NELSON QMATHS 12 GENERAL MATHEMATICS

WORKED SOLUTIONS

Chapter 1 Associations between variables

Exercise 1.01 Bivariate data

Question 1

a

	Surf	Swim	Lie on beach	
Staying locally	12	15	4	31
Visiting	6	7	6	19
	18	22	10	50

b There were 7 swimmers visiting Kirra beach.

Question 2

	Logging support		
	Yes	No	
NSW	20	56	76
Victoria	18	63	81
Queensland	25	43	68
NT	8	23	31
SA	12	48	60
WA	24	39	63
Tasmania	15	32	47
ACT	2	25	27
	124	329	453

Question 3

		Flat	Unit	House	
Refrigerators and freezers	1	40	35	40	115
	2	10	20	70	100
	3	5	5	30	40
	4	0	0	20	20
	> 4	0	0	5	5
		55	60	165	280

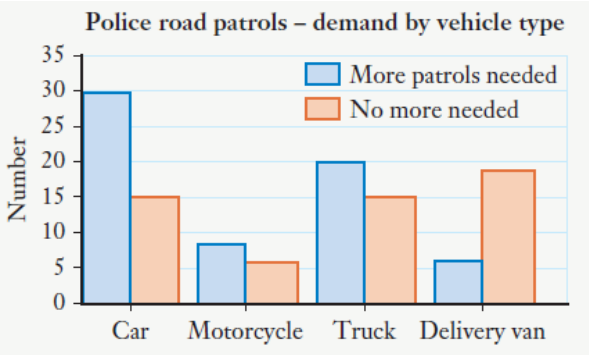
Question 4

	Male	Female	
Book club member	20	32	52
Non-member	8	15	23
	28	47	75

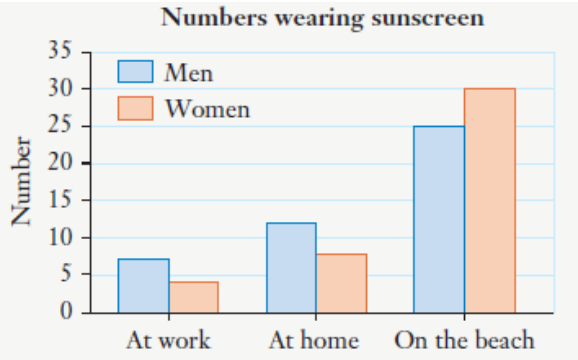
a There are 23 non-members.

b There are 47 women.

Question 5



Question 6



Question 7

Students are less than 20 years of age and teachers are more than 20 years of age.

		Age		
		≤ 20 (student)	>20 (teacher)	
Music type	C	5	6	11
	J	5	7	12
	E	9	5	14
	CW	5	6	11
	R	12	8	20
		36	32	68

It looks like more students have a greater preference for easy-listening and rock than teachers.

Question 8

		Years of education									
		11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	
Worker	**Blue**	4	6	9	2	9	0	0	0	0	30
	White	0	10	11	8	11	10	0	0	0	50
	Management	0	0	0	2	3	1	6	4	4	20
		4	16	20	12	23	11	6	4	4	100

Blue-collar workers have the lowest number of years of education, and management workers the highest.

Exercise 1.02 Percentage tables

Question 1

a The percentage is the total of single parents.

b The percentage is the total of men.

c The percentage is the total of accidental injuries.

d The percentage is the total of sports games.

e The percentage is the total of low-income families.

Question 2

a The total is the number of people interviewed.

b The total is the number of women interviewed.

c The total is the number of people in favour of daylight saving.

d The total is the number of teenagers.

e The total is the number of pet-owners.

