

7.1

You have been successful in an interview for a trainee business analyst post at National Bank. You are keen to accept since you understand from the personnel manager that "the average annual salary of business analysts is £30,000". The salaries of 9 analysts working at this bank is shown in the box below.

Gross annual salary: Business analysis section (£)

70,000	65,000	18,000	17,000	19,000
19,000	21,000	20,000	21,000	

- Calculate the mean salary.
- Calculate the standard deviation of the salaries. (Hint: to simplify the arithmetic work in thousands of £s)
- Determine the median salary.
- Comment on the personnel manager's statement. Was it helpful?
- (Optional) Check your answers using Excel.

Solutions by E PARRY

7.1

Now $\bar{X} = \Sigma X/n$, and here $n = 9$.

$$\therefore \bar{X} = 270/9 = 30 \text{ (£000)}$$

The mean gross annual salary in the section is **£30,000**

$$s = \sqrt{\frac{\sum X^2}{n} - (\bar{X})^2}$$

$$s = \sqrt{\frac{\sum (x - \bar{X})^2}{n}}$$

Total 270

Solutions by E PARRY

7.1

Let's apply the first formula.

X	$X - \bar{X}$	$(X - \bar{X})^2$
70	40	1600
65	35	1225
18	-12	144
17	-13	169
19	-11	121
19	-11	121
21	-6	81
20	-10	100
21	-9	81
Total	0	3642

Handwritten notes: $70 - 30 = 40$, $40^2 = 1600$, 40^2

Solutions by E PARRY

7.2

The table shows the payment record of a sample of 100 of your account customers.

Payment within (days)	No. of customers
0-9	4
10-19	15
20-29	32
30-39	24
40-59	12
60-74	8
75-99	5

(a) Estimate the arithmetic mean and standard deviation number of days credit being extended to these customers.

(b) How many days credit are the worst 20% of payers taking?

Solutions by E PARRY

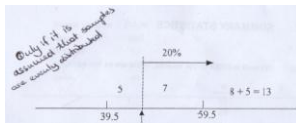
7.2

Payment within (days)	X	f	Xf	X ² f
0-9	4.5	4	18	81
10-19	14.5	15	217.5	3153.75
20-29	24.5	32	784	19208
30-39	34.5	24	828	28566
40-59	49.5	12	594	29403
60-74	67.0	8	536	35912
75-99	87.0	5	435	37845
		100	3412.5	154168.75

$$\bar{X} = \Sigma Xf/n, \text{ and here } n = \Sigma f$$

$$\therefore \bar{X} = 3412.5/100 = 34.1 \text{ days}$$

$$\text{Now } s = \sqrt{\frac{\sum X^2 f}{n} - (\bar{X})^2} = \sqrt{\frac{154168.75}{100} - (34.125)^2} = \sqrt{377.17} = 19.4 \text{ days}$$



Solutions by E PARRY

7.3

A study of hours worked overtime (including evenings and weekends) over the last year in a large plant yielded the following summary statistics.

Sex	Age		
	Under 30 years	30 to under 45 years	45 years and more
MALE: mean	400	350	280
median	350	275	300
std. dev.	80	100	140
FEMALE: mean	180	200	150
median	200	220	140
std. dev.	80	90	70

What, if any, are the main points of interest?

Solutions by E PARRY

7.4

The table shows the asking prices of a sample of three-bedroom houses currently for sale in a Northwest town.

Asking price (£'000s)	No. of Houses
80 and <100	4
100 and <120	19
120 and <140	31
140 and <160	16
160 and <200	11
200 and <240	6
240 and <300	3

- (a) Estimate the arithmetic mean and standard deviation of the asking prices.
 (b) Apart from random variation, what factors might explain the variation in asking price?

