

# **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)

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**Terrorist Attacks:** (None, Few, Many)

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**Neighborhood:** (Central, South, North, West)

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**Starting Wage:** (\$ per hour)

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**Class at U:** (Frosh, Soph, Jr, Sr, Grad)

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**Work Status:** (Unemployed, Working)

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**Age of Mother:** (in years)

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**Stock Price Move:** (Down, Steady, Up)

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**Work Week:** (Hours at job)

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**Relative Age:** (Young, Old)

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# 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:**

	<b>f</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cum%</b>
<b>Blue</b>	<b>3</b>			
<b>Red</b>	<b>6</b>			
<b>Yellow</b>	<b>9</b>			
<b>Total</b>	<b>18</b>			
<b>Missing</b>	<b>3</b>			
<b>Total</b>	<b>21</b>			

# Mean for UNGROUPED Scores

<b>i</b>	<b>Y<sub>i</sub></b>
<b>1</b>	<b>Y<sub>1</sub> = 5</b>
<b>2</b>	<b>Y<sub>2</sub> = 2</b>
<b>3</b>	<b>Y<sub>3</sub> = 3</b>
<b>4</b>	<b>Y<sub>4</sub> = 4</b>
<b>5</b>	<b>Y<sub>5</sub> = 6</b>
<b>6</b>	<b>Y<sub>6</sub> = 4</b>

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

**=** \_\_\_\_\_

**N =** \_\_\_\_\_

# Mean for GROUPED Scores

How much TV watching?	
Category i $Y_i$	$f_i$
1. Low $Y_1 = 1$	15
2. Medium $Y_2 = 2$	25
3. High $Y_3 = 3$	30
Total	70

$$\bar{Y} = \sum_{i=1}^K \frac{Y_i f_i}{N}$$
$$= \frac{Y_1 f_1 + Y_2 f_2 + Y_3 f_3}{N}$$

= \_\_\_\_\_

**WHAT ARE the MODE & MEDIAN?**

\_\_\_\_\_

# Dispersion of a Discrete Variable

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

Category	Proportion
Drivers	0.10
Bikers	0.30
Skaters	0.25
Joggers	0.20
Walkers	0.15

$$D = 1 - \sum_{i=1}^K p_i^2 = \underline{\hspace{2cm}}$$

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

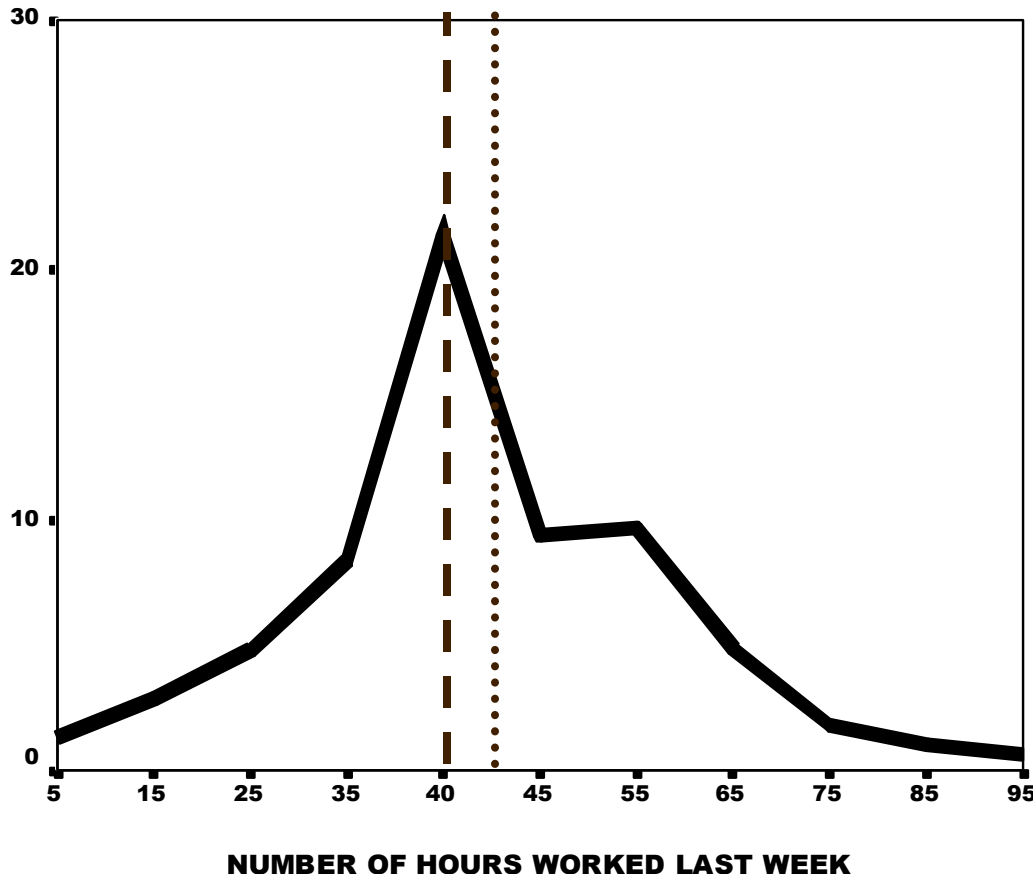
$$= \underline{\hspace{2cm}}$$

# 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



# Variance & s.d. for UNGROUPED Scores

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

$i$	$Y_i$	$-$	$\bar{Y}$	$=$	$d_i$	$d_i^2$	$\frac{\sum d_i^2}{N-1} =$	_____
<b>1:</b>	<b>5</b>	<b>-</b>	<b>4</b>	<b>=</b>	<b>1</b>	<b>1</b>		

