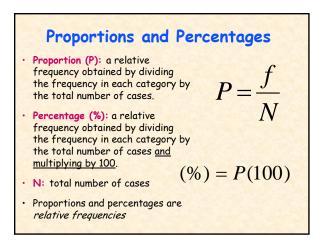


State	Minimum Age	State	Minimum Age
Arkansas	14	Texas	17
/irginia	15	California	18
Nabama	16	Colorado	18
Delaware	16	Connecticut	18
ndiana	16	Illinois	18
Kentucky	16	Louisiana	18
Mississippi	16	Maryland	18
Aissouri	16	Nebraska	18
Vevada	16	New Jersey	18
Oklahoma	16	New Mexico	18
Vyoming	16	Ohio	18
Georgia	17	Oregon	18
New Hampshire	17	Tennessee	18
North Carolina	17		

Minimum Age	Tally	Frequency
14	1	1
15	T	1
16		9
17		4
18		12
Total N		27



Proportions and Percentages							
Minimum Age	Frequency	Proportion	Percentage				
14	1	1/27=.037	3.7				
15	1	.037	3.7				
16	9	.333	33.3				
17	4	.148	14.8				
18	12	.444	44.4				
Total N	27	1.0	100.0				

Cumulat	tive Free	quency D	istribution
Minimum			Cumulative
Age	Freq. (f)	Percentage	Frequency
14	1	3.7	01
15	1	3.7	02
16	9	33.3	11
17	4	14.8	15
18	12	44.4	27
Total (N)	27	99.9*	
* Deagn't tate	l to 100% due t	to nounding	

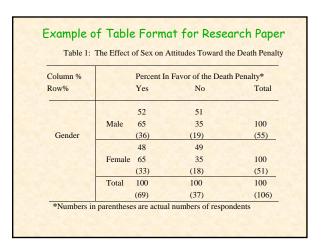
Minimum			Cumulative
Age	Frequency	Percentage	Percentage
14	1	3.7	3.7
15	1	3.7	7.4
16	9	33.3	40.7
17	4	14.8	55.5
18	12	44.4	99.9*
Total N	27	99.9*	
Doesn't to	tal to 100% due	to rounding	

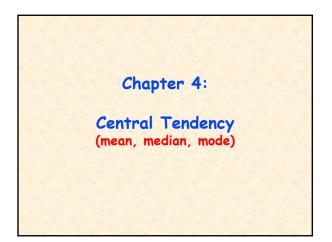
	Rates
A number obtained by a occurrences in a given t occurrences.	dividing the number of <i>actual</i> time period by the number of <i>possible</i>
Marriage rate, 1990 =	Number of marriages in 1990 Total population in 1990
Marriage rate, 1990 =	2,448,000 marriages 250,000,000 Americans
Marriage rate, 1990 = (9.8 marriages for every 1	.0098 000 people)

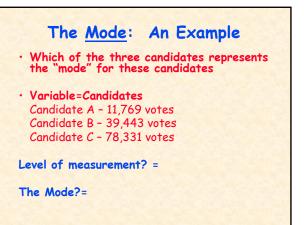
#### Reading Statistical Tables Basic principles for understanding what the researcher is trying to tell you (that is, questions you should ask yourself when reading a table): • What is the source of this table? • How many variables are presented? What are their names? • What is represented by the numbers presented in the first column? In the second column?

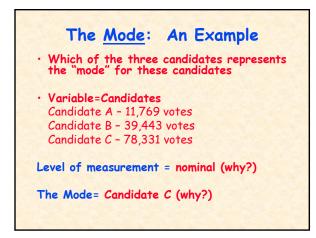
Example of Table Format for Research Paper								
Table 1: The Effect of Sex on Attitudes Toward the Death Penalty								
In Favor of the Death Penalty (actual number of respondents reported)								
	-	Yes	No	Total				
Gender	Male	36	19	55				
ochider	Female	33	18	51				
	Total	69	37	106				
(Source: class)	(Source: non-random sample obtained by students in a college statistics class)							