Question 3

Location	By men		By women		Total
	On men	On women	On men	On women	
At home	258.9	44.5	34.7	119.0	457.1
At work	21.8	141.8	23.8	7.3	
At licensed premises	24.1	42.6	7.7	4.3	78.7
Outside	11.3	167.9	18.9	18.4	
Other	30.0	47.1	9.4	10.6	
Total	346.1	443.9	94.5	159.6	

a The percentage of assaults at home by women = $\frac{34.7+119}{457.1}\times 100 = 33.6\%$

b The percentage of assaults by women at home = $\frac{34.7+119}{94.5+159.6}\times 100 = 60.5\%$

c The percentage of assaults on men by women = $\frac{94.5}{346.1+94.5}\times 100 = 21.4\%$

d The percentage of assaults by women on men = $\frac{94.5}{94.5+159.6}\times 100 = 37.2\%$

e The percentage of assaults at licensed premises by men = $\frac{24.1+42.6}{78.7}\times 100 = 84.8\%$

f The percentage of assaults by men at work = $\frac{21.8+141.8}{346.1+443.9}\times 100 = 20.7\%$

g The percentage of assaults on men at work. = $\frac{21.8+23.8}{346.1+94.5}\times 100 = 10.3\%$

Question 4

	Lunch break			
	½ hour	**¾ hour**	**1 hour**	**Total**
Workshop	14	20	12	46
On-site	20	14	6	40
Office	6	8	13	27
Total	40	42	31	113

a The percentage of workshop workers who prefer 1 hour = $\frac{12}{46} \times 100 = 26.1\%$

b The percentage of office workers who prefer $\frac{1}{2}$ hour = $\frac{6}{27} \times 100 = 22.2\%$

c The percentage of those who prefer $\frac{1}{2}$ hour who are office workers

= $\frac{6}{40} \times 100 = 15.0\%$

d The percentage of all workers who prefer $\frac{1}{2}$ hour and are office workers

= $\frac{6}{113} \times 100 = 5.3\%$

e The percentage of on-site workers who prefer 1 hour. = $\frac{6}{40} \times 100 = 15\%$

Question 5

	Quality control		
	Pass	**Fail**	**Total**
Line A	35	6	41
Line B	42	8	50
Line C	59	8	67
Total	136	22	158

a The percentage of failures that are from line A = $\frac{6}{22} \times 100 = 27.3\%$

b The percentage of Line A that fail quality control = $\frac{6}{41} \times 100 = 14.6\%$

c The percentage of total production from line A = $\frac{41}{158} \times 100 = 25.9\%$

d The percentage of good production that is from line A = $\frac{35}{136} \times 100 = 25.7\%$

e The percentage of Line C that fail quality control = $\frac{8}{67} \times 100 = 11.9\%$

Question 6

a

	Republic			
	Yes	Don't care	No	
Labor	28	4	17	49
Liberal/ National	25	3	27	55
Minor parties	8	7	6	21
	61	14	50	125

b Row percentages = $\frac{\text{cell value}}{\text{row total}} \times 100\%$

Labor

Yes $\frac{28}{49} \times 100 = 57.1\%$ Don't care $\frac{4}{49} \times 100 = 8.2\%$

No $\frac{17}{49} \times 100 = 34.7\%$

	Republic			
	Yes	Don't care	No	
Labor	57.1	8.2	34.7	100
Liberal/ National	45.5	5.5	49.1	100
Minor parties	38.1	33.3	28.6	100
	48.8	11.2	40	100

Labor voters favour a republic, but Liberal/National voters oppose it. Minor party voters are equivocal.

Question 7

	Oil exploration support		
	Yes	**No**	**Total**
NSW	3	6	9
Vic	2	7	9
Qld	4	7	11
NT	3	4	7
SA	2	6	8
WA	4	5	9
Tas	1	4	5
ACT	1	4	5
Total	20	43	63

	Oil exploration support		
	Yes	**No**	**Total**
NSW	33.3%	66.7%	100%
Vic	22.2	77.8%	100%
Qld	36.4%	63.6%	100%
NT	42.9%	57.1%	100%
SA	25%	75%	100%
WA	44.4%	55.6%	100%
Tas	20%	80%	100%
ACT	20%	80%	100%
Total	31.7%	68.3%	100%
	31.7	68.3	100

Australians are generally opposed to oil exploration on the reef.

Question 8

0 51, 26; 59, 48, 59,

1 55, 39, 52, 17,19, 21,41, 43

2 35, 58, 52, 23, 39, 65,46, 25; 24, 59

3 24, 32, 59, 22, 46, 56, 38, 46, 17

4 24, 41, 26, 26, 26, 31

5 32

7 17

	Age group		
	40 or less	**More than 40**	
Less than 2	5	8	13
2	5	5	10
More than 2	12	5	17
	22	18	40

	Age group		
	40 or less	**More than 40**	
Less than 2	38.5%	61.5%	100%
2	50%	50%	100%
More than 2	70.6%	29.4%	100%
	55%	45%	100%

People under 40 have more takeaways than people over 40.

