

Measures of central tendency

- Used only for interval data or ordinal data we treat as interval
- Allows us to talk about “average” or “typical” value
- 3 averages: arithmetic mean, median, mode
- Sometimes these values are 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

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

Arithmetic mean:
ungrouped data

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

10

Arithmetic mean:
grouped data

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

Where f = # in group

Arithmetic mean:
grouped data

<u>Values</u>	<u>Frequency</u>	<u>Value x frequency</u>
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 from 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

Money Income of Households, 1998 (in 1,000's)

<u>Household \$</u>	<u>f</u>	<u>Midpoint</u>
< \$10,000	10,705	5,000
\$10,000-14,999	8,093	12,500
\$15,000-24,999	14,587	20,000
\$25,000-34,999	13,698	30,000
\$35,000-49,999	16,660	42,500
\$50,000-74,999	19,272	62,500
\$75,000+	20,860	75,000
	103,875	

Source: U.S. Census Bureau, Statistical Abstract of the U.S., 2000, Table 738.

Arithmetic mean: grouped data

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

n

$$= \$41,727$$

Median: grouped data

Money Income of Households, 1998 (in 1,000's)		
<u>Household \$</u>	<u>f</u>	<u>Cumulative f</u>
< \$10,000	10,705	10,705
\$10,000-14,999	8,093	18,798
\$15,000-24,999	14,587	33,385
\$25,000-34,999	13,698	47,083
\$35,000-49,999	16,660	63,743
\$50,000-74,999	19,272	83,015
\$75,000+	20,860	103,875

Source: U.S. Census Bureau, Statistical Abstract of the U.S., 2000, Table 738.

Median (and percentiles): grouped data

- $103,875 \times .25 = 25,968.75$
- $103,875 \times .50 = 51,937.5$
- $103,875 \times .75 = 77,906.25$

Median (and percentiles): grouped data

Money Income of Households, 1998 (in 1,000's)		
<u>Household \$</u>	<u>f</u>	<u>Cumulative f</u>
< \$10,000	10,705	10,705
\$10,000-14,999	8,093	18,798
\$15,000-24,999	14,587	33,385 (25%)
\$25,000-34,999	13,698	47,083
\$35,000-49,999	16,660	63,743 (50%)
\$50,000-74,999	19,272	83,015 (75%)
\$75,000+	20,860	103,875

Source: U.S. Census Bureau, Statistical Abstract of the U.S., 2000, Table 738.

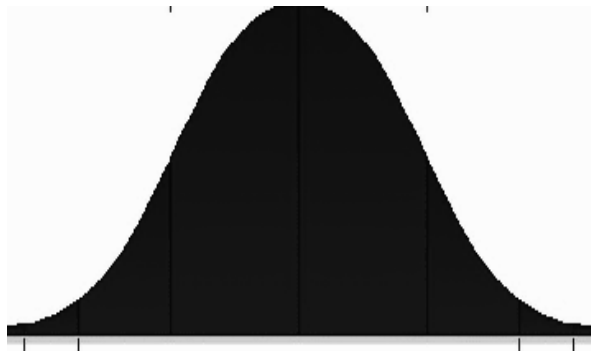
Median (and percentiles) grouped data

- 25th percentile: \$20,000
- 50th percentile (median): \$42,500
- 75th percentile: \$62,500

Mode

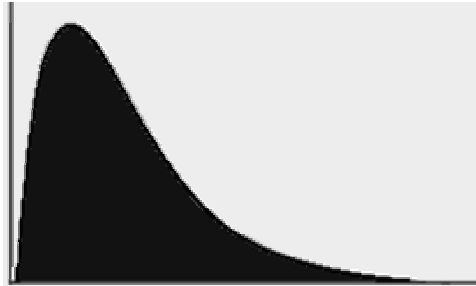
- Can you calculate the mode for this distribution?

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

