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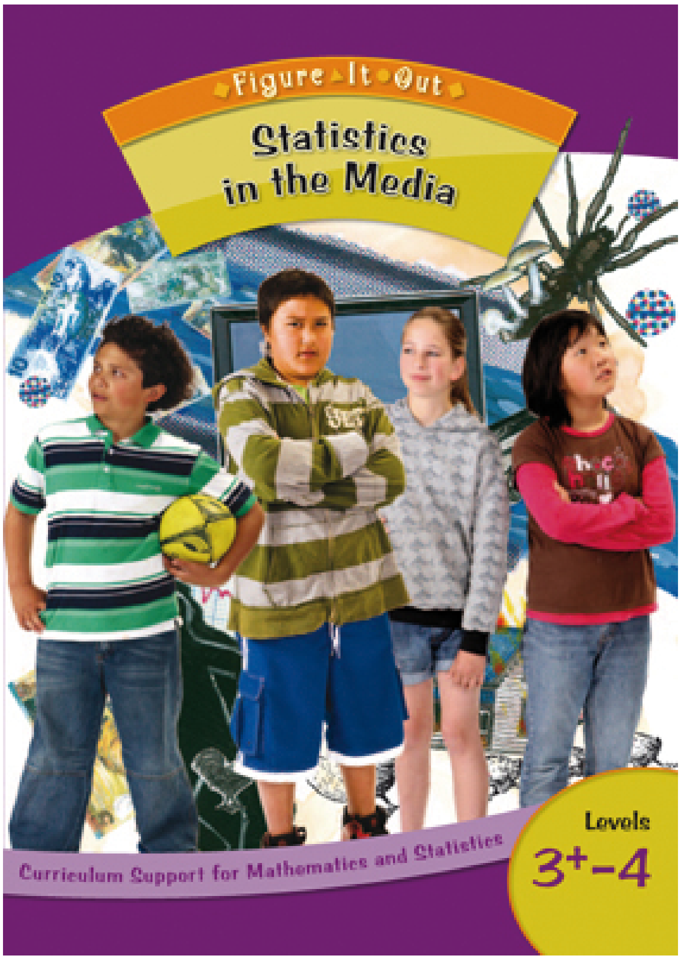
Answers and Teachers' Notes



MINISTRY OF EDUCATION
Te Tāhuhu o te Mātauranga

Contents

Introduction

The books in the Figure It Out series are issued by the Ministry of Education to provide support material for use in New Zealand classrooms. In recent years, much of the Figure It Out student material has been aligned with Numeracy Development Projects strategies, which are reflected in the Answers and in the Teachers' Notes where appropriate.

The mathematics and statistics learning area achievement objectives and the key competencies referred to in these *Answers and Teachers' Notes* are from *The New Zealand Curriculum*.

Student books

The activities in the Figure It Out student books are written for New Zealand students and are set in meaningful contexts, including real-life and imaginary scenarios. The contexts in the level 3^{+}–4 *Statistics in the Media* reflect the ethnic and cultural diversity and the life experiences that are meaningful to students in year 6. However, you should use your judgment about whether to use the student book with older or younger students who are also working at this level.

Figure It Out activities can be used as the focus for teacher-led lessons, for students working in groups, or for independent activities. You can also use the activities to fill knowledge gaps (hot spots), to reinforce knowledge that has just been taught, to help students develop mental strategies, or to provide further opportunities for students moving between strategy stages of the Number Framework.

Answers and Teachers' Notes

The Answers section of the *Answers and Teachers' Notes* for *Statistics in the Media* includes full answers and explanatory notes. Students can use this section for self-marking, or you can use it for teacher-directed marking. The teachers' notes for each activity, game, or investigation include comments on mathematical ideas, processes, and principles, and suggestions on teaching approaches. The *Answers and Teachers' Notes* can also be downloaded from nzmaths at www.nzmaths.co.nz/node/1992

Using Figure It Out in the classroom

Where applicable, each activity title page of the student book starts with a list of equipment that the students will need in order to do the activities. Encourage the students to be responsible for collecting the equipment they need and returning it at the end of the session.

Many of the activities suggest different ways of recording the solution to the problem. Encourage your students to write down as much as they can about how they did investigations or found solutions, including drawing diagrams. Discussion and oral presentation of answers is encouraged in many activities, and you may wish to ask the students to do this even where the suggested instruction is to write down the answer.

Students will have various ways of solving problems or presenting the process they have used and the solution. You should acknowledge successful ways of solving questions or problems, and where more effective or efficient processes can be used, encourage the students to consider other ways of solving a particular problem.

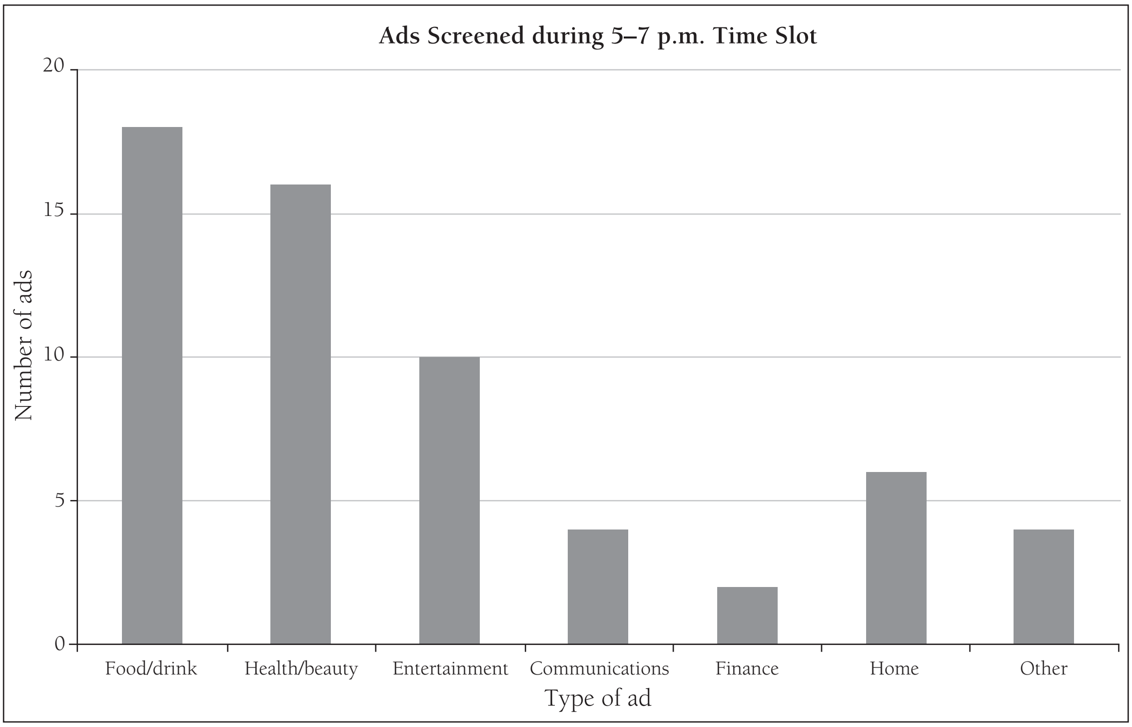
Figure It Out
Statistics in the Media
Levels 3^{+}–4
Answers