Question 9

Neither age groups nor number of siblings can be easily divided to make less than 5.

The combinations shown are the best that can be achieved.

		Age group			
		25 or less	**26 to 35**	**35+**	
Siblings	**2 or less**	9	8	5	22
	More than 2	4	4	3	11
		13	12	8	33

		Age group			
		25 or less	**26 to 35**	**35+**	
Siblings	**2 or less**	69%	67%	63%	67%
	More than 2	31%	33%	38%	33%
		100%	100%	100%	100

There is a tendency for those who are older to have more siblings, but this is only slight and could be a random variation, as some of the group sizes are less than 5.

It could be that families were larger in the past.

Exercise 1.03 Interpreting associations

Question 1

a

	Heart attack		
	Yes	**No**	
Obese	3020	2820	5840
Not obese	6380	41 780	48 160
	9400	44 600	54 000

b Row percentages

	Heart attack		
	Yes	**No**	
Obese	51.7%	48.3%	100%
Not obese	13.2%	86.8%	100%
	17.4%	82.6%	100%

51.7% of obese people die from heart attack.

13.2% of non-obese people die from heart attack.

Obese people are 4 times more likely to die of heart attack than non-obese people.

Question 2

		Pregnant		
		Yes	**No**	
Test	**Positive**	27%	7%	34%
	Negative	3%	63%	66%
		30%	70%	100%

Pregnant and positive = 30% × 90% = 27%

Not pregnant and negative = 70% × 90% = 63%

Recalculate as row percentages

		Pregnant		
		Yes	**No**	
Test	**Positive**	79.4%	20.6%	100%
	Negative	4.5%	95.4%	100%
		30%	70%	100%

a About 21% of women who are not pregnant have a false positive.

b About 4.5% of pregnant women have a false negative.

Question 3

a

	Full-time	Part-time	Not returning	
Professional	3%	6%	3%	12%
Administration	5%	7%	25 – 5 – 7 = 13%	25%
Clerical	17%	18%	28%	63%
	25%	100 – 69 = 31%	44%	100%

b The probability that a woman is a professional planning to return to part-time work

= 6% (from the table)

c The probability that a professional woman plans to return to part-time work

$= \frac{6}{12} \times 100 = 50\%$

d The probability that a woman planning to return to part-time work is a professional

$= \frac{6}{31} \times 100 = 19\%$

e The number of clerical workers planning to return to full-time work

$= 130 \times 17\% = 22$

f The number of professionals not planning to return to work

$= 90 \times 3\% = 2.3$. Less than 3.

Question 4

The table below shows the percentages of people interviewed about TV-watching preferences, by age.

	Age				
	≤ 30	**31–40**	**41–50**	**> 50**	
Current affairs	12	10	11	14	47
Sport	10	7	8	6	31
Drama	1	3	5	13	22
	23	20	24	33	100

a The number of people from a similar group of 150 who would prefer to watch drama

$= \frac{22}{100} \times 150 = 33$

b The number of people from a similar group of 150 who would be over 50

$= \frac{33}{100} \times 150 = 50$

c The number of people from a similar group of 150 who would be under 30 and prefer to watch drama $= \frac{1}{100} \times 150 = 1.5$, which represents 1 or 2 people.

d The expected number who would prefer to watch sport from 50 people aged 41–50

$= \frac{8}{24} \times 50 \approx 17$

e The expected number from 90 current affairs enthusiasts who would be aged 31–40

$= \frac{10}{47} \times 90 \approx 19$

Question 5

		Disease		
		Yes	**No**	
Test	**Positive**	24%	14%	38%
	Negative	6%	56%	62%
		30%	70%	100%

Disease and positive = 30% × 80% = 24%

Not disease and negative = 70% × 80% = 56%

Recalculate as row percentages

		Pregnant		
		Yes	**No**	
Test	**Positive**	$\frac{24}{38}\times 100 = 63.2\%$	36.8%	100%
	Negative	9.7%	$\frac{56}{62}\times 100 = 90.3$	100%
		30%	70%	100%

About 63% of positive results are correct and about 37% are false.