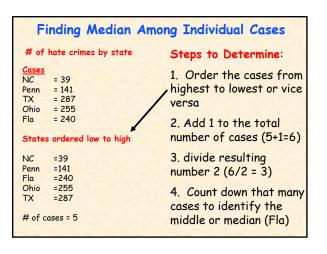
SPSS	5 Output Looks Som	ething l	.ike Th	is:
V13 *	V6 Crosstabulation			
		V	5	
		Yes	No	Total
V13	Male Count	36	19	55
	% within V6	52.2%	51.4%	51.9
	% within V13	65.5%	34.5%	100.0
	Female Count	33	18	51
	% within V6	47.8%	48.6%	48.1
	% within V13	64.7%	35.3%	100.0
Total	Count	69	37	106
4.4	% within V6	100.0%	100.0%	100.0
	% within V13	65.1%	34.9%	100.0

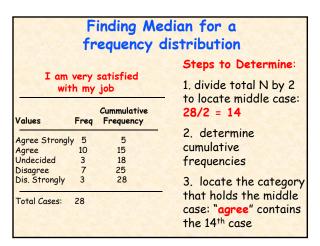


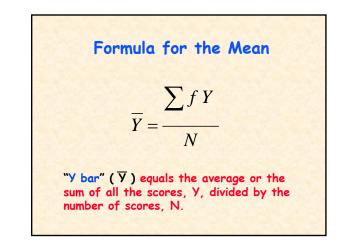


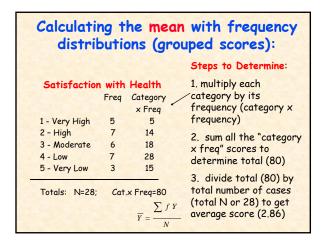


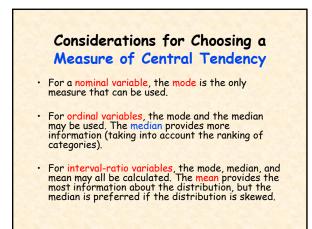












#### Chapter 5: The Importance of Measuring Variability

- Measures of Central Tendency -Numbers that describe what is typical or average (central) in a distribution (e.g., mean, mode, median).
- Measures of Variability Numbers that describe diversity or variability in the distribution (e.g., range, interquartile range, variance, standard deviation).

# The Range • Range - A measure of variation in interval-ratio variables. • It is the difference between the highest (maximum) and the lowest (minimum) scores in the distribution. Range = highest score - lowest score

What is the range for these diversity scores?								
(hi	(higher number means more diversity)?							
	Steps to determine: subtract the lowest scorefrom the highestto obtain the range of IQV scores							
nignes	STT	o obtain the ra	nge of 1	QV scores	<u></u>			
State	IQV	State	IQV	State	IQV			
California	0.80	Alabama	0.51	Indiana	0.27			
New Mexico	0.76	North Carolina	0.51	Utah	0.26			
Texas	0.74	Delaware	0.49	Nebraska	0.24			
New York	0.66	Colorado	0.45	South Dakota	0.24			
Hawaii	0.64	Oklahoma	0.44	Wisconsin	0.24			
Maryland	0.62	Connecticut	0.42	Idaho	0.23			
New Jersey	0.61	Arkansas	0.40	Wyoming	0.22			
Louisiana	0.61	Michigan	0.40	Kentucky	0.20			
Arizona	0.61	Tennessee	0.39	Minnesota	0.20			
Florida	0.61	Washington	0.37	Montana	0.20			
Mississippi	0.61	Massachusetts	0.34	North Dakota	0.17			
Georgia	0.59	Missouri	0.31	Iowa	0.13			
Nevada	0.57	Ohio	0.31	West Virginia	0.11			
Illinois	0.57	Pennsylvania	0.31	New Hampshire	0.08			
South Carolina	0.56	Kansas	0.30	Maine	0.06			
Alaska	0.56	Rhode Island	0.30	Vermont	0.06			
Virginia	0.53	Oregon	0.28	and the second	121.01			

Steps to					
Steps to					
		ne: subtract the			om
the high	est	to obtain the r	range of	IQV scores	
State	IOV	State	IOV	State	101
California	0.80	Alabama	0.51	Indiana	0.27
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South Carolina	0.56	Kansas	0.30	Maine	0.06
Alaska	0.56	Rhode Island	0.30	Vermont	0.06
Virginia	0.53	Oregon	0.28		

