[redacted]

Example: ⓐ $\{1.3 \quad 1.39 \quad 1.37 \quad 1.41 \quad 1.1 \quad 1.42\}$

~~n=6~~: sorted set: $\{1.1 \quad 1.3 \quad 1.37 \quad 1.39 \quad 1.41 \quad 1.42\}$

$n=6 \Rightarrow$ sample median $= \frac{1}{2}(x_3 + x_4) = \frac{1}{2}(1.37 + 1.39) = 1.38$

ⓑ $\{1.3 \quad 1.39 \quad 1.37 \quad 1.41 \quad 1.1\}$

sorted set: $\{1.1 \quad 1.3 \quad 1.37 \quad 1.39 \quad 1.41\}$

$n=5 \Rightarrow$ sample median $= x_3 = 1.37$

[redacted]

$\{2.7 \quad 1.9 \quad 2.8 \quad 2.9 \quad 3.1 \quad 3.7 \quad 3.3\}$. $n=7$

Find 10th percentile & 90th percentile ?

① the sorted set $= \{1.9 \quad 2.7 \quad 2.8 \quad 2.9 \quad 3.1 \quad 3.3 \quad 3.7\}$

② the 10th percentile is given by

$x_{0.1} = x_{10\%} =$ the $[(n-1)\cdot P/100+1]$ th element in the sorted set

$=$ the $[6 \times 0.1 + 1] = 2$th element $= 2.7$

$x_{0.9} = x_{90\%} =$ the $[6 \times 0.9 + 1] = 6$th element $= 3.3$

Hands-on problems (1)

[redacted]

① $\bar{X} = \dfrac{\sum_{i=1}^{n} x_i}{n} = \dfrac{17.5}{6} = 2.917$

② sorted $\{1.9, 2.7, 2.8, 2.8, 3.2, 4.1\}$

$\therefore$ sample median $= \dfrac{2.8+2.8}{2} = 2.8$

③ $s = \sqrt{\dfrac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n-1}} = \sqrt{\dfrac{2.5883}{5}} = \sqrt{0.5177}$

$= 0.7195$ ①

④ $SIQR = \dfrac{Q_3 - Q_1}{2}$

$Q_1 = x_{[(n+1)\cdot p/100+1]} = x_{[5\times 0.25+1]} = x_{[2.25]} = x_2 = 2.7$

$Q_3 = x_{[5\times 0.75+1]} = x_{[4.75]} = x_5 = 3.2$

$SIQR = \dfrac{3.2-2.7}{2} = 0.25$

(Alt. $\dfrac{5-2}{2}$ or $\dfrac{4.75-2.25}{2}$)

Hands-On Problems (2)

- The performance improvements in the latest version of 7 layers of a new networking protocol was measured separately for each layer. What is the average improvement per layer? (Hint: the improvements in the 7 layers work in a multiplicative way)

Layer	1	2	3	4	5	6	7
Improvement (%)	18	13	11	8	10	28	5

Other examples that work in a multiplicative manner:
- Cache hit/miss ratios over several levels of caches
- Percentage performance improvement between successive versions
- Average error rate per hop on a multi-hop path in a network

[redacted] $(1.18 * 1.13 * 1.11 * 1.08 * 1.1 * 1.28 * 1.05)^{1/7} - 1$

$= 0.13 = 13\%$

avg improvement per layer is 13%

$\boxed{\text{Use Geometric Mean.}}$

[redacted]