The ratio is 63 : 37 = 1.7 : 1

Which is about 12 : 7.

Question 6

This table shows support for paid maternity leave. A student concluded that '30% of women would vote for paid maternity leave'. Explain why the conclusion is incorrect and find the correct result.

	Paid maternity leave		
	Yes	**No**	
Men	15%	35%	50%
Women	30%	20%	50%
	45%	55%	100%

Recalculate as row percentages.

	Paid maternity leave		
	Yes	**No**	
Men	$\frac{15}{50} \times 100 = 30\%$	70%	100%
Women	$\frac{30}{50} \times 100 = 60\%$	40%	100%
	45%	55%	100%

Recalculating by row shows that 60% of women would vote for paid maternity leave.

Question 7

	Age			
	≤ 5	**5 – 10**	**> 10**	
Soft drinks	5	13	10	28
Milk drinks	14	16	4	34
Fruit juice	6	26	6	38
	25	55	20	100

Recalculate as row percentages.

	Age			
	≤ 5	**5 – 10**	**> 10**	
Soft drinks	17.9%	46.4%	35.7%	100%
Milk drinks	41.2%	47.1%	11.8%	100%
Fruit juice	15.8%	68.4%	15.8%	100%
	25%	55%	20%	100%

a The percentage of medium age children who preferred fruit juices

$= \frac{26}{55} \times 100 = 47\%$ Incorrect.

b The percentage of older children who prefer soft drinks = $\frac{10}{20} \times 100 = 50\%$

The percentage of young children who prefer soft drinks = $\frac{5}{25} \times 100 = 20\%$

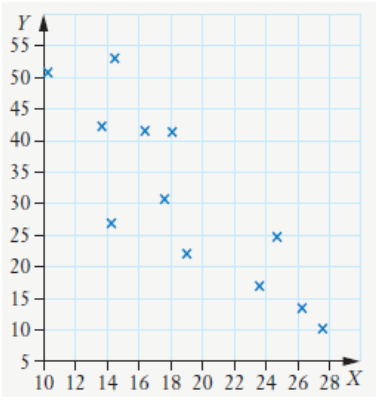
Older children are more than twice as likely to prefer soft drink compared with young children. Correct

c From the row percentages it can be seen that of the children who prefer milk 12% are older children. Incorrect

Exercise 1.04 Scatterplots

Question 1

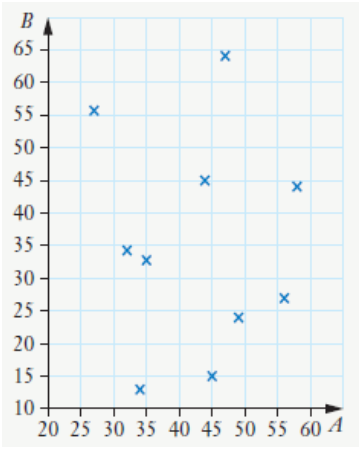
a



b As the X values increase the Y values decrease, therefore X and Y have a negative association.

Question 2

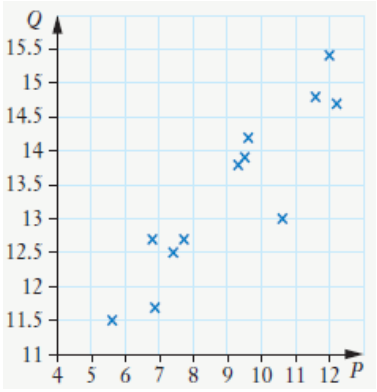
a



b A and B have no apparent association.

Question 3

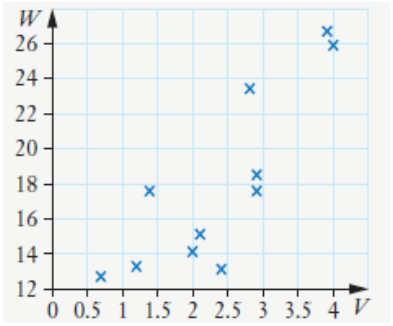
a



b As the P values increase the Q values also increase, therefore P and Q have a positive association.

