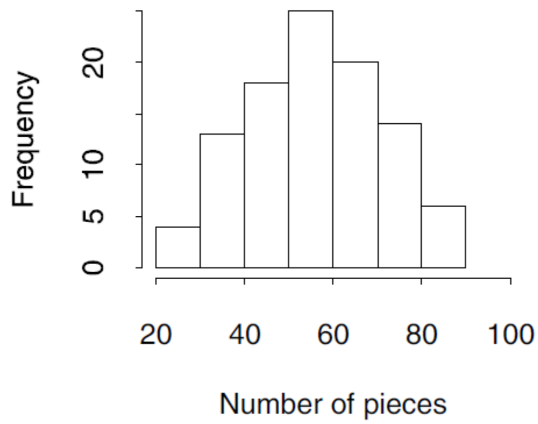
Solution to tutorial 1

2.14 We first create the frequency table.

Class limits	Frequency	Class limits	Frequency
20 - 29	4	60 - 69	20
30 - 39	13	70 - 79	14
40 - 49	18	80 - 89	6
50 - 59	25		

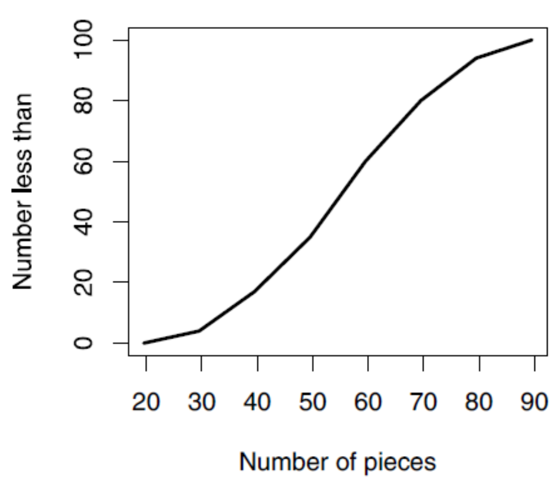
The histogram is



2.15 The "less than" distribution of the data in the preceeding exercise is:

Class boundary	Number less than	Class boundary	Number less than
20.0	0	60.0	60
30.0	4	70.0	80
40.0	17	80.0	94
50.0	35	90.0	100

The ogive is



Solution to tutorial 1

2.34 (a) A computer calculation gives

```
N      MEAN    STDEV
29   1.4707   0.5235
```

You may verify the mean by first showing that $\sum x_i = 4265$.

(b) You may confirm the calculation of s by showing that $\sum x_i^2 = 2041.54$ so

$$s^2 = \frac{29(2041.54) - (4265)^2}{29 \cdot 28} = .2740 \quad \text{or} \quad s = \sqrt{.2740} = .5235$$

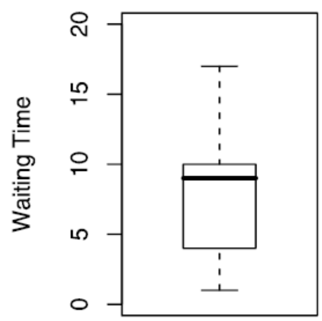
2.39 (a) The mean is 8.

(b) The sorted data are:

1, 2, 2, 3, 5, 6, 8, 9, 9, 10, 10, 10, 13, 15, 17.

The median is the eighth smallest which is 9.

(c) The boxplot is



2.40 (a) The table of data, deviation, and deviation squared is:

Data	1	2	2	3	5	6	8	9	9	10	10	10	13	15	17
Dev.	−7	−6	−6	−5	−3	−2	0	1	1	2	2	2	5	7	9
Sq.	49	36	36	25	9	4	0	1	1	4	4	4	25	49	81

The sum of the squared deviations is 328. Thus,

$$s^2 = 328/14 = 23.43 \quad \text{and} \quad s = 4.84.$$

(b) The sum of the observations is 120. The sum of the observations squared is 1288. Thus,

$$s^2 = (15 \cdot 1288 - 120^2)/(15 \cdot 14) = 23.43 \quad \text{and} \quad s = 4.84.$$

Solution to tutorial 1

2.50

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

But $\bar{x} = \sum_{i=1}^{n} x_i/n$, so,

$$\sum_{i=1}^{n}(x_i - \bar{x}) = \sum_{i=1}^{n} x_i - \sum_{i=1}^{n} x_i = 0.$$

2.52 Let $x_i = cu_i + a$. Then

$$\bar{x} = \sum_{i=1}^{n} x_i/n = \left(\sum_{i=1}^{n}(cu_i + a)\right)/n = c\sum_{i=1}^{n} u_i/n + na/n = c\bar{u} + a.$$

Now,

$$\begin{aligned} s_x^2 &= \sum_{i=1}^{n}(x_i - \bar{x})^2/(n-1) = \sum_{i=1}^{n}(cu_i + a - c\bar{u} - a)^2/(n-1) \\ &= \sum_{i=1}^{n}(cu_i - c\bar{u})^2/(n-1) = c^2\sum_{i=1}^{n}(u_i - \bar{u})^2/(n-1) = c^2 s_u^2. \end{aligned}$$

Thus, $s_x = cs_u$.

