



Measures of Dispersion

- Example: Monthly Salaries of three Dept.

Dept. A	Dept. B	Dept. C
25000	24000	18000
25000	26000	32000
25000	23000	15000
25000	27000	35000

- Range

$$X_{\max} - X_{\min}$$

- Interquartile Range

Quartiles

- **Quartiles are the percentage points that break down the ordered data set into quarters.**
- **The first quartile is the 25th percentile. It is the point below which lie 3/4 of the data. It is the lower quartile. $Q_1 = (n+1)/4$ ordered observation.**
- **The second quartile is the 50th percentile. It is the point below which lie 1/2 of the data. This is also called the median. It is the middle quartile.**
- **The third quartile is the 75th percentile. It is the point below which lie 1/4 of the data. It is the upper quartile. $Q_3 = 3(n+1)/4$ ordered observation.**

Example (Continued)

Percentiles

- Find the 50th, 80th, and the 90th percentiles of this data set.
- To find the 50th percentile, determine the data point in position $(n + 1)P/100 = (20 + 1)(50/100) = 10.5$.
- Thus, the percentile is located at the 10.5th position.
- The 10th observation is 16, and the 11th observation is also 16.
- The 50th percentile will lie halfway between the 10th and 11th values (which are both 16 in this case) and is thus 16.

Example (Continued)

Percentiles

- To find the **80th percentile**, determine the data point in position $(n + 1)P/100 = (20 + 1)(80/100) = 16.8$.
- Thus, the percentile is located at the **16.8th position**.
- The **16th observation is 19**, and the **17th observation is also 20**.
- The **80th percentile** is a point lying **0.8** of the way from **19** to **20** and is thus **19.8**.

Example 1-2 (Continued)

Percentiles

- To find the **90th percentile**, determine the data point in position $(n + 1)P/100 = (20 + 1)(90/100) = 18.9$.
- Thus, the percentile is located at the **18.9th position**.
- The **18th observation** is **21**, and the **19th observation** is also **22**.
- The **90th percentile** is a point lying **0.9** of the way from **21** to **22** and is thus **21.9**.

Quartiles – Special Percentiles

- **Quartiles** are the percentage points that break down the ordered data set into quarters.
- The **first quartile** is the **25th percentile**. It is the point below which lie 3/4 of the data which is larger.
- The **second quartile** is the **50th percentile**. It is the point below which lie 1/2 of the data. This is also called the **median**.
- The **third quartile** is the **75th percentile**. It is the point below which lie 1/4 of the data which is larger.



Example : Finding Quartiles

Sales	Sorted Sales		$(n+1)P/100$ Position	Quartiles
9	6			
6	9			
12	10			
10	12			
13	13	← First Quartile	$(20+1)25/100=5.25$	$13 + (.25)(1) = 13.25$
15	14			
16	14			
14	15			
14	16			
16	16	← Median	$(20+1)50/100=10.5$	$16 + (.5)(0) = 16$
17	16			
16	17			
24	17			
21	18			
22	18	← Third Quartile	$(20+1)75/100=15.75$	$18 + (.75)(1) = 18.75$
18	19			
19	20			
18	21			
20	22			
17	24			



Quartiles for grouped data

$$Q_1 = L + \frac{(n/4) - m}{f} \times c$$

$$Q_2 = L + \frac{(n/2) - m}{f} \times c$$

$$Q_3 = L + \frac{(3n/4) - m}{f} \times c$$

where

L = lower limit of the class in which quartile lies.

n = Total no. of observations = $\sum f$

f = the frequency of the class in which the quartile observation lies.

C = Class interval of the class in which the quartile observation lies.

m = the cumulative frequency of the class preceding the one in which the Quartile lies.