Question 4

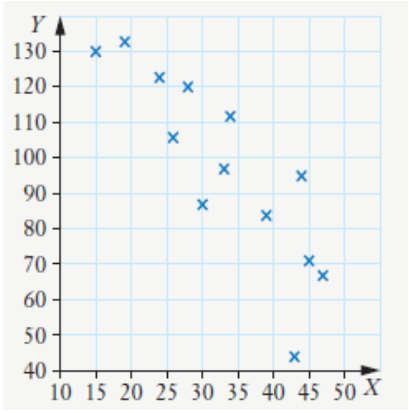
a



b As the V values increase the W values also increase, therefore V and W have a positive association.

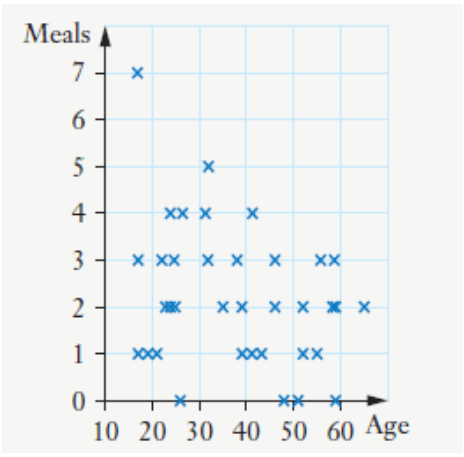
Question 5

a



b As the X values increase the Y values decrease, therefore X and Y have a negative association.

Question 6



The values go downward from left to right, so there is a negative association between age and the number of takeaways.

Exercise 1.05 Describing associations

Question 1

a The points are sloping down from left to right and almost all the points are close to the line of best fit, therefore there is a moderate negative linear association.

b There is no linear association.

c The points are sloping upward from left to right and all the points are close to the line of best fit, therefore there is a strong positive linear association.

d The points are sloping down from left to right and the points are not all close to the line of best fit, therefore there is a weak negative linear association.

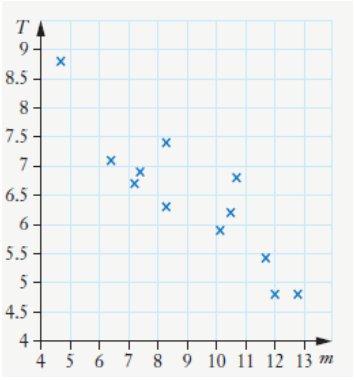
e No apparent association

f Weak positive linear association

g Moderate positive linear association

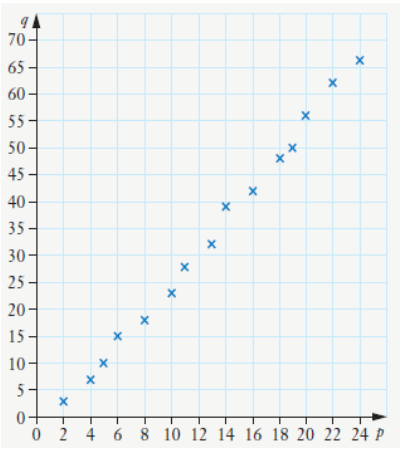
Question 2

As the m values increase, the T values decrease and almost all the points are close to the line of best fit. Therefore, there is a moderate negative linear association between m and T.



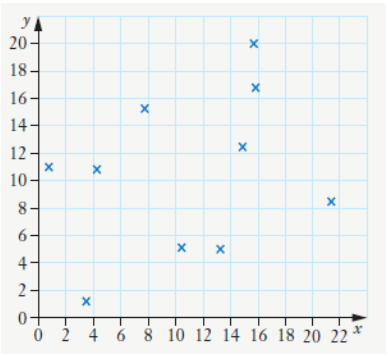
Question 3

As the p values increase, the q values also increase and all the points are close to the line of best fit. Therefore, there is a strong positive linear association between p and q.



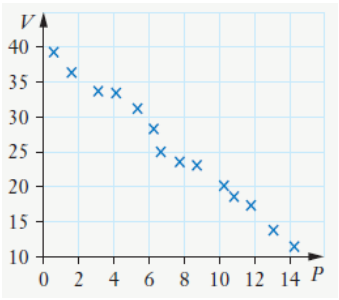
Question 4

There is a weak positive linear association between x and y.