What is the range for these diversity scores? (higher number means more diversity)? Steps to determine: subtract the lowest score _06_ from the highest _80_ to obtain the range of IQV scores_							
State	IOV	State	IOV	State	IQV		
California	0.80	Alabama	0.51	Indiana	0.27		
New Mexico	0.76	North Carolina	0.51	Utah	0.26		
Texas	0.74	Delaware	0.49	Nebraska	0.24		
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Mississippi	0.61	Massachusetts	0.34	North Dakota	0.17		
Georgia	0.59	Missouri	0.31	Iowa	0.13		
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Illinois	0.57	Pennsylvania	0.31	New Hampshire	0.08		
South Carolina	0.56	Kansas	0.30	Maine	0.06		
Alaska	0.56	Rhode Island	0.30	Vermont	0.06		
Virginia	0.53	Oregon	0.28		States and the		

<mark>(hig</mark> l Steps to a	What is the range for these diversity scores? (higher number means more diversity)? Steps to determine: subtract the lowest score _06_ from the highest _80_ to obtain the range of IQV scores74						
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Nevada	0.57	Ohio	0.31	West Virginia	0.11		
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Alaska	0.56	Rhode Island	0.30	Vermont	0.06		
Virginia	0.53	Oregon	0.28				

#### Inter-quartile Range Inter-quartile range (IQR) - The width of the middle 50 percent of the distribution. The IQR helps us to get a better picture of the variation in the data than the range. The shortcoming of the range is that an "outlying" case at the top or bottom can increase the range substantially.

Inter-quartile Range
• Inter-quartile range (IQR) – The width of the middle 50 percent of the distribution.
<ul> <li>It is defined as the difference between the lower and upper quartiles (Q1 and Q3.)</li> </ul>
• IQR = q3 - q1

Diversity Scores?					
State	IQV	State	IQV	State	IQV
California	0.80	Alabama	0.51	Indiana	0.27
New Mexico	0.76	North Carolina	0.51	Utah	0.26
Texas	0.74	Delaware	0.49	Nebraska	0.24
New York	0.66	Colorado	0.45	South Dakota	0.24
Hawaii	0.64	Oklahoma	0.44	Wisconsin	0.24
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Louisiana	0.61	Michigan	0.40	Kentucky	0.20
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Nevada	0.57	Ohio	0.31	West Virginia	0.11
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South Carolina	0.56	Kansas	0.30	Maine	0.06
Alaska	0.56	Rhode Island	0.30	Vermont	0.06
Virginia	0.53	Oregon	0.28		

# What is the IQR for the Diversity Scores? Steps to determine the IQR (Q3 - Q1): 1. Order the categories from highest to lowest (or vice versa) 2. To obtain Q1, begin by dividing N (total number of categories or states) by 4 (or alternatively multiply N by .25). This equals 2 3. We now know that Q1 falls between the 12<sup>th</sup> and 13<sup>th</sup> category or, in this case, states. 4. To find the exact number for Q1, determine the midpoint between the 12<sup>th</sup> and 13<sup>th</sup> states or between .59 and .57) 5. Q1 = \_\_\_\_

### What is the IQR for the Diversity Scores?

Steps to determine the IQR (Q3 - Q1):

- Order the categories from highest to lowest (or vice versa)
   To obtain Q1, begin by dividing N (total number of categories or states) by 4 (or alternatively multiply N by .25). This equals <u>12.5</u> <u>2</u>
- We now know that Q1 falls between the 12<sup>th</sup> and 13<sup>th</sup> category or, in this case, states.
- To find the exact number for Q1, determine the midpoint between the 12<sup>th</sup> and 13<sup>th</sup> states or between .59 and .57)
- 5. Q1 = \_\_\_\_

## What is the IQR for the Diversity Scores?

Steps to determine the IQR (Q3 - Q1):

- Order the categories from highest to lowest (or vice versa)
   To obtain Q1, begin by dividing N (total number of categories or states) by 4 (or alternatively multiply N by .25). This
- equals 12.5 2 3. We now know that Q1 falls between the 12<sup>th</sup> and 13<sup>th</sup> category
- or, in this case, states. 4. To find the exact number for Q1, determine the midpoint
- between the 12<sup>th</sup> and 13<sup>th</sup> states or between .59 and .57)
- 5. Q1 = \_\_.58\_\_\_