Page 1: Dinner Time Ads

Activity

1. **a.–b.** Answers will vary depending on how you classify some of the ads. Here is one possible tally chart and the graph based on it:

	Food/drink	Health/beauty	Entertainment	Communications	Finance	Home	Other
	~~////~~ ~~////~~ ~~////~~ ///	~~////~~ ~~////~~ ~~////~~ /	~~////~~ ~~////~~	////	//	~~////~~ /	////
Total	18	16	10	4	2	6	4



2. **a.** Descriptions will vary. There were 60 ads screened between 5 p.m. and 7 p.m. The largest category is food/drink, followed by health/beauty. (In the analysis above, the "other" category included fund-raising, holidays, and the shopping mall.)

   b. Near dinner time, people are hungry, so they may be easily influenced by food and drink ads. The health and beauty ads may attract attention because often viewers are weary at this time; the thought of having greater vitality and energy and easy ways to look and feel good may appeal. The other categories are limited by the number of spots available, but some viewers will still take note of them.

   c. Yes, Dad is right. This data suggests that food-related ads are more common than other types of ads around dinner time. (However, although your analysis may show that 25–30% of the ads are food/drink ads, this is not "most", and we also can't tell from Daniel's data how common food ads are at other times or on other channels.)

3. Questions will vary. For example, for food/drink ads, Daniel might ask: What types of food or drink are typically advertised between 5 and 7 p.m.? What age group is most often targeted in these ads? Is there any pattern to the "repeats"?

4. **a.–c.** Graphs and findings will vary. Your investigation data may be similar to Daniel's. Extra investigative questions and data to answer them will vary. For example, additional information might include how many times particular ads are repeated during the 2 hours, types of food ad (for example, fast food), or age groups targeted by the ads. It would also be possible to classify ads according to style of presentation (for example, animated, talking head, skit, product demonstration).

Pages 2–3: CensusAtSchool

Activity

1. **a.** Media questions discussed will vary, depending on the most recent survey available on CensusAtSchool.

   b. Practical activity

2. Investigative questions will vary. As well as those on the student page, examples are:
   - What kinds of TV programmes do students of my year typically like?
   - How much do girls in my year group typically spend on cellphones each month?
   - Are boys in my year group more likely to have a game console than girls?
   - Where do students in my year group typically get the money to pay for their cellphone use?

3. Investigations, graphs, and conclusions will vary. When you are giving feedback to other students, evaluate their use of the PPDAC cycle, the quality of their presentation, and the appropriateness and clarity of the graphs they have created. Remember to keep the tone of your feedback positive!

Pages 4–5: Bad News?

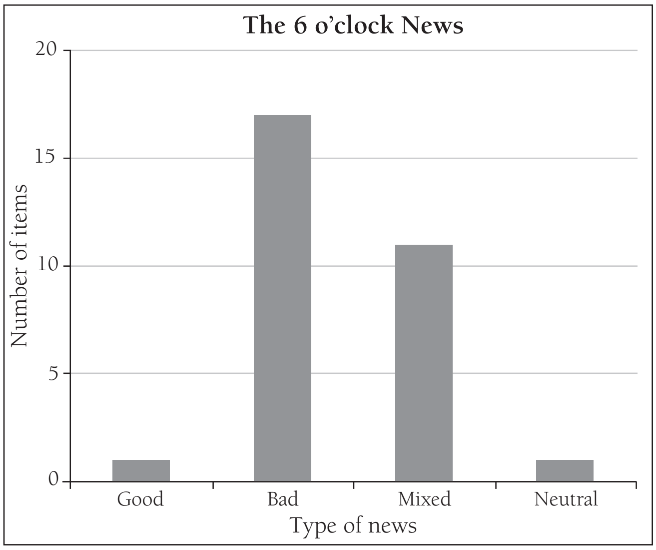
Activity

1. **a.** Coding will vary. For example, "Death toll in bridge collapse not as high as first thought" could be either B or M (the collapse and deaths are bad news, but the fact that the toll is "not as high as first thought" is good news).

   b. The table will vary depending on your answers to **a**. A possible table is:

Type of news	Tally	Frequency (tally total)	Percentage
Good	/	1	3
Bad	### ### ### //	17	57
Mixed	### ### /	11	37
Neutral	/	1	3
TOTAL	30	30	100

2. **a.** Types of graphs will vary. For example, you could use standard graphs such as a bar graph, a strip graph, or a dot plot (but not a pie chart as it would be difficult to show such small numbers or percentages on it) or you could invent a graph. The shape of the graphs will depend on your answers for **1b**. A possible bar graph is:



   b. Comments will vary. In the analysis given for question **1b**, only 1 out of the 30 stories is classified as good and only 1 as neutral, supporting Laki's view that there is very little good news. However, the data covers only 3 nights. The investigation would have to be extended to confirm whether these results are typical.

3. a. Discussion will vary. Data displays will differ depending on how the stories have been categorised and the types of graph used.

   b. Answers will vary. For example, Anna could have investigated what proportion of stories were about weather-related or natural disasters, crime, or politics or what proportion were current news stories versus old news with a new bit added.

Investigation One

After you decided on your investigative question, your planning would need to have included basic details such as which news data you would collect data from, on which nights, and for how many nights. The actual data collected will depend on your investigative question. That data will determine the best kind of graph to show the important features.

Investigation Two

Investigations and findings will vary.

Pages 6–7: Ad Mad

Activity One

1. a. The graph shows how much a 30-second ad on two different radio stations costs at different times of the day. (Note that the figures for both radio and TV are not from actual New Zealand radio or TV companies but are based on general information available at the time of writing.) For each station, the graph generally slopes downwards, meaning that ads cost more in the mornings and less in the afternoons and evenings. This difference is greater for station B than for station A. Except for the evening slot, ads on radio station B cost more than they do for station A (the price difference is especially noticeable in the early morning).

   b. More people listen to the radio in the morning (for example, getting ready for, or on the way to, school or work). When there are more listeners, a station can charge more for its ads.

   c. Station A probably charges less (except in the evening) because it has fewer listeners.

   d. Station B because the advertisers pay more to get their message out than they do on station A. This suggests that the expected audience is bigger than station A's.

