Soc3811 First Midterm Exam

SEMI-OPEN NOTE:
One sheet of paper, signed
& turned in with exam booklet

(Bring Your Own Pencil with Eraser)
Variable Measurements

What types of variables are these?

Gender: (Male, Female)
Terrorist Attacks: (None, Few, Many)
Neighborhood: (Central, South, North, West)
Starting Wage: ($ per hour)
Class at U: (Frosh, Soph, Jr, Sr, Grad)
Work Status: (Unemployed, Working)
Age of Mother: (in years)
Stock Price Move: (Down, Steady, Up)
Work Week: (Hours at job)
Relative Age: (Young, Old)
Central Tendencies

Find the Mode, Median, Mean of these scores:

\[ Y_i = 1, 2, 2, 3, 3, 3, 4, 5, 6, 6, 8 \]

\[
\text{Mode} = 3 \quad \text{Mdn} = 3 \quad \bar{Y} = 3.91
\]

Compute the Percentages:

<table>
<thead>
<tr>
<th></th>
<th>f</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cum%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yellow</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>21</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Mean for UNGROUPED Scores

\[Y = \frac{1}{N} \sum_{i=1}^{N} Y_i = \frac{Y_1 + Y_2 + Y_3 + Y_4 + Y_5 + Y_6}{N}\]

<table>
<thead>
<tr>
<th>i</th>
<th>(Y_i)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(Y_1 = 5)</td>
</tr>
<tr>
<td>2</td>
<td>(Y_2 = 2)</td>
</tr>
<tr>
<td>3</td>
<td>(Y_3 = 3)</td>
</tr>
<tr>
<td>4</td>
<td>(Y_4 = 4)</td>
</tr>
<tr>
<td>5</td>
<td>(Y_5 = 6)</td>
</tr>
<tr>
<td>6</td>
<td>(Y_6 = 4)</td>
</tr>
</tbody>
</table>

\(N = \) ___
Mean for GROUPED Scores

<table>
<thead>
<tr>
<th>Category</th>
<th>( i )</th>
<th>( Y_i )</th>
<th>( f_i )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>1</td>
<td>( Y_1 = 1 )</td>
<td>15</td>
</tr>
<tr>
<td>Medium</td>
<td>2</td>
<td>( Y_2 = 2 )</td>
<td>25</td>
</tr>
<tr>
<td>High</td>
<td>3</td>
<td>( Y_3 = 3 )</td>
<td>30</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>70</td>
</tr>
</tbody>
</table>

\[
\bar{Y} = \frac{\sum_{i=1}^{K} Y_i f_i}{N}
\]

\[
= \frac{Y_1 f_1 + Y_2 f_2 + Y_3 f_3}{N}
\]

\[
= \frac{15 + 25 + 30}{70}
\]

WHAT ARE the MODE & MEDIAN?

____________
Dispersion of a Discrete Variable

Find the Index of Diversity & IQV for this nonordered discrete variable:

<table>
<thead>
<tr>
<th>Category</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drivers</td>
<td>0.10</td>
</tr>
<tr>
<td>Bikers</td>
<td>0.30</td>
</tr>
<tr>
<td>Skaters</td>
<td>0.25</td>
</tr>
<tr>
<td>Joggers</td>
<td>0.20</td>
</tr>
<tr>
<td>Walkers</td>
<td>0.15</td>
</tr>
</tbody>
</table>

\[ D = 1 - \sum_{i=1}^{K} p_i^2 = \]

\[ IQV = \left( \frac{K}{K - 1} \right) (D) = \]

= ____________________
Skewness

Absence of symmetry in a distribution, indicated by positive or negative difference between mean and median:

\[ \text{Skewness} = \frac{3(\bar{Y} - \text{Mdn})}{S_Y} \]

- Positive skew: “tail” to right of Mdn
- Negative skew: “tail” to left of Mdn

Number of hours worked last week

Mean = 43.3 hours
Mdn = 40 hours
Std dev = 4 hours

Skewness = _____
Variance & s.d. for UNGROUPED Scores

\[ s_Y^2 = \frac{\sum_{i=1}^{N} (Y_i - \bar{Y})^2}{N-1} = \frac{\sum d_i^2}{N-1} \]

<table>
<thead>
<tr>
<th>i</th>
<th>Y_i</th>
<th>- \bar{Y} = d_i</th>
<th>d_i^2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>- 4 = 1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>- 4 = -2</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>- 4 = -1</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>- 4 = 0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>- 4 = 2</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>- 4 = 0</td>
<td>0</td>
</tr>
</tbody>
</table>

\[ \sum d_i^2 = \]

\[ s_Y = \sqrt{s_Y^2} = \]
Variance & s.d. for GROUPED Scores

\[ i \quad Y_i - \overline{Y} = d_i \quad d_i^2 \quad \left( d_i^2 \right) f_i \]

1: \( 1 - 2.33 = \quad \_ \_ \quad 1.77 \quad (1.77)(10) = \quad \_ \_ \)