# What is the IQR for the Diversity Scores?

Steps to determine the IQR (Q3 - Q1):

- To obtain Q3, begin by multiplying 12.5 by 3 (or alternatively multiply 12.5 by .75). This will give us\_\_\_\_\_.
- 7. Based on this number, Q3 falls between the 37th and 38th states.
- 8. Determine the midpoint between these two states. This equals\_\_\_\_\_. This tells us that 50% of the cases fall between .58 and .24.
- 9. To obtain the IQR subtract Q3 from Q1 which equals\_\_\_\_\_or the middle of the middle 50% of the cases.

#### What is the IQR for the Diversity Scores?

Steps to determine the IQR (Q3 - Q1):

- To obtain Q3, begin by multiplying 12.5 by 3 (or alternatively multiply 12.5 by .75. This will give us<u>37.5</u>.
- 7. Based on this number, Q3 falls between the 37<sup>th</sup> and 38<sup>th</sup> states.
- 8. Determine the midpoint between these two states. This equals\_\_\_\_\_. This tells us that 50% of the cases fall between .58 and .24.
- To obtain the IQR subtract Q3 from Q1 which equals \_\_\_\_\_or the middle of the middle 50% of the cases.

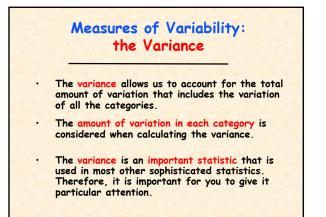
# What is the IQR for the Diversity Scores?

#### Steps to determine the IQR (Q3 - Q1):

- To obtain Q3, begin by multiplying 12.5 by 3 (or alternatively multiply N (50) by .75). This will give us<u>37.5</u>.
- 7. Based on this number, Q3 falls between the 37<sup>th</sup> and 38<sup>th</sup> states.
- 9. To obtain the IQR subtract Q3 from Q1 which equals <u>.34</u> or the middle of the middle 50% of the cases.

#### Measures of Variability: Shortcomings of the Range and IQR

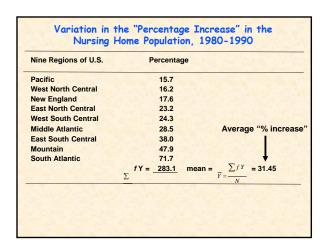
- The range is based on only two categories (the highest and lowest)
- Likewise, only two categories are used to calculate the inter-guartile range.
- Neither allows us to know how much variation there is among all the categories.



Nine Regions of U.S.	Percentage		
Pacific	15.7		
West North Central	16.2		
New England	17.6		
East North Central	23.2		
West South Central	24.3		
Middle Atlantic	28.5		
East South Central	38.0		
Mountain	47.9		
South Atlantic	71.7		

Nine Regions of U.S.	Percentage	144.54
Pacific	15.7	
West North Central	16.2	
New England	17.6	
East North Central	23.2	
West South Central	24.3	
Middle Atlantic	28.5	
East South Central	38.0	
Mountain	47.9	
South Atlantic	71.7	
How might we take into acco	unt the variation that exists for ea	ch category?

Nine Regions of U.S.	Percentag	
Pacific	15.7	
West North Central	16.2	
New England	17.6	
East North Central	23.2	
West South Central	24.3	
Middle Atlantic	28.5	Average "% increase
East South Central	38.0	A REAL PROPERTY AND INCOME.
Mountain	47.9	
South Atlantic	71.7	+
	fY = 283.1	mean = $\frac{\sum f Y}{\overline{Y} = \frac{1}{1}}$ = 31.45
	Σ	$\overline{Y} = - $