2. Discussion will vary.

Investigation

i.–iv. Investigations and findings will vary.

Activity Two

1. a. Differences you may notice include:
      - It is much more expensive to advertise on TV than on radio.
      - On radio, the most expensive time to advertise is the morning, whereas on TV, the most expensive time is the evening.
      - The price difference between day and evening advertising on TV is huge, whereas on radio, the difference (both actual and relative) is much smaller.
      - While the morning time slots for radio and TV are identical, there are 5 TV time slots after midday compared with 3 for radio.

   b. Answers will vary. For most adults, TV is evening entertainment, whereas during the day, many listen to the radio while they do other things (for example, drive to and from work or do housework). Unlike most TV, listening to the radio is something that you can do while doing something else. Because far more people watch TV in the evening, TV companies can charge more for advertising.

   The after-school audience for TV is mainly children. Children's spending power is not as high as that of adults, so advertisers are not charged as much as later in the day. (However, advertisers are also interested in advertising to children because children can often persuade their parents to buy a product or service and because they will one day be able to make their own purchasing decisions.)

2. Answers may include these ideas:

- Radio is a relatively cheap medium, so advertisers can afford to repeat ads.
- Radio and TV companies give discounts for repeats.
- Repetition gives the ads greater impact.
- The ads become familiar to the listeners (some ads are also shown in a shortened version, but the listeners/viewers still recall the whole ad).
- Having an ad repeated is cheaper than making a new one.

Pages 8–9: People Meters

Activity One

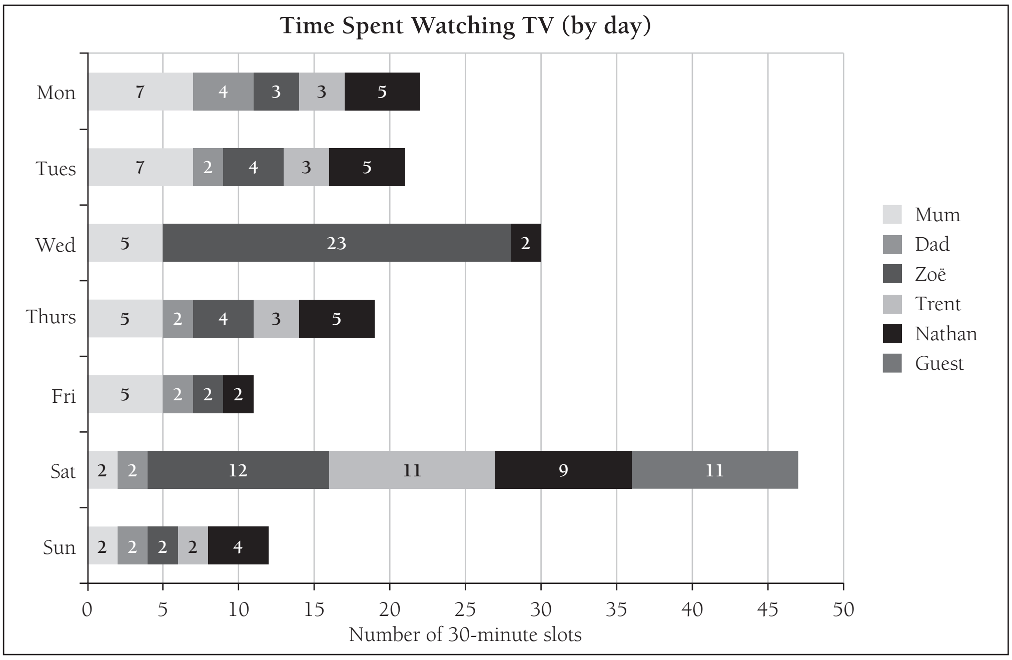
1. a.

	Number of 30-minute Slots					
Day	**Mum**	**Dad**	**Zoë**	**Trent**	**Nathan**	**Guest**
Mon	7	4	3	3	5	
Tue	7	2	4	3	5	
Wed	5		23		2	
Thurs	5	2	4	3	5	
Fri	5	2	2		2	
Sat	2	2	12	11	9	11
Sun	2	2	2	2	4	

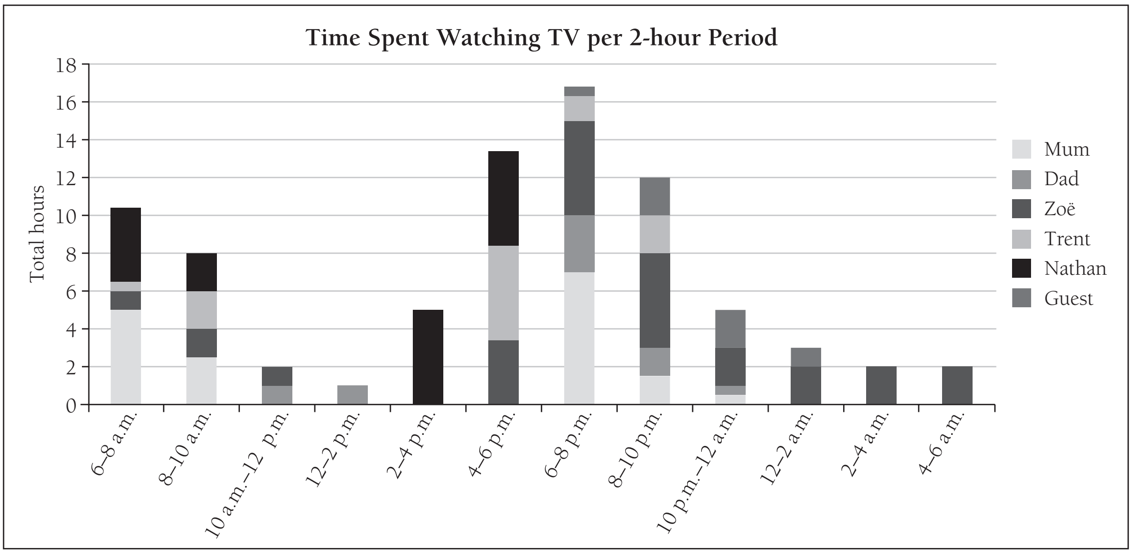
b.