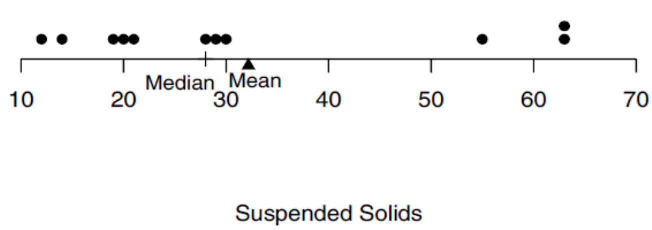
2.56 Suppose the data in set 1 is $\{x_1, ..., x_{n_1}\}$, set 2 $\{x_{n_1+1}, ..., x_{n_2}\}$, ..., set k $\{x_{n_{k-1}+1}, ..., x_{n_k}\}$. The total size of the data is

$$n = n_1 + ... + n_k.$$

Since $x_1 + ... + x_{n_1} = n_1\bar{x}_1$, $x_{n_1+1} + ... + x_{n_2} = n_2\bar{x}_2$, ... $x_{n_{k-1}+1} + ... + x_{n_k} = n_k\bar{x}_k$, we have

$$\begin{aligned} \bar{x} &= \frac{x_1 + ... + x_{n_1} + x_{n_1+1} + ... + x_{n_2} + ... + x_{n_{k-1}+1} + ... + x_{n_k}}{n} \\ &= \frac{n_1\bar{x}_1 + n_2\bar{x}_2 + ... + n_k\bar{x}_k}{n_1 + n_2 + ... + n_k} \end{aligned}$$

2.68 (a) The dot diagram for the suspended solids data is



(b) The median = 28.0 and the mean = 32.182.

(c) The variance and standard deviation are

$s^2 = 363.76$ and $s = 19.073$.

Solution to tutorial 1

2.69 (a) The ordered data are: 12 14 19 20 21 28 29 30 55 63 63

The quartiles for the suspended solids data are $Q_1 = 19$, $Q_2 = 28$, and $Q_3 = 55$.

(b) The minimum, maximum, range and the interquartile range are

Minimum = 12, maximum = 63, range = 63 − 12 = 51 and

interquartile range = $Q_3 - Q_1 = 55 - 19 = 36$.

(c) The boxplot is given in Figure 2.3.

2.75 (a) The ordered observations are

389.1 390.8 392.4 400.1 425.9 429.1 448.4 461.6
479.1 480.8 482.9 497.2 505.8 516.5 517.5 547.5
550.9 563.7 567.7 572.2 572.5 575.6 595.5 602.0
606.7 611.9 618.9 626.9 634.9 644.0 657.6 679.3
698.6 718.5 738.0 743.3 752.6 760.6 794.8 817.2
833.9 889.0 895.8 904.7 986.4 1146.0 1156.0

The first quartile is the 12th observation, 497.2, the median is the 24th observation, 602.0, and the third quartile is the 36th observation, 743.3.

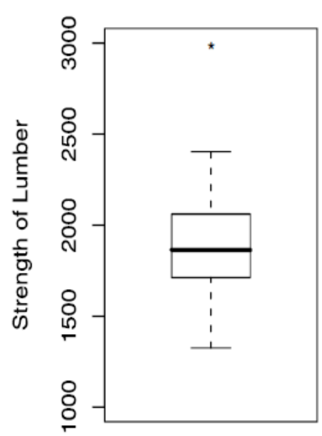
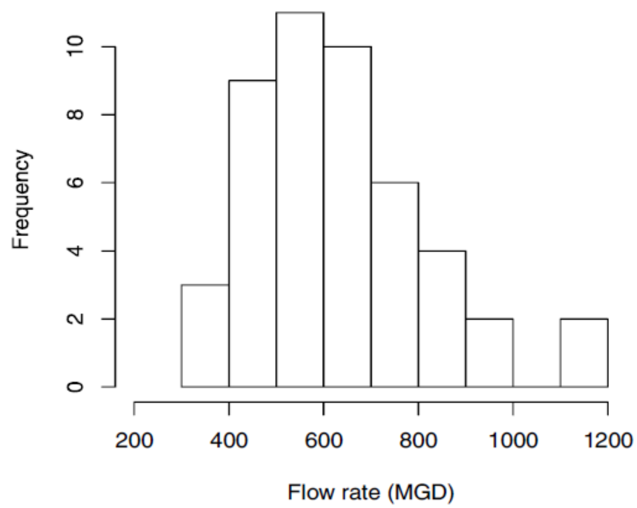


Figure 2.4: Boxplot for Exercise 2.74

(b) Since 47(.90) = 42.3, the 90th percentile is the 43rd observation, 895.8.

(c) The histogram is

Solution to tutorial 1



2.21

Calculate the cumulative frequencies

Value x_i	12,	14,	21,	28,	30,	55,	63
Cumulative frequency ($\leq x_i$)	1 ,	2,	4,	5,	8,	9,	10
Relative Cumulative frequency	0.1,	0.2,	0.4,	0.5 ,	0.8	0.9,	1.0