Tutorial 1

2.14 In a two-week study of the productivity of workers, the following data were obtained on the total number of acceptable pieces which 100 workers produced:

65	36	49	84	79	56	28	43	67	36
43	78	37	40	68	72	55	62	22	82
88	50	60	56	57	46	39	57	73	65
59	48	76	74	70	51	40	75	56	45
35	62	52	63	32	80	64	53	74	34
76	60	48	55	51	54	45	44	35	51
21	35	61	45	33	61	77	60	85	68
45	53	34	67	42	69	52	68	52	47
63	65	55	61	73	50	53	59	41	54
41	74	82	58	26	35	47	50	38	70

Group these figures into a distribution having the classes 20–29, 30–39, 40–49, . . . , and 80–89, and plot a histogram using [20, 30), . . . , [80, 90), where the left-hand endpoint is included but the right-hand endpoint is not.

2.15 Convert the distribution obtained in Exercise 2.14 into a cumulative "less than" distribution and plot its ogive.

2.34 A contract for the maintenance of a national railway's high-horsepower locomotives was given to a large private company. After one year of experience with the maintenance program, those in charge of the program felt that major improvements could be made in the reliability of the locomotives. To document the current

status, they collected data on the cost of materials for rebuilding traction motors. Use the data below to

(a) calculate the sample mean $\bar{x}$,

(b) calculate the sample standard deviation s.

Materials costs for rebuilding traction motors (thousands of dollars):

1.41	1.70	1.03	0.99	1.68	1.09	1.68	1.94
1.53	2.25	1.60	3.07	1.78	0.67	1.76	1.17
1.54	0.99	0.99	1.17	1.54	1.68	1.62	0.67
0.67	1.78	2.12	1.52	1.01			

The following are the numbers of minutes that a person had to wait for a bus to work on 15 working days:

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

(a) Find the mean.

(b) Find the median.

(c) Draw a boxplot.

With reference to the preceding exercise, find s^2 using

(a) the formula that defines s^2;

(b) the handheld calculator formula for s^2.

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2.50 Show that

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

for any set of observations $x_1, x_2, \ldots, x_n$.

2.52 If data are coded so that $x_i = c \cdot u_i + a$, show that $\bar{x} = c \cdot \bar{u} + a$ and $s_x = |c| \cdot s_u$.

2.56 If k sets of data consist, respectively, of $n_1, n_2, \ldots, n_k$ observations and have the means $\bar{x}_1, \bar{x}_2, \ldots, \bar{x}_k$, then the overall mean of all the data is given by the formula

$$\bar{x} = \frac{\sum_{i=1}^{k} n_i \bar{x}_i}{\sum_{i=1}^{k} n_i}$$

Please prove it.

2.68 A civil engineer monitors water quality by measuring the amount of suspended solids in a sample of river water. Over 11 weekdays, she observed

14 12 21 28 30 63 29 63 55 19 20

suspended solids (parts per million).

(a) Draw a dot diagram.

(b) Find the median and the mean. Locate both on the dot diagram.

(c) Find the variance and standard variation.

2.69 With reference to Exercise 2.68,

(a) find the quartiles:

(b) find the minimum, maximum, range, and interquartile range:

(c) construct a boxplot.

2.75 Civil engineers must monitor flow on rivers where power is generated. The following are the daily mean flow rates in millions of gallons per day (MGD) on the Namekagon River during the month of May for 47 years.

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

(a) Obtain the quartiles.

(b) Obtain the 90th percentile.

(c) Construct a histogram.

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2.21 Given a set of observations $x_1, x_2, \ldots,$ and x_n, we define their **empirical cumulative distribution** as the function whose values $F(x)$ equal the proportion of the observations less than or equal to x. Graph the empirical cumulative distribution for the data

14, 12, 21, 21, 28, 30, 30, 30, 63,55