	Total Viewing for 1 Week (in hours)					
Time slot	**Mum**	**Dad**	**Zoë**	**Trent**	**Nathan**	**Guest**
6–8 a.m.	5		1	0.5	4	
8–10 a.m.	2.5		1.5	2	2	
10 a.m.–12 p.m.		1	1			
12–2 p.m.		1				
2–4 p.m.					5	
4–6 p.m.			3.5	5	5	
6–8 p.m.	7	3	5	1.5		0.5
8–10 p.m.	1.5	1.5	5	2		2
10 p.m.–12 a.m.	0.5	0.5	2			2
12–2 a.m.			2			1
2–4 a.m.			2			
4–6 a.m.			2			

2. a. Graphs will vary. One way of presenting each person's viewing time by day is in a horizontal stacked bar graph like this:



One way of presenting people's viewing time broken down by time of day (in 2-hour periods) is in a vertical stacked bar graph like this:



Comments will vary. For example, from the first graph, you can say that Saturday was the most popular viewing day and that Fridays and Sundays were the least popular. You would, however, want to question the large number of 30-minute time slots (23) recorded on Wednesday as being watched by Zoë. (What would the graph tell you if she had logged off at 7.30 p.m.?) From the second graph, you can tell that 6–8 p.m. was when most TV was watched and 12–2 p.m. the least. Again, you will want to think about the early morning viewing recorded by Zoë on Wednesday. (The most likely explanation for this is that she forgot to log off her people meter.)

b. Answers will vary. For example, you can't tell from the graphs who was watching TV at a particular time on a particular day; you can't tell what channel was being watched; you can't tell whether people were actually paying attention to what was on the screen or even if they were in the room.

3. **a.** Comments will vary. Mum logs in over breakfast time during the week and again at news time. She sometimes watches TV with Dad later in the evening. Dad sometimes watches TV in the middle of the day – perhaps when he is home because of his shift-work hours. Zoë is logged on for the most hours (but see comments in **2a** about Wednesday); she watches TV at some stage every day. There were 3 weekdays when Trent didn't watch any TV (or if he did, he forgot to log on!). He seems to prefer watching TV when someone else is there. Nathan watches TV every weekday during the 2–4 p.m. slot and most days in the 4–6 p.m. slot. He watches TV early in the morning in the weekend.

b. According to the logged hours, Zoë watches the most and Dad the least. (If you don't count Zoë's Wednesday hours after 7.30 p.m., would she still watch the most?)

c. As it was a Saturday night, the guest may have been a babysitter, who logged off when Mum and Dad came home about 12.30 a.m. Alternatively, if the guest was a child (or teenager) watching TV with Zoë and Trent (who both logged off at 10 p.m.), it may be that the guest forgot to log off and Mum or Dad may have come into the room and turned the TV off between 12.30 and 1.00 a.m.

4. It's odd that Zoë apparently watched TV all night on Wednesday night (see the answer for question **2a**). (The guest watching alone on Saturday night isn't odd if that person was babysitting.)

5. Answers will vary, but you need to refer back to the information given about the family. Apart from Zoë's Wednesday night, there is nothing that stands out as necessarily unusual in the data (as would, for example, Zoë or Trent being logged on during the school day).

6. a. The data doesn't match Mum's comment because Mum is logged on more than most of the others. Perhaps Mum logs on at 7 a.m. for a news broadcast, gets busy doing other things (in the same room or in different rooms), and then logs off about 8.30 a.m. She might log on at 6 p.m. for the news and then go backwards and forwards to the kitchen while preparing a meal, before logging off at 7 p.m. (Or if there is a TV in the kitchen, Mum may be logged on but not feel as if she is watching it.)

b. If Mum's comment is true, then her data isn't of much value to the data collection company.

Activity Two

1. Discussion will vary. Data such as this is collected by a market research company on behalf of television channels. It is used to generate ratings information and audience numbers and probably also to encourage advertising. TV channels use the ages of the viewers to establish the demographics of the people who watch their shows.

2. Data for 1 week (or even for 1 year) for 1 family is not enough to make a statement about the population, even more so when it seems that some of the data does not tell the full story. You would need to collect data over a period of time and from many families to get an accurate picture of the viewing habits of people of different ages.

3. Answers will vary, but possible questions to investigate include:

   - At what times of the day do the different members of a family (such as the Wades) typically watch TV? (This is a variation of the question in **Activity One**, question **3a**.)
   - When would be the best time to advertise to target different audiences such as children, home-based adults, workers?

   Decisions about extra data required will vary.

Pages 10–11: Spin to Win!

Activity One

1.

Prize	Probability
$20,000	$\frac{1}{10}$
Kelly Tarlton family day	$\frac{2}{10} = \frac{1}{5}$
Computer package	$\frac{2}{10} = \frac{1}{5}$
Health bar	$\frac{1}{10}$
$1,000	$\frac{2}{10} = \frac{1}{5}$
Game console pack	$\frac{2}{10} = \frac{1}{5}$

2. Answers will vary. If Laki wants a guaranteed prize worth more than $1,000, he should take the $4,000. Taking into account that some prizes are on 2 sectors of the wheel, there are more prizes below $4,000 than above that amount. Laki has 3 chances in 10 of winning a prize of more than $4,000 and 7 chances in 10 of winning one valued at less than $4,000.

The table below shows the probability of winning each prize compared with the $4,000 cash.

Prize	Value	Probability	Compared with $4,000 cash
$20,000	$20,000	$\frac{1}{10}$	Greater than
Kelly Tarlton family day (2 chances)	$500	$\frac{2}{10} = \frac{1}{5}$	Less than
Computer package (2 chances)	$5,000	$\frac{2}{10} = \frac{1}{5}$	Greater than
Health bar	$5	$\frac{1}{10}$	Less than
$1,000 (2 chances)	$1,000	$\frac{2}{10} = \frac{1}{5}$	Less than
Game console pack (2 chances)	$450	$\frac{2}{10} = \frac{1}{5}$	Less than

3. What has happened previously makes no difference to what happens next because spins are all independent of each other. (This means that it is possible, for example, for a 1-in-100 event to happen twice or more in a row!)

Activity Two

1. a. $40,000

   b. 67% ($\frac{40\ 000}{60\ 000}$)

2. The cost would vary from season to season. It could be as little as $50 for 10 health bars or as much as $200,000 for 10 x $20,000; in the latter case, the show would make a big loss! (Sometimes, games show promoters take out insurance against worst-case scenarios.) The reality is likely to be somewhere in between, with the probable value of prizes being less than the season's $60,000 budget.