Solutions by E PARRY

7.4

Asking price (£'000s)	X	f	Xf	X ² f
80 & < 100	90	4	360	32400
100 & < 120	110	19	2090	229900
120 & < 140	130	31	4030	523900
140 & < 160	150	16	2400	360000
160 & < 200	180	11	1980	356400
200 & < 240	220	6	1320	290400
240 & < 300	270	3	810	218700
		90	12990	2011700

$$\bar{X} = \Sigma fX/n, \text{ and here } n = \Sigma f$$

$$\therefore \bar{X} = 12990/90 = 144.33 \text{ (£'000)} = \text{£}144,330$$

$$\text{Now } s = \sqrt{\frac{\Sigma X^2 f}{n} - (\bar{X})^2} = \sqrt{\frac{2011700}{90} - (144.33)^2} = \sqrt{1520.1111} \\ = 38.99 \text{ (£'000)} = \text{£}38,990$$

Solutions by E PARRY

7.5

G & S plc is a small brewery supplying public houses in East Anglia. The production manager, Jim Froth, as an aid to forecasting notes weekly sales of mild and bitter beer for a sample of weeks during last year. He chose the first week in each month over the period April to December. The data is shown below.

Week Ending 1997	Sales of Mild gallons	Sales of Bitter gallons
April 5	8500	17500
May 3	8500	18900
June 7	9000	23800
July 5	12000	22500
August 2	8000	27500
September 8	7500	26300
October 4	7500	20000
November 1	12000	18700
December 6	9500	15000

- (a) For each type of beer calculate:

(i) the mean sales

- (ii) the range
 (iii) the standard deviation.
 (To simplify the arithmetic work in thousands of gallons.)

(b) Advise Jim on your results.

(c) What reservations would you have about his sampling method?

Solutions by E PARRY

7.5

w/e	X	X ²
05-Apr-97	8.5	72.25
03-May	8.5	72.25
07-Jun	9	81.00
05-Jul	12	144.00
02-Aug	8	64.00
06-Sep	7.5	56.25
04-Oct	7.5	56.25
01-Nov	12	144.00
06-Dec	9.5	90.25
SUM	82.5	780.25

(i) Mean weekly sales $\bar{X} = \Sigma X/n = 82.5/9 = 9.17$ (000) = 9,167 gallons.

(ii) The range is 12000 - 7500 = 4,500 gallons.

(iii) The standard deviation is given by

$$s = \sqrt{\frac{\Sigma X^2}{n} - (\bar{X})^2} = \sqrt{\frac{780.25}{9} - 9.167^2} = \sqrt{2.6667} = 1.633$$

Applying the small sample correction factor we obtain

$$s = 1.633 \sqrt{\frac{n}{n-1}} = 1.633 \sqrt{\frac{9}{8}} = 1.73 \text{ (000)}$$

i.e. $s = 1,730$ gallons coefficient of variation = $s/\bar{X} \times 100\% = 19\%$

Solutions by E PARRY

7.5

w/e	X	X ²
05-Apr-97	17.5	306.250
03-May	18.8	353.440
07-Jun	23.8	566.440
05-Jul	22.5	506.250
02-Aug	27.5	756.250
06-Sep	26.3	691.690
04-Oct	20	400.000
01-Nov	18.7	349.690
06-Dec	15	225.000
SUM	190.1	4155

(i) Mean weekly sales $\bar{X} = \Sigma X/n = 190.1/9 = 21.12$ (000) = 21,120 gallons.

(ii) The range is 27500 - 15000 = 12,500 gallons.

(iii) The standard deviation is given by

$$s = \sqrt{\frac{\Sigma X^2}{n} - (\bar{X})^2} = \sqrt{\frac{4155}{9} - 21.12^2} = \sqrt{15.195} = 3.939$$

Applying the small sample correction factor we obtain

$$s = 3.939 \sqrt{\frac{n}{n-1}} = 3.939 \sqrt{\frac{9}{8}} = 4.18 \text{ (000)}$$

i.e. $s = 4,180$ gallons coefficient of variation = $s/\bar{X} \times 100\% = 20\%$

Solutions by E PARRY