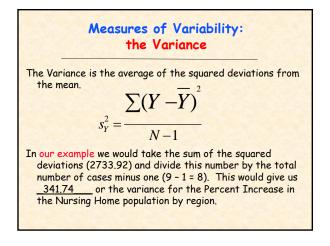


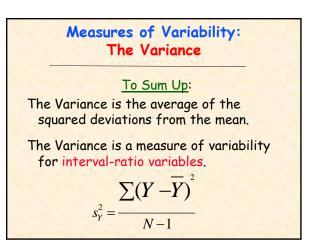
Nine Regions of U.S.	P	ercentage	Y - Y
Pacific		15.7	15.7 - 31.5 = -15.8
West North Central		16.2	16.2 - 31.5 = -15.3
New England		17.6	17.6 - 31.5 = -13.9
East North Central		23.2	23.2 - 31.5 = -8.3
West South Central		24.3	24.3 - 31.5 = -7.2
Middle Atlantic		28.5	28.5 - 31.5 = - 3.0
East South Central		38.0	38.0 - 31.5 = 6.5
Mountain		47.9	47.9 - 31.5 = 16.4
South Atlantic		71.7	71.7 - 31.5 = 40.2
(mean = 31.5)	$\Sigma Y =$	283.1	$\Sigma (Y - \overline{Y}) = 0$

Nine Regions of U.S.	Percentage	Y - Y
Pacific	15.7	15.7 - 31.5 = -15.8
West North Central	16.2	16.2 - 31.5 = -15.3
New England	17.6	17.6 - 31.5 = -13.9
East North Central	23.2	23.2 - 31.5 = -8.3
West South Central	24.3	24.3 - 31.5 = -7.2
Middle Atlantic	28.5	28.5 - 31.5 = - 3.0
East South Central	38.0	38.0 - 31.5 = 6.5
Mountain	47.9	47.9 - 31.5 = 16.4
South Atlantic	71.7	71.7 - 31.5 = 40.2
(mean = 31.5)	∑ Y = 283.1	$\Sigma (Y - \overline{Y}) = 0$

Nine Regions of U.S.	Percentage	Y-Y	$(Y - \overline{Y})^2$
		(squ	ared deviatio
Pacific	15.7	15.7 - 31.5 = -15.8	249.64
West North Central	16.2	16.2 - 31.5 = -15.3	234.09
New England	17.6	17.6 - 31.5 = -13.9	193.21
East North Central	23.2	23.2 - 31.5 = -8.3	68.89
West South Central	24.3	24.3 - 31.5 = -7.2	51.84
Middle Atlantic	28.5	28.5 - 31.5 = - 3.0	9.00
East South Central	38.0	38.0 - 31.5 = 6.5	42.25
Mountain	47.9	47.9 - 31.5 = 16.4	268.96
South Atlantic	71.7	71.7 - 31.5 = 40.2	1616.04

two negative numbers are multiplied the resulting product is a positive number).





#### Measures of Variability: Standard Deviation vs Variance

 $\cdot$  One problem with the variance is that the final number obtained is in a squared form

(that is, we squared all the deviations from the mean and so the final number is still "inflated" in this way making it difficult to interpret)

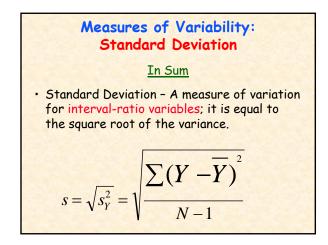
• One solution is to take the square root of the variance so that the number is no longer in a squared form (or "inflated") and it is back to its original form. The square root of the variance is called the Standard Deviation.

#### Measures of Variability: Standard Deviation

• To obtain the square root of the variance simply enter the number (variance) into your calculator and then push the square root button.

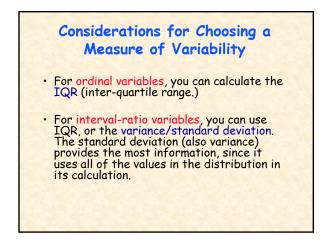
•If the variance is 341.74 the standard deviation would be 18.49. This tells us that the percent of change in the nursing home population for the nine regions is widely dispersed around the mean (mean = 31.45).

• Thus, the standard deviation is a measure of the average amount of variation (or deviation) around the mean.



#### Measures of Variability: Standard Deviation (a look at what's to come in future chapters) We will see later that when the data are "normally distributed" around the mean (produce a normal curve), 34% of the scores will be one standard deviation above the mean and 34% will be one standard deviation below the mean. Scores are often "normally distributed" around the mean when a random sample has

been used to obtain the scores or there are a large number of cases.



$$\sqrt{\frac{\sum (Y - \overline{Y})^2}{N - 1}}$$