   The table below shows what the cost would be if no one chose the $4,000 and each sector of the wheel came up once during the season:

Prize	Value	Probability
$20,000	$20,000	$\frac{1}{10}$
Kelly Tarlton family day	$450	$\frac{1}{10}$
Kelly Tarlton family day	$450	$\frac{1}{10}$
Computer package	$5,000	$\frac{1}{10}$
Computer package	$5,000	$\frac{1}{10}$
$1,000	$1,000	$\frac{1}{10}$
$1,000	$1,000	$\frac{1}{10}$
Game console pack	$500	$\frac{1}{10}$
Game console pack	$500	$\frac{1}{10}$
Health bar	$5	$\frac{1}{10}$
TOTAL	$33,905	

Activity Three

1. a. Results will vary. For example:

The Winning Wheel: Season's Winnings			
Episode	Decision	Prize	Value
1	Spin	Console	$450
2	Cash	$4,000	$4,000
3	Spin	Health bar	$5
4	Cash	$4,000	$4,000
5	Cash	$4,000	$4,000
6	Spin	Computer	$5,000
7	Spin	$20,000	$20,000
8	Spin	Kelly Tarlton	$500
9	Spin	Kelly Tarlton	$500
10	Cash	$4,000	$4,000

   b. Results will vary. The cost for the example given is $42,455.

2. a. No. It will be different every time, depending on the spins. However, over time, the producers would be able to get a fair idea of the likely cost per season.

   b. Graphs will vary, but the combined results should give some idea of what expenditure the producers could expect from season to season. (This would be even more apparent if the data was from 100 or more seasons.)

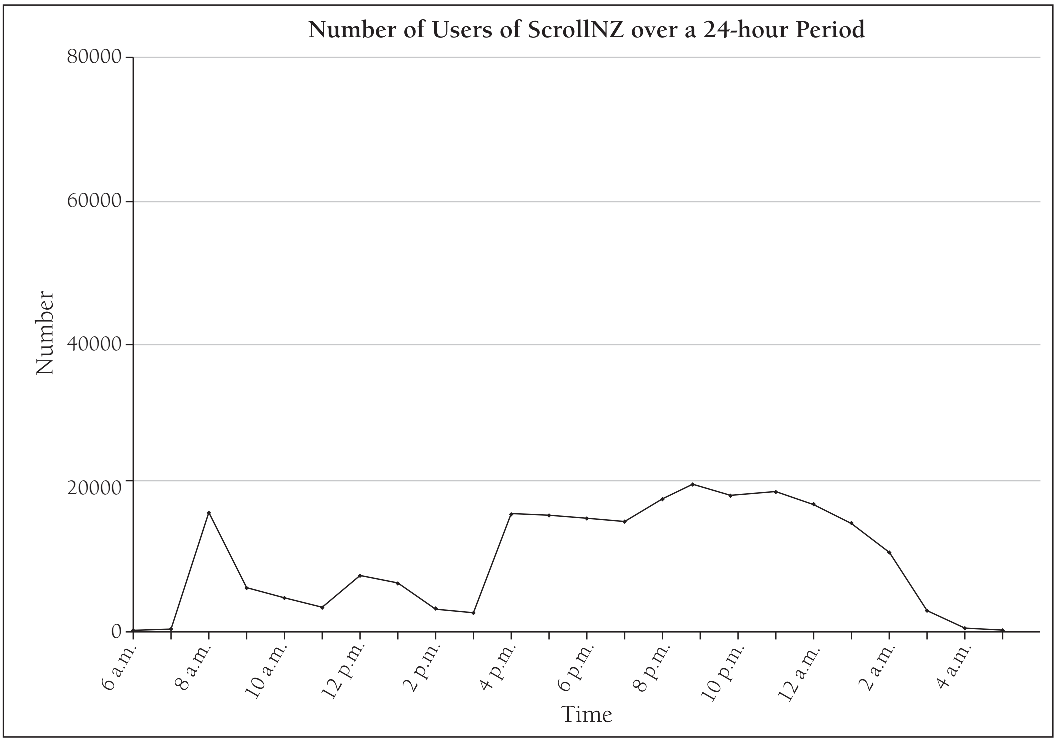
3. Answers will vary. If contestants take the money each time, the cost would be $40,000 for a season. If all or most contestants spin the wheel, the value of prizes for 1 season, unless the $20,000 comes up more than once, will probably be a bit more or a bit less than $40,000 (see the table in the answers for **Activity Two**, question **2**). However, the probability is that seven-tenths of spins (see **Activity One**, question **2**) will win less than $4,000, so it may be financially better for the show's host to encourage contestants to spin the wheel.

   Ratings and advertising revenue are also a factor. Audiences enjoy watching contestants taking a risk, especially if the risk "pays off" and the spinner wins a good prize (or possibly, if the person seems "greedy", the audience are pleased if the spin results in a low prize!), but they are also pleased when a cash prize of $4,000 is given out instead of a health bar or a lower value prize. However, if everyone took the $4,000 cash instead of spinning the wheel, viewers might lose interest and the audience numbers might drop, and that would affect advertising revenue.

Pages 12–13: Logging On

Activity One

1. Graphs will vary, depending on the scale used. The graph below goes up to 80 000 on the vertical scale, as does the graph in **Activity Two**. Although this is not necessary, it is helpful when you come to compare the two graphs later.



2. **a.** Key features should include: a peak at 8 a.m., followed by a trough in mid-morning; a slight rise at lunchtime, followed by a decline, then large numbers in mid–late afternoon and throughout the evening, slowly tailing off after 11 p.m.

   b. Answers will vary, but the 8 a.m. peak could be a quick check of the site before leaving for school or work; the lower numbers during school hours are perhaps because many users of the site are school students; the late afternoon and night-time pattern fits with most people's after-school and after-work hours.

Activity Two

1. **a.** The number of users increases fairly steadily throughout the day, peaking at 9 p.m. and then declining sharply over the next 3 hours. The lowest number of users is between 2 a.m. and 6 a.m.

   b. The graph shows an activity pattern that is similar to those of actual Internet auction sites. People involved in Internet auctions often check their bids or auctions during the day (although some workplaces block certain popular sites); 7–9 p.m. is the time of evening when most people are at home (some of these people will have already logged on during the day). Most people putting goods or services up for Internet auction will avoid having the closing time later than 10 p.m. because that would limit the number of viewers or bidders.

