# Answer on Question #81193 – Math – Statistics and Probability

## Question

For the following data

| x | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| f | 1 | 9 | 26 | 59 | 72 | 52 | 29 | 7 | 1 |

Calculate the quartiles $Q_1$, $Q_2$, and $Q_3$.

## Solution

There is no common definition of quartiles and they can be selected in different ways. The Wikipedia article describes 3 methods to split off a set of data into four equal groups (quarters). First of all, the values must be sorted in ascending order (by finding the next larger value):

| f | 1 | 9 | 26 | 59 | 72 | 52 | 29 | 7 | 1 |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | | | | | | | | |
| | 1 | 1 | | | | | | | |
| | 1 | 1 | 7 | | | | | | |
| S | 1 | 1 | 7 | 9 | 26 | 29 | 52 | 59 | 72 |

Suppose the median, or the second quartile $Q_2$, is defined as follows:

$$Q_2(n = 2k + 1) = (\text{ k+1-th term}),\ \ Q_2(n = 2k) = (\text{k-th term})\div 2 + (\text{ k+1-th term})\div 2.$$

Therefore, $Q_2 = Q_2(S) = \text{5-th term} = 26$. Now $Q_1$ and $Q_3$ can be calculated using the methods described there.

Method 1

| S | 1 | 1 | 7 | 9 | | 29 | 52 | 59 | 72 |
|---|---|---|---|---|---|---|---|---|---|

$Q_1 = 1\div 2 + 7\div 2 = .5 + 3.5 = 4$, $Q_3 = 52\div 2 + 59\div 2 = 26 + 29.5 = 55.5$

Method 2

| S | 1 | 1 | 7 | 9 | 26 | 29 | 52 | 59 | 72 |
|---|---|---|---|---|---|---|---|---|---|

$Q_1 = 7$ , $Q_3 = 52$

Method 3

| S | 1 | 1 | 7 | 9 | 26 | 29 | 52 | 59 | 72 |
|---|---|---|---|---|---|---|---|---|---|

$Q_1 = 1\div 4 \times 3 + 7\div 4 = 2.5$ , $Q_3 = 52\div 4 + 59\div 4 \times 3 = 229\div 4 = 57.25$

If $Q_1$ is in $[1, 7]$, $Q_2$ is in $[9, 29]$, and $Q_3$ is in $[52, 59]$, then about $25\%$ of the values lie at or below $Q_1$, about 50% at or below $Q_2$, and about $75\%$ at or below $Q_3$.