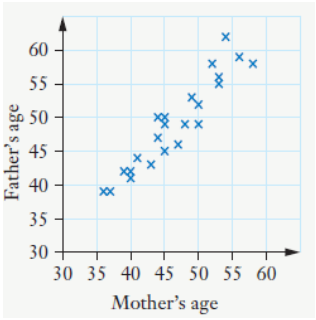
Question 5

As the P values increase, the V values decrease and all the points are close to the line of best fit. Therefore, there is a strong negative linear association between P and V.



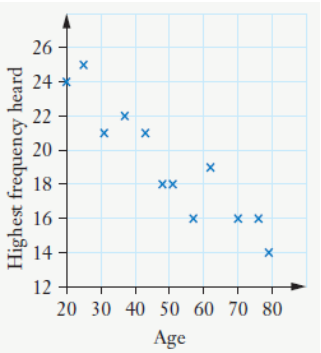
Question 6

Parents' ages have a moderate positive linear association. They have similar ages.



Question 7

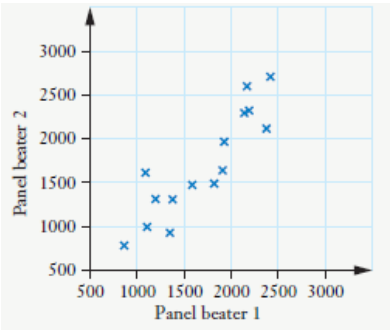
There is a moderate negative linear association between age and the highest frequency heard. People lose hearing as they get older.



Question 8

There is a moderate positive linear association of their quotes.

Although their quotes follow the same trend, either could be the cheaper for particular jobs.



Exercise 1.06 The correlation coefficient

Question 1

The covariance of a and b is 6.6 and their standard deviations are 2.1 and 3.4.

a $$r = \frac{COV(x, y)}{SD(x) \times SD(y)} = \frac{6.6}{2.1 \times 3.4} = 0.92$$

b There is a strong positive association.

Question 2

The covariance of m and p is –8.9 and their standard deviations are 5.1 and 6.3.

a $$r = \frac{COV(x, y)}{SD(x) \times SD(y)} = \frac{-8.9}{5.1 \times 6.3} = -0.28$$

b There is a weak negative association.

Question 3

The covariance of a and b is 28.6 and their standard deviations are 7.9 and 5.9.

a $$r = \frac{COV(x, y)}{SD(x) \times SD(y)} = \frac{28.6}{7.9 \times 5.9} = 0.61$$

b There is a moderate positive association.

Question 4

The covariance of y and z is –12.5 and their standard deviations are 2.4 and 6.1.

a $$r = \frac{COV(x, y)}{SD(x) \times SD(y)} = \frac{-12.5}{2.4 \times 6.1} = -0.85$$

b There is a strong negative association.

Question 5

The covariance of p and q is 15.2 and their standard deviations are 9.7 and 10.2.

a $$r = \frac{COV(x, y)}{SD(x) \times SD(y)} = \frac{15.2}{9.7 \times 10.2} = 0.15$$

b There is a little or no association.

Question 6

g	f	Covariance	$SD(g)$	$SD(f)$	r
8	55	38.1818182	6.32456	9.16567	0.6588
10	67.1				
12	64				
14	77				
16	64.6				
18	57.2				
20	83.7				
22	77.6				
24	70.6				
26	78.2				
28	80.1				

A moderate positive association.

Question 7

t	v	Covariance	$SD(t)$	$SD(v)$	r
8.4	102	–96.357	11.6768	19.7627	–0.4176
6.6	59.4				
9.3	57.1				
14.4	86.5				
19.2	67.1				
24.3	72.1				
26.6	31.7				
32.3	37.3				
34.4	57.2				
42.7	67.1				

A moderate negative association.