2. **a.** Comments will vary. U–MeSwap has considerably more users than ScrollNZ at all times; the most popular times for both websites are from mid-afternoon onwards; U–MeSwap peaks at 9 p.m. (a sensible time for auctions to finish) and then sharply declines, whereas the number of ScrollNZ users is reasonably constant

between 4 p.m. and 12 a.m.; U–MeSwap has a more or less increasing number of users during the day, whereas, apart from the 8 a.m. surge, ScrollNZ's daytime numbers are low up to 3 p.m.

b. Reasons will vary. For example, Internet auction sites are very popular and will usually have more users than general interest or information sites; from mid-afternoon, users of both sites will probably include students or workers who have limited or no time for access during the day; student use may account for the 4 p.m. surge in ScrollNZ numbers; U–MeSwap users will include adults accessing the site from home or work during the day; most people access sites such as these from late afternoon through to bedtime.

Pages 14–15: Ad Appeal!

Activity One

1. Survey results and overall headings will vary. At the collation stage, you could sort the data cards physically rather than rewriting the information in a table. After you have put the data into groups by initial association, it is useful to make a table such as this one:

Gender	Age	Colour	Association
M	11	Green	Trees
M	10	Green	Envy
F	12	Green	Spring
F	11	Green	Leaves
M	10	Green	Frogs
F	12	Green	Seasick

and then break it down further into similar associations, such as:

Colour	Association	Total	Male	Female	Age 10	Age 11	Age 12
Green	Foliage	7	////	///		////	///
Green	Animals/Insects	3	//	/	//	/	
Green	Negative	2	/	/	/		/

(By including age again, you can discuss any differences.)

2. **a.** Comments will vary. For example, you might find that there is very little difference in what people think about the different colours, or you might find that everyone has a different idea about a colour. For those associations that are widely shared, it might be because the colour is associated with something that is very familiar or is a widely held notion, for example, the association of blue with sky. Opinions about the reasons for differences will vary.

   b. Answers will vary. Girls and boys may have different interests that relate to their associations of colour.

3. **a.** Graphs (for example, bar or strip graphs) and statements will vary.

   b. The findings might help advertisers assess whether the colours used in their ads are going to appeal to potential buyers or users or encourage them to associate a particular colour with a product or service.

Activity Two

1. Survey results and tally charts will vary.

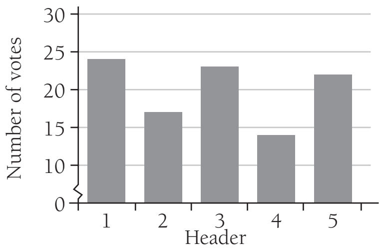
2. **a.** Tables will vary depending on survey results. Over the page is an example of a table summarising the results from a class survey.

Votes for Header and Pitch

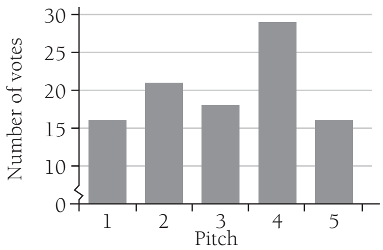
		Header 1	Header 2	Header 3	Header 4	Header 5	Row summary	Percentage
Pitch	1	5	0	5	3	3	16	16
	2	4	4	5	3	5	21	21
	3	2	3	5	4	4	18	18
	4	10	6	5	3	5	29	29
	5	3	4	3	1	5	16	16
Column summary		24	17	23	14	22	100	
Percentage		24	17	23	14	22		100

Votes for header 1, pitch 4

i. In this example, header 1 is most popular, followed by header 3. A possible graph is:



ii. In this example, pitch 4 is most popular, followed by pitch 2. A possible graph is:



iii. In this example, header 1, pitch 4 is the most popular combination. (In your survey, two or more options could be very close.)

b. Recommendations and reasons will vary, but they should be supported by results from the survey data. You and your classmates will be using your own school's data, so progress towards agreement should be possible. (The class may need to undertake a further survey, based perhaps on the 3 or 4 most popular recommendations.)

Page 16: Optimal Velocity

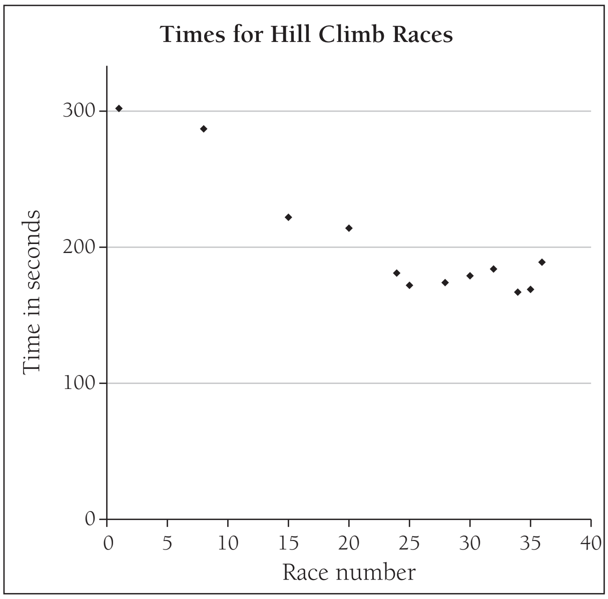
Activity One

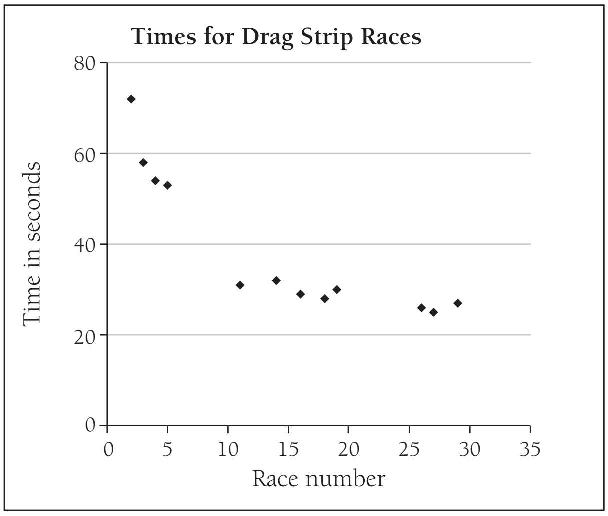
1. **a.** Drag strip: car 4 because it accelerates fast and has top equal speed

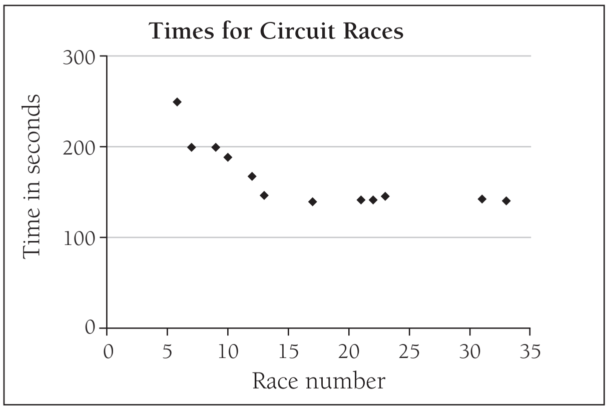
   b. Hill climb: car 2 because it handles well and accelerates well

   c. Circuit: car 1 because it handles well and has top equal speed

2. **a.** Graphs will vary. For example (with times converted to seconds):







b. Your graphs should show that Nick's times improve for the first few races on each track and then remain relatively constant. The times stay low after 10 races, which suggests that he had reached a plateau in terms of his ability to operate the cars.

c. Variables that you might take into account could include time of day, whether anyone is watching Nick, or the noise level around him. These could all affect his progress.