<b>2:</b>	<b>2</b>	<b>-</b>	<b>4</b>	<b>=</b>	<b>-2</b>	<b>4</b>		
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<b>3:</b>	<b>3</b>	<b>-</b>	<b>4</b>	<b>=</b>	<b>-1</b>	<b>1</b>		
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$$s_Y = \sqrt{s_Y^2} = \underline{\hspace{2cm}}$$

<b>4:</b>	<b>4</b>	<b>-</b>	<b>4</b>	<b>=</b>	<b>0</b>	<b>0</b>		
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<b>5:</b>	<b>6</b>	<b>-</b>	<b>4</b>	<b>=</b>	<b>2</b>	<b>4</b>		
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<b>6:</b>	<b>4</b>	<b>-</b>	<b>4</b>	<b>=</b>	<b>0</b>	<b>0</b>		
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$$\sum d_i^2 = \underline{\hspace{2cm}}$$



# Variance & s.d. for GROUPED Scores

$$i \quad Y_i - \bar{Y} = d_i \quad d_i^2 \quad (d_i^2)(f_i)$$

$$1: 1 - 2.33 = \underline{\hspace{2cm}} \quad 1.77 \quad (1.77)(10) = \underline{\hspace{2cm}}$$

$$2: 2 - 2.33 = \underline{\hspace{2cm}} \quad 0.11 \quad (0.11)(20) = \underline{\hspace{2cm}}$$

$$3: 3 - 2.33 = \underline{\hspace{2cm}} \quad 0.45 \quad (0.45)(30) = \underline{\hspace{2cm}}$$

$$\Sigma = \underline{\hspace{2cm}}$$

$$Y_1 = 1 \quad f_i = 10$$

$$Y_2 = 2 \quad f_i = 20$$

$$Y_3 = 3 \quad f_i = 30$$

$$\text{Mean} = 2.33$$

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

$$s_Y^2 = \frac{\sum d_i^2 f_i}{N-1} = \underline{\hspace{2cm}}$$

$$s_Y = \sqrt{s_Y^2} = \underline{\hspace{2cm}}$$

# 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:**

$$p_1 = \frac{f_1}{f_0 + f_1} = \underline{\hspace{2cm}}$$

**Variance:**

$$s^2 = p_0 p_1 = \underline{\hspace{2cm}}$$

## Y-scores & Z-scores

$\bar{Y} = 20$  and  $s^2 = 16$ ; Find  $Z_i$  for these  $Y_i$  :

$Y_i = 28$        $Z_i =$  \_\_\_\_\_

$Y_i = 10$        $Z_i =$  \_\_\_\_\_

$Y_i = 18$        $Z_i =$  \_\_\_\_\_

$\bar{Y} = 47.8$  and  $s = 3.5$ ; Find  $Y_i$  for these  $Z_i$  :

$Z_i = -1.34$        $Y_i =$  \_\_\_\_\_

$Z_i = -0.86$        $Y_i =$  \_\_\_\_\_

$Z_i = 4.51$        $Y_i =$  \_\_\_\_\_

# Calculate mean for ungrouped data

<b>i</b>	<b><math>Y_i</math></b>	
<b>1</b>	<b>2</b>	$\bar{Y} = \sum_{i=1}^N \frac{Y_i}{N}$
<b>2</b>	<b>3</b>	
<b>3</b>	<b>3</b>	
<b>4</b>	<b>4</b>	<b>N</b> = _____
<b>5</b>	<b>5</b>	$\sum_{i=1}^N Y_i = \text{_____}$
<b>6</b>	<b>5</b>	
<b>7</b>	<b>6</b>	
<b>8</b>	<b>7</b>	$\bar{Y} = \text{_____}$
<b>9</b>	<b>7</b>	
<b>10</b>	<b>8</b>	

# Calculate variance & std. dev. for 10 scores

$Y_i$	-	$\bar{Y}$	=	$d_i$	$(d_i)^2$
<b>2</b>	-	=	_____	_____	_____
<b>3</b>	-	=	_____	_____	_____
<b>3</b>	-	=	_____	_____	_____
<b>4</b>	-	=	_____	_____	_____
<b>5</b>	-	=	_____	_____	_____
<b>5</b>	-	=	_____	_____	_____
<b>6</b>	-	=	_____	_____	_____
<b>7</b>	-	=	_____	_____	_____
<b>7</b>	-	=	_____	_____	_____
<b>8</b>	-	=	_____	_____	_____

$$\sum_{i=1}^{10} (d_i)^2 = \underline{\hspace{4cm}}$$

$$s_Y^2 = \sum (d_i)^2 / (N-1) =$$

\_\_\_\_\_

$$s_Y = \sqrt{s_Y^2} = \underline{\hspace{4cm}}$$

# Find the Z scores

$$Z_i = \frac{Y_i - \bar{Y}}{s_Y}$$

$$(Y_i - \bar{Y}) / s_Y =$$

$$(2 - ) / \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

$$(3 - ) / \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

$$(3 - ) / \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

$$(4 - ) / \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

$$(5 - ) / \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

$$(5 - ) / \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

$$(6 - ) / \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

$$(7 - ) / \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

$$(7 - ) / \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

$$(8 - ) / \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

# 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?”

**N = 1,355**

**Mean = 1.35**

Category	$Y_i$	$f_i$	$(d_i)^2(f_i)$
TOO LITTLE	1	962	_____
ABOUT RIGHT	2	306	_____
TOO MUCH	3	87	_____

$$\sum_{i=1}^K (d_i)^2 (f_i) = \underline{\hspace{2cm}}$$

$$s_Y^2 = \frac{\sum_{i=1}^K (d_i)^2 (f_i)}{N-1} = \underline{\hspace{4cm}}$$

$$s_Y = \sqrt{s_Y^2} = \underline{\hspace{2cm}}$$