2. In 1798, the British scientist Henry Cavendish measured the density of the earth by careful work with a torsion balance. The variable recorded was the density of the earth as a multiple of the density of water (taken as 1). Cavendish's 29 measurements (y_j) were:

5.50	5.61	4.88	4.07	5.26	5.55	5.36	5.29	5.58	5.65
5.57	5.53	5.62	5.29	5.44	5.34	5.79	5.10	5.27	5.39
5.42	5.47	5.63	5.34	5.46	5.30	5.75	5.86	5.85;	

MARKS

7

(2, 3, 2)

for these data: $\sum_{j=1}^{n} y_j = 157.17$; $\sum_{j=1}^{n} y_j^2 = 855.0227$; $n = 29$.

(a) Construct a stemplot (with *ordered* leaves) of these data.

(b) On the basis of your stemplot, comment briefly on the main feature(s) of the distribution.

(c) What is your estimate of the density of the earth based on these measurements? Justify your answer briefly.

(a) A stemplot with *ordered* leaves is:

5.9		(–)
5.8	56	(2)
5.7	59	(2)
5.6	1235	(4)
5.5	03578	(5)
5.4	2467	(4)
5.3	04469	(5)
5.2	6799	(4)
5.1	0	(1)
5.0		(–)
4.9		(–)
4.8	8	(1)
4.7		(–)
4.6		(–)
4.5		(–)
4.4		(–)
4.3		(–)
4.2		(–)
4.1		(–)
4.0	7	(1)

(b) 27 of the 29 observations are reasonably **symmetrically** distributed over the interval 5.1 to 5.8 units, with the **centre** of the distribution being around 5.45 units.

The observation 4.07 is most likely an outlier.

The observation 4.88 may also be an outlier.

(c) The *median* (the *15*th *ordered* observation) is 5.46 units; it is a *resistant* measure of location.

For the 27 observations *omitting* 4.07 and 4.88:

$\sum_{j=1}^{27} y_j = 157.17 - 4.07 - 4.88 = 148.22$;

the *average* of these 27 measurements is $\bar{y} = \frac{148.2}{27} \simeq 5.49$ units.

Thus, the data suggest a 'best' estimate of around 5.46-5.49 units for the density of the earth.

5.46-5.49 units (c)

Density estimate