Pages 17–19: Data Distortion

Activity One

1. Discussion and evaluation will vary. In some cases, the intention may be to distort the data to support the headline, or it may just be a poor choice of graph style or wording. Points may include:

For **i.**:

a. Flaws:

- Although it is acceptable for the vertical axis to not start at 0, this needs to be indicated (for example, by a jagged or wavy line). This axis only goes up in ones, which hardly suggests that crime rates are "skyrocketing".
- The graph itself doesn't have a title (a separate element from the headline) or a vertical axis label. (Does it mean the number of criminals caught or the number of crimes reported?)

b. The author of the graph may have been inexperienced in using a graphing program or may have wished to exaggerate the increase in crime rates.

c. Possible changes:

- Provide a title for the graph. (This will indicate context. For example, if the graph is about the number of crimes reported, the title could be: Reported Crimes 2006–08.)
- Start the vertical axis at 0 or use a jagged line to indicate that it doesn't start at 0. Decide on an appropriate vertical axis interval (increment).
- A better headline might be: Reported crime rates edge upwards.

For **ii.**:

a. Flaws:

- The graph does not have a title.
- The bars (drawn as potatoes) expand in width as well as height (thus visually exaggerating the increase). It is not clear what represents the value – is it the height, the area, or the volume?
- The potatoes are not sitting on the same starting point (the horizontal axis).
- The intervals on the horizontal axis are not equal.
- The label on the vertical axis is not informative (greater than 3 per week or per day?), and in any case, the information on that label should be part of the missing title, with the vertical label just saying Percentage.
- The graph doesn't say how many children were surveyed, how the sample was chosen, or how reliable or accurate the data source is.
- It's a very bad graph!

b. The author of the graph might not have been aware that objects should start at the same point on the vertical axis or that increasing both width and height is misleading. However, it could have been deliberate if the author wanted to emphasise the 2008 figures.

c. Possible changes:

- Change the graph to a bar graph with consistent widths for each year.
- Decide on a title that is based on the current vertical axis label.
- Change the vertical axis label to Percentage.
- A possible headline could be: Big increase in children's TV watching.

For **iii.**:

a. Flaws:

- Bars (buildings) are not of equal width.
- The use of colour and shading detracts from meaning (some colours stand out more than others).
- It doesn't say what the other buildings are.

b. The author may have been using colour and a drawing of each building to give interest to the graph.

c. Possible changes:

- Change the graph to a bar graph or to something else (for example, a vertical line with heights and names on it).
- Label the buildings with their names and location.
- Make the graph title more accurate. Research would show that many skyscrapers around the world are over 600 metres high, so the Sky Tower is not "up there" in world terms, even though it is the tallest structure in New Zealand.
- A possible headline is: Heights of Tall Buildings.

For **iv.**:

a. Flaws:

- The 3D graph does not accurately reflect proportions.
- The front segment of the pie looks bigger because it is closer and lighter in colour.
- The categories are too vague. The first label in the key doesn't say if those students actually do drink water at school (for example, out of a drinking fountain); the fact that other students bring either another type of drink or a bottle of water to school doesn't mean they actually drink it.
- There is no title for the graph to indicate what the graph is showing, for example: What group of students? How many?

b. The author may have hoped that people would read the headline and relate it to the large top segment without reading the key or thinking about other ways in which those students have access to drinking water.

c. Possible changes:

- Draw the graph as a two-dimensional pie graph or as a bar or strip graph.
- Give the graph a title, for example, Percentage of Students Who Bring Drinks to School.
- A possible headline is: Most students rely on school drinking water.

For **v.**:

a. Flaws:

- The pictures of the different items are different sizes, skewing the results (visually, it looks like more burgers are sold than other food).
- There is no key: does 1 symbol = 1 person or 1 purchase? 10 purchases?
- The headline seems to be based on the length of the item lines, not the number of them (bananas and apples make up more than half the number of items sold).

b. If the author wanted to highlight the non-healthy food choices, using different scales is one way to achieve this.

c. Possible changes:

- Use the same symbol for all pictures, or at least make the existing symbols the same size. The pictogram could also be arranged as a bar graph (still using symbols).
- A possible headline (based on the limited information provided) is: More healthy snacks being bought at interval (because you don't know if a particular student bought more than one kind of snack).

For **vi.**:

a. Flaws:

- The vertical axis doesn't show the gap between 0 and 1 042 as a break or in any other way.
- The interval on the vertical axis is 1, which is pretty meaningless when you are talking about over 1 042 sales.
- The use of a line graph in combination with the flawed vertical axis makes the increases or decreases look to be much more than they are.
- The intervals on the horizontal axis are uneven (some months are very close together).

- The title is uninformative (where is the data from: New Zealand? Auckland? 1 shop?)
- The headline describes the information shown, not the actual trend.

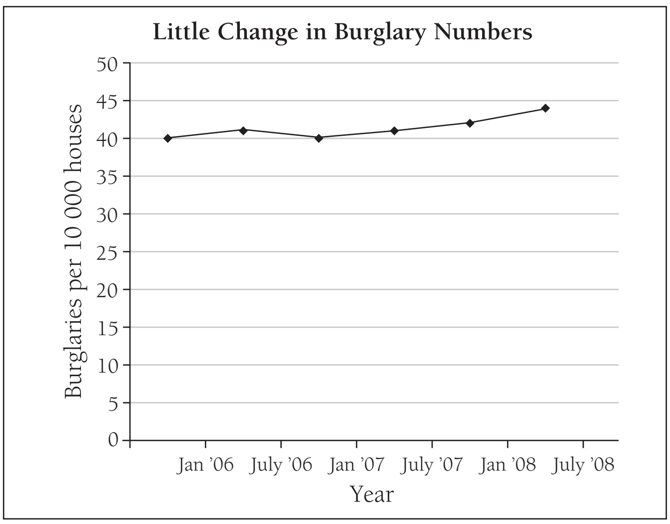
b. The author may have been trying to show the values (a graph with a scale starting at zero would be practically flat between 1 040 and 1 050); on the other hand, the author may have wanted to exaggerate the variation in the sales.

