Measures of central tendency

- Used for interval or ordinal data
- “average” or “typical” value
- 3 averages: arithmetic mean, median, mode
- Sometimes equal, sometimes not

Arithmetic mean

- Assume 10 students have the following academic year earnings

$7,000	$4,000
$8,000	$16,000
$4,000	$7,000
$25,000	$8,000
$15,000	$7,000

Arithmetic mean:
ungrouped data

$$\overline{Y} = \frac{\sum Y}{n}$$

Arithmetic mean:
ungrouped data

$$= \frac{101{,}000}{10} = \$10{,}100$$

Arithmetic mean: grouped data

$$\overline{Y} = \frac{\sum fY}{n}$$

Where f = # in group

Arithmetic mean: grouped data

Values	Frequency	
4,000 x	2	
7,000 x	3	
8,000 x	2	
15,000 x	1	
16,000 x	1	
25,000 x	1	
	10	

Arithmetic mean:
grouped data

Values	Frequency	Value x frequency
4,000 x	2	8,000
7,000 x	3	21,000
8,000 x	2	16,000
15,000 x	1	15,000
16,000 x	1	16,000
25,000 x	1	25,000
	10	101,000/10 = 10,100

Median

$4,000
$4,000
$7,000
$7,000
$7,000
$8,000
$8,000
$15,000
$16,000
$25,000

Order #'s low to high

If odd #: choose middle number

If even #: average two in middle

Interpretation: Half of the people earn more than $7,500, half earn less.

Mode

$4,000
$4,000
$7,000
$7,000
$7,000
$8,000
$8,000
$15,000
$16,000
$25,000

Number that occurs most frequently =

$7,000

Arithmetic mean: grouped data

Income of Households, 2004 (in 1,000's)		
Household $	f	
< $10,000	9,805	
$10,000-19,999	14,754	
$20,000-39,999	26,904	
$40,000-59,999	19,972	
$60,000-79,999	14,535	
$80,000-99,999	9,362	
$100,000+	17,813	
	113,145	

Source: U.S. Census Bureau, Current Population Survey, 2005 Annual Social and Economic Supplement.

Arithmetic mean: grouped data

Income of Households, 2004 (in 1,000's)		
Household $	f	Midpoint
< $10,000	9,805	5,000
$10,000-19,999	14,754	15,000
$20,000-39,999	26,904	30,000
$40,000-59,999	19,972	50,000
$60,000-79,999	14,535	70,000
$80,000-99,999	9,362	90,000
$100,000+	17,813	100,000
	113,145	

Arithmetic mean:grouped data

$$\overline{Y} = \frac{\sum fY}{n}$$

= $50,531

Median: grouped data

Income of Households, 2004 (in 1,000's)		
Household $	f	
< $10,000	9,805	
$10,000-19,999	14,754	
$20,000-39,999	26,904	
$40,000-59,999	19,972	
$60,000-79,999	14,535	
$80,000-99,999	9,362	
$100,000+	17,813	
	113,145	

Source: U.S. Census Bureau, Current Population Survey, 2005 Annual Social and Economic Supplement.

Median: grouped data

Income of Households, 2004 (in 1,000's)		
Household $	f	Cumulative f
< $10,000	9,805	9,805
$10,000-19,999	14,754	24,559
$20,000-39,999	26,904	51,463
$40,000-59,999	19,972	71,435
$60,000-79,999	14,535	85,970
$80,000-99,999	9,362	95,332
$100,000+	17,813	113,145
	113,145	

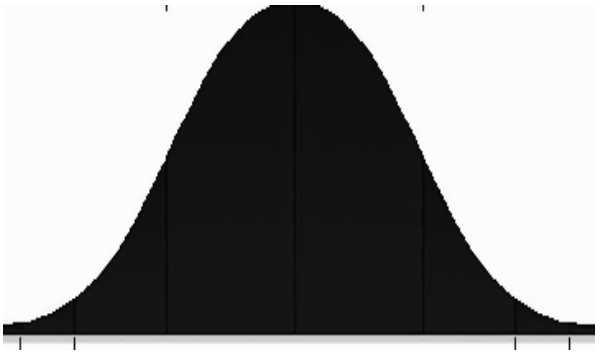
Median (and percentiles): grouped data

- 113,145 x .25 = 28286.25
- 113,145 x .50 = 56572.5
- 113,145 x .75 = 84858.75

Mode

- Can you calculate the mode for this distribution?

Normal distribution



Mean = Median = Mode

Positive skew,
or skew to the right

Example: income distribution

Negative skew, or skew to the left

Example: grade distribution

Bimodal distribution