2: \( 2 - 2.33 = \quad \_ \_ \quad 0.11 \quad (0.11)(20) = \quad \_ \_ \)

3: \( 3 - 2.33 = \quad \_ \_ \quad 0.45 \quad (0.45)(30) = \quad \_ \_ \)

\[ Y_1 = 1 \quad f_i = 10 \]
\[ Y_2 = 2 \quad f_i = 20 \]
\[ Y_3 = 3 \quad f_i = 30 \]

Mean = 2.33

\[ \sum = \quad \_ \_ \]

\[ s_Y^2 = \frac{\sum_{i=1}^{N} \left( Y_i - \overline{Y} \right)^2 f_i}{N-1} = \frac{\sum d_i^2 f_i}{N-1} \]

\[ s_Y^2 = \frac{\sum d_i^2 f_i}{N-1} = \quad \_ \_ \]

\[ s_Y = \sqrt{s_Y^2} = \quad \_ \_ \]
Special Case of a Dichotomy

Find the mean and variance of this nonordered dichotomous variable:

“The primary U.S. response to terrorist attacks should be to use...”

Diplomacy \( f_0 = 7 \)

Military \( f_1 = 43 \)

Mean:

\[
p_1 = \frac{f_1}{f_0 + f_1} = \quad __________
\]

Variance:

\[
s^2 = p_0 p_1 = \quad __________
\]
Y-scores & Z-scores

\( \overline{Y} = 20 \text{ and } s^2 = 16; \text{ Find } Z_i \text{ for these } Y_i : \)

\[
\begin{align*}
Y_i &= 28 \quad Z_i = \_\_\_ \\
Y_i &= 10 \quad Z_i = \_\_\_ \\
Y_i &= 18 \quad Z_i = \_\_\_
\end{align*}
\]

\( \overline{Y} = 47.8 \text{ and } s = 3.5; \text{ Find } Y_i \text{ for these } Z_i : \)

\[
\begin{align*}
Z_i &= -1.34 \quad Y_i = \_\_\_ \\
Z_i &= -0.86 \quad Y_i = \_\_\_ \\
Z_i &= 4.51 \quad Y_i = \_\_\_
\end{align*}
\]
Calculate mean for ungrouped data

\[
\bar{Y} = \frac{\sum_{i=1}^{N} Y_i}{N}
\]

\[
N = ______
\]

\[
\sum_{i=1}^{N} Y_i = ______________________
\]

\[
\bar{Y} = ______________
\]
Calculate variance & std. dev. for 10 scores

\[
\begin{align*}
Y_i & - \bar{Y} = d_i \\
2 & - = \underline{____} \underline{____} \\
3 & - = \underline{____} \underline{____} \\
3 & - = \underline{____} \underline{____} \\
4 & - = \underline{____} \underline{____} \\
5 & - = \underline{____} \underline{____} \\
5 & - = \underline{____} \underline{____} \\
6 & - = \underline{____} \underline{____} \\
7 & - = \underline{____} \underline{____} \\
7 & - = \underline{____} \underline{____} \\
8 & - = \underline{____} \underline{____}
\end{align*}
\]

\[
\sum_{i=1}^{10} (d_i)^2 = \underline{\underline{____}}
\]

\[
s_Y^2 = \sum (d_i)^2 / (N-1) = \underline{\underline{____}}
\]

\[
s_Y = \sqrt{s_Y^2} = \underline{\underline{____}}
\]
Find the Z scores

\[ Z_i = \frac{Y_i - \overline{Y}}{s_Y} \]

\[
\begin{array}{ccc}
(Y_i - \overline{Y}) / s_Y &=& \\
(2) &=& \\
(3) &=& \\
(3) &=& \\
(4) &=& \\
(5) &=& \\
(5) &=& \\
(6) &=& \\
(7) &=& \\
(7) &=& \\
(8) &=& \\
\end{array}
\]
Calculate variance & std. dev. of NATEDUC

“Are we spending too much money, too little money, or about the right amount on the nation’s education system?”

\[ \text{N} = 1,355 \quad \text{Mean} = 1.35 \]

<table>
<thead>
<tr>
<th>Category</th>
<th>( Y_i )</th>
<th>( f_i )</th>
<th>((d_i)^2(f_i))</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOO LITTLE</td>
<td>1</td>
<td>962</td>
<td></td>
</tr>
<tr>
<td>ABOUT RIGHT</td>
<td>2</td>
<td>306</td>
<td></td>
</tr>
<tr>
<td>TOO MUCH</td>
<td>3</td>
<td>87</td>
<td></td>
</tr>
</tbody>
</table>

\[
\sum_{i=1}^{K} (d_i)^2(f_i) = \underline{\text{__________}} \\
S_Y^2 = \frac{\sum_{i=1}^{K} (d_i)^2(f_i)}{N-1} = \underline{\text{______________________________________________}} \\
S_Y = \sqrt{S_Y^2} = \underline{\text{______________}}
\]