Question 8

$r = –0.88$, a strong negative association

Question 9

$r = 0.33$, a weak positive association

Question 10

$r = -0.32$, a weak negative association

Question 11

$r = 0.82$, a strong positive association

Question 12

$r = 0.62$, a moderate positive association

Question 13

$r = 0.98$, a very strong association

Question 14

Using 1 = E–, up to 15 = A+, $r = 0.68$, a moderate association

Maths	1	4	4	5	5	6	7	7	7	9	10	11	12	12	15
English	6	4	5	6	7	11	2	5	10	9	15	8	8	15	15

Question 1

a

	Southside	Northside	Total
Female	320	320	640
Male	210	330	540
Total	530	650	1180

b There are 330 males were on the Northside.

c There are 530 students were living on the Southside.

Question 2

a

	E	G	M	Total
Apprenticeship	2	2	1	5
TAFE	3	3	2	8
Work	3	3	2	8
Uni	1	5	6	12
Total	9	13	11	33

b There are 13 students, including apprentices, who intend to get a job next year.

Question 3

E

	Biology	Ancient History	Geography	Total
Male	4	2	4	10
Female	3	3	6	12
Total	7	5	10	22

There are 6 female students who study Geography.

Question 4

A

As the total number of students in the Year 12 General Maths class is 24, there must be 2 students who study another subject.

Question 5

	Caffeine	Sugar	Total
None	3	0	3
Low	4	4	8
Medium	1	1	2
High	2	4	6
Total	10	9	19

Question 6

a The percentage of the crowd at a Sydney FC–Brisbane Roar game who are Brisbane fans is a percentage of the number of people at the game

b The probability that a randomly chosen teenager from Kalkadoon SHS has a pet dog is a proportion of the number of students at Kalkadoon SHS.

c The probability that a Brisbane supporter on a train is female is a proportion of the number of Brisbane supporters on the train.

Question 7

		Hair colour				
		Black	**Brown**	**Fair**	**Red**	**Total**
Eye colour	**Brown**	3	13	4	1	21
	Hazel	2	9	3	1	15
	Green	1	2	1	0	4
	Blue	4	16	5	1	26
	Grey	1	2	1	0	4
	Total	11	42	14	3	70

a The percentage of brown-haired people with blue eyes

$= \frac{16}{42} \times 100 = 38.1\%$

b The probability that someone has red hair and blue eyes

$= \frac{1}{70} \times 100 = 0.014$

Question 8

Time	Morning shower	Night shower	Total
Before 5:45	2	0	2
Before 6:00	3	0	3
Before 6:15	4	2	6
Before 6:30	3	4	7
Before 6:45	5	2	7
Before 7:00	4	3	7
Before 7:15	4	4	8
Before 7:30	3	3	6
Before 7:45	3	4	7
Before 8:00	2	5	7
Before 8:15	0	6	6
Before 8:30	0	3	3
Total	33	36	69

Calculate cell percentages: $\frac{\text{cell value}}{\text{total}} \times 100$

Time	Morning shower	Night shower	Total
Before 5:45	2.9%	0%	2.9%
Before 6:00	4.3%	0%	4.3%
Before 6:15	5.8%	2.9%	8.7%
Before 6:30	4.3%%	5.8%	7
Before 6:45	7.2%	2.9%	7
Before 7:00	5.8%	4.3%	7
Before 7:15	5.8%	5.8%	8
Before 7:30	4.3%	4.3%	8.6%
Before 7:45	4.3%	5.8%	10.1%
Before 8:00	2.9%	7.2%	10.1%
Before 8:15	0%	8.7%	8.7&
Before 8:30	0%	4.3%	4.3%
Total	47.8%	52.2%	100%

Students who prefer a night shower tend to get up later than those preferring a morning shower. Slightly over half prefer a night shower.

Question 9

a

	Osteoporosis (age over 65)		
	Yes	**No**	
Very active (age 20 – 60)	10	50	60
Sedentary (age 20 – 60)	60	120	180
	70	170	240

b 60 women with sedentary lifestyles developed osteoporosis when aged over 65.

c The probability of developing osteoporosis for those with very active lifestyles

$= \frac{10}{60} = \frac{1}{6}$

The probability of developing osteoporosis for those with sedentary lifestyles

$= \frac{60}{180} = \frac{1}{3}$

d Those with sedentary lifestyles were twice as likely to develop osteoporosis as those with very active lifestyles.

