MDM 4U

MEASURES OF SPREAD

Measures of Spread = In a set of data, the measures of spread ***indicate how closely a set of data clusters around its centre*** (mean or median).

① STANDARD DEVIATION

= indicates how closely a set of data clusters around its ***mean***.

Population:

μ = mean of data

$= \sum_{i=1}^{N} \frac{x_i}{N}$ where *N* is number of data; x_i is each datum.

σ = standard deviation

$= \sqrt{\frac{\sum_{i=1}^{N}(x_i)^2 - N\mu^2}{N}}$

z = the number of standard deviations that a datum is from the mean.

$z = \frac{x-\mu}{\sigma}$

Sample:

$\bar{x}$ = mean of data

$= \sum_{i=1}^{n} \frac{x_i}{n}$ (*n* = number of data)

s = standard deviation

$= \sqrt{\frac{\sum_{i=1}^{n}(x_i)^2 - n\bar{x}^2}{n-1}}$

$z = \frac{x-\bar{x}}{s}$

EXAMPLE: Given the set of data represents a sample of percentages on a recent math test, determine the mean and standard deviation, and the z-score of the lowest mark.

21	52	58	62	65	65	66	71	75	76
78	78	80	82	83	86	88	91	92	96

$\sum \boldsymbol{x = 1465}$ $\sum \boldsymbol{x^2 = 112883}$

② QUARTILES & INTERQUARTILE RANGE

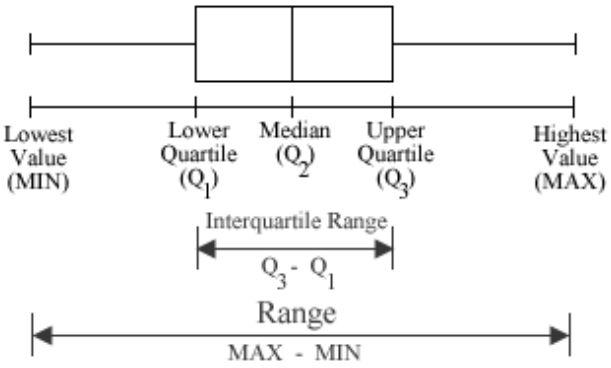
= indicates how closely the data are clustered around the ***median***.

QUARTILES = divide a set of ordered data into 4 equal groups.

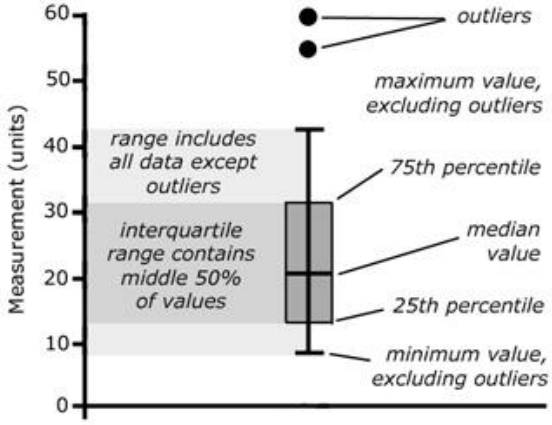
Q_1 = first quartile = middle datum of first half of data
Q_2 = second quartile = median
Q_3 = third quartile = middle datum of the second half of data
$IQR = Q_3 - Q_1$
Range = MAX - MIN

Box-and-Whisker Plots: Illustrations of quartiles, interquartile range, and outliers.

①



②

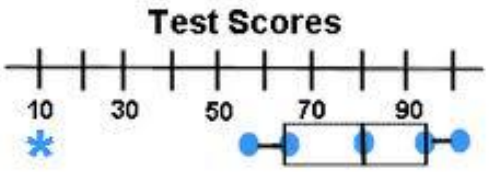


Outliers are data points that are further than the length of 1.5 x IQR away from either end of the box-and-whisker plot.

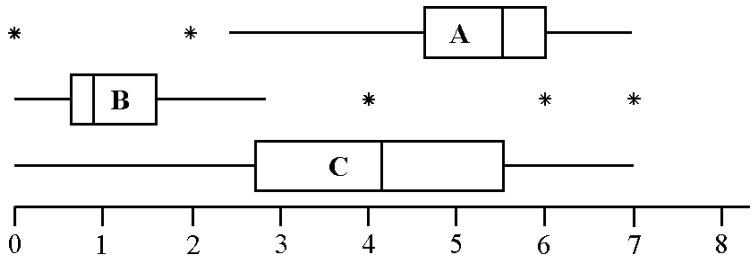
EXAMPLES:

For each box-and-whisker plot in #1-3, determine the values of all quartiles, IQR, range, and outliers.

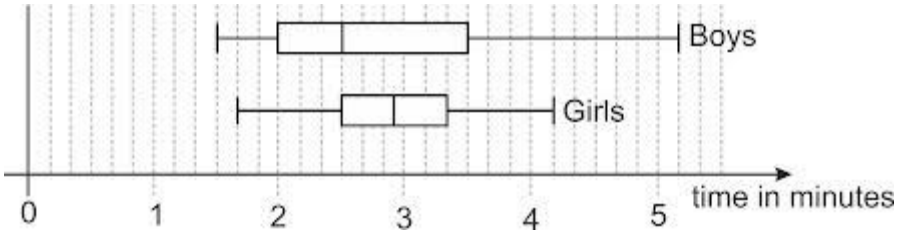
1.



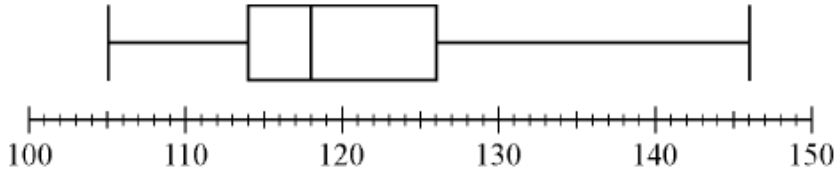
2.



3.



4. Eight hundred insects were weighed, and the resulting measurements, in milligrams, are summarized in the boxplot below.



(a) What are the range, the three quartiles, and the interquartile range of the measurements?
(b) If the 80th percentile of the measurements is 130 milligrams, about how many measurements are between 126 milligrams and 130 milligrams?

5. Draw a box-and-whisker plot to illustrate the scores for the applications.

APPLICATION	# of vulnerabilities by severity				SCORE
	TOTAL	HIGH	MEDIUM	LOW	
1. Apple Safari	81	2	71	8	413
2. Mozilla Firefox	44	3	30	11	236
3. Google Chrome	61	1	30	30	205
4. Microsoft Internet Explorer	34	1	30	3	178
5. Adobe Flash Player	34	0	34	0	170
6. Adobe Reader	34	0	34	0	170
7. Java Runtime Environment	28	5	5	18	168
8. Adobe Acrobat	32	0	32	0	160
9. Adobe Air	28	0	28	0	140
10. Mozilla SeaMonkey	26	1	20	5	130
11. Microsoft Office	22	0	22	0	110
12. Mozilla Thunderbird	18	1	14	3	98
13. Adobe Shockwave Player	18	0	18	0	90
14. Oracle Database Server	9	3	0	6	81
15. Microsoft Visio	3	3	0	0	75