate a population mean. Based on previous evidence, you believe the population standard deviation is approximately $\sigma = 7.1$. You would like to be 90% confident that you estimate is within 0.2 of the true population mean. How large of a sample size is required?

$$n = \text{______________}$$

Do not round mid-calculation.

22. You want to obtain a sample to estimate a population mean. Based on previous evidence, you believe the population standard deviation is approximately $\sigma = 58.4$. You would like to be 99.5% confident that you estimate is within 1.5 of the true population mean. How large of a sample size is required?

$$n = \text{______________}$$

Do not round mid-calculation.
**Key - Form 1**

1. 0
2. 50
3. 22
4. The outcomes that make up the event A are the outcomes in the first column and the second row. ~ 54
5. 28
6. 0.5155 or 0.516 ~ 0.6523 or 0.6517
7. 0.4097 or 0.41
8. 0.2791 or 0.2779
9. 0.9902 or 0.9901
10. (95.9, 104.1)
11. 0.0588235294118
12. 0.692307692308
13. 0.652173913043
14. 0.439024390244
15. 0.590909090909 ~ 0.30303030303 ~ 0.515151515152 ~ 0.611111111111
16. 3.83
17. 45.7 ~ 49.1
18. There is not sufficient sample evidence to support the original claim
19. -1.048 ~ 0.1474 or 0.1473 ~ greater than $\alpha$ ~ fail to reject the null ~ There is not sufficient sample evidence to support the claim that the population mean is less than 73.4.
20. 3.214 ~ 0.0007 ~ less than (or equal to) $\alpha$ ~ reject the null ~ The sample data support the claim that the population mean is greater than 83.9.
21. 341928
22. 11944