Question 10

	Blood disorder		
	Yes	**No**	
Positive	0.392%	1.992%	2.384%
Negative	0.008%	97.608%	97.616%
	0.400%	99.600%	100.000%

False positive

Patient does not have the disease and tests positive = 99.6 × 2% = 1.992%

False negative

Patient does have the disease and tests negative = 0.4 × 2% = 0.008%

True positive

Patient does have the disease and tests positive = 0.4 × 98% = 0.392%

True negative

Patient does not have the disease and tests negative = 99.6 × 98% = 97.608%

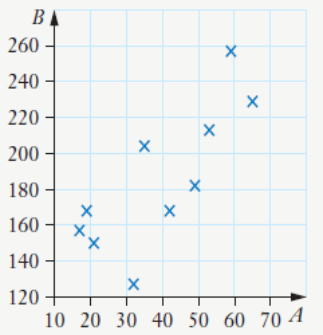
	Blood disorder		
	Yes	**No**	
Positive	0.392%	1.992%	2.384%
Negative	0.008%	97.608%	97.616%
	0.400%	99.600%	100.000%

a A positive result is false = $\frac{1.992}{2.384} \times 100 = 83.6\%$

b A negative result is false = $\frac{0.008}{97.616} \times 100 = 0.0082\%$

Question 11

a



b There is a moderate positive linear association.

Question 12

a As the X values increase, the Y values decrease and all the points are close to the line of best fit. Therefore there is a strong negative linear association between X and Y.

A strong negative linear association.

b A non-linear association.

c As the X values increase, the Y values increase and the points are not all close to the line of best fit. Therefore, there is a weak positive linear association.

d A moderate negative linear association.

Question 13

D

$$r = \frac{COV(x, y)}{SD(x) \times SD(y)} = \frac{27.8}{6.3 \times 7.1} = 0.62$$

Question 14

a

$$r = \frac{COV(x, y)}{SD(x) \times SD(y)} = \frac{25.8}{5.7 \times 9.3} = 0.49$$

A moderate positive linear association.

b

$$r = \frac{COV(x, y)}{SD(x) \times SD(y)} = \frac{-16.2}{4.7 \times 11.5} = -0.30$$

A weak negative linear association.

c

$$r = \frac{COV(x, y)}{SD(x) \times SD(y)} = \frac{17.6}{3.5 \times 5.8} = 0.87$$

A strong positive linear association.

Question 15

a $r = -0.89$ strong negative linear association

b $r = 0.10$ little or no association

Question 16

Year 7

30 15 15 20 15 10 10 10 10 10 15 10 15 10 10 15 20

Year 8

30 10 30 50 20 50 40 30 10 10 50 30 10 20 50 20

Year 9

90 70 70 30 70 80 80 20 30 90 20 60 80 30 80 40 70

Year 10

90 90 80 70 30 30 20 30 60 40 30 10

Year 11

30 150 80 40 40 140 40 120 140 150 110 110 120 70 50 150

Year 12

80 60 180 20 90 40 60 130 70 100 120 120 180 70 110 140 160 150 30

	7	**8**	**9**	**10**	**11**	**12**	**Total**
10–30 m	17	11	5	6	1	2	42
40–60 m	0	5	2	2	4	3	16
70–90 m	0	0	10	4	2	4	20
100–120 m	0	0	0	0	4	4	8
Over 120 m	0	0	0	0	5	6	11
Total	17	16	17	12	16	19	97

Students in later years say they spend more time than younger students.

Question 17

	Height			
	Short	**Average**	**Tall**	
Male	23	65	42	130
Female	46	73	26	145
	49	138	68	275

The probability that a female student is tall = $\frac{26}{145} = 0.18$

The probability that a tall student is female = $\frac{26}{68} = 0.38$

Question 18

A true positive is when a patient has the disease and the test is accurate.

The probability of a true positive = 0.5 × 87% = 0.435%

A false positive is when a patient does not have the disease but the test is inaccurate.

The probability of a false positive = 99.5 × 13% = 12.935%

Question 19

r = 0.95, strong positive association. Higher loss is associated with a higher mouse population.

3	6
29	4
34	18
52	28
78	14
114	42
112	36
134	55
162	67
168	73

0.947158