c. Possible changes:

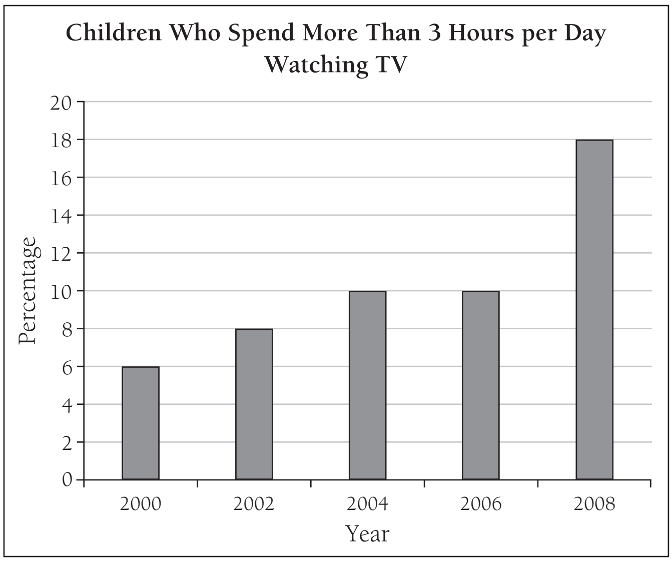
- Use a wavy line on the vertical axis to indicate the gap between 0 and 1 042.
- Space the months evenly on the horizontal axis.
- Use a bar graph so that monthly totals can be clearly read.
- Given the closeness of the figures, the headline bears little resemblance to the graph because there is only a difference of 5 consoles between the highest and lowest sales figures. A more accurate headline would be: Sales of games consoles flat.

2. Answers and graphs will vary. An example for each of the first two students' book scenarios is given below.

The first graph is about a particular crime, in this example, burglaries. The graph has been redrawn with the vertical axis starting at zero. This shows a slight increase in numbers over the 2 years, but it is not exaggerated.



The graph below on the amount of time children spend watching TV shows an increase over time, but more clearly than the potato graph.



Activity Two

Answers will vary.

Page 20: Scratch, Text, and Win

Activity

1. You can spell 24 different "words", for example, WIN!, WI!N, WN!I, WNI!, W!NI, W!IN, and so on (4 x 6 = 24, four starting "letters" each having the six combinations, or 4! = 4 x 3 x 2 x 1 = 24).
2. There is no way of knowing because you are not told how many of each prize there are. (If there were equal numbers of each prize, the probability would be $\frac{1}{3}$.)
3. You are not told how many prizes are being given away or the number of cards being distributed.
4. Answers will vary. It may cost her more money overall for her groceries than it does at her normal shop; it may cost her more money in petrol to get there. And she may not win an MP3 for Kelly no matter how many times she shops there!
5. It will cost Kelly 90 cents every time she texts a code in. She might be better off putting this money aside to save towards an MP3 player.

Kelly doesn't know what the second-chance prizes are – if she wins one, she may get something that she doesn't even like. If everyone who gets a non-prize card texted their code in, the probability of winning a second-chance prize would be low.

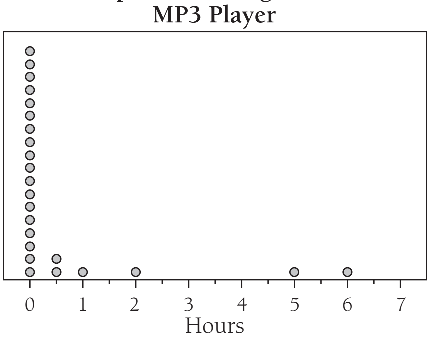
Page 21: Electronic Excess?

Activity

1. **a.–c.** Answers will vary. For example, you could group the cards according to gender, favourite pastime, or time spent on that pastime and make statements about gender or about whether time spent matches choice of favourite. For example: More boys than girls in this class like using computers as entertainment. More girls than boys in this class like using TV as entertainment. Both boys and girls in this class spend more time watching TV than they do on computer entertainment, but boys spend more time watching TV than girls do.

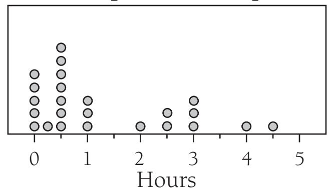
2. **a.–b.** Displays (using the data cards or graphs such as the dot plots below) and comments will vary.

i. **Hours Spent Listening to Radio or MP3 Player**

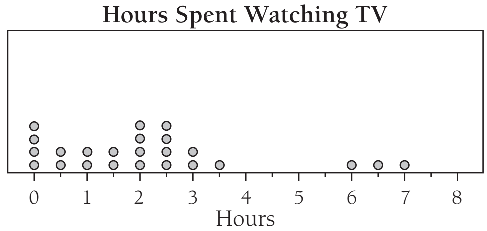


Most students don't listen to the radio or an MP3 player. Only 6 of the 24 students did in fact listen to the radio or an MP3 player for 30 minutes or more. No one selected this option as their favourite. This data suggests that typically the students don't listen to the radio or an MP3 player. Those that do listen do so for between 30 minutes and 6 hours per 24 hours. (Up to 5 minutes are counted as zero in these dot plots.)

ii. **Hours Spent on Computer**

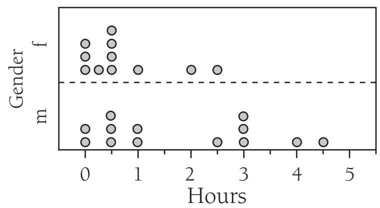


Hours Spent Watching TV

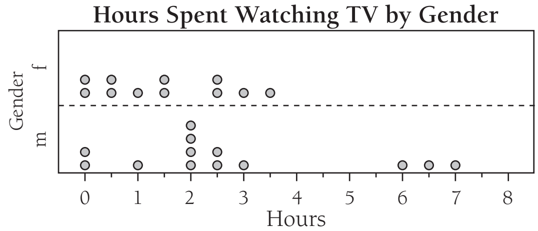


Class members tend to spend more time watching TV than playing on the computer. The graphs show that the times for computer use go from 0 to 4.5 hours, whereas the TV watching times go from 0 to 7 hours. The middle group of times for watching TV are between 1 and 3 hours, whereas the middle group of times for playing on the computer are between 20 minutes and 1 hour.

iii. **Hours Spent on Computer by Gender**



Hours Spent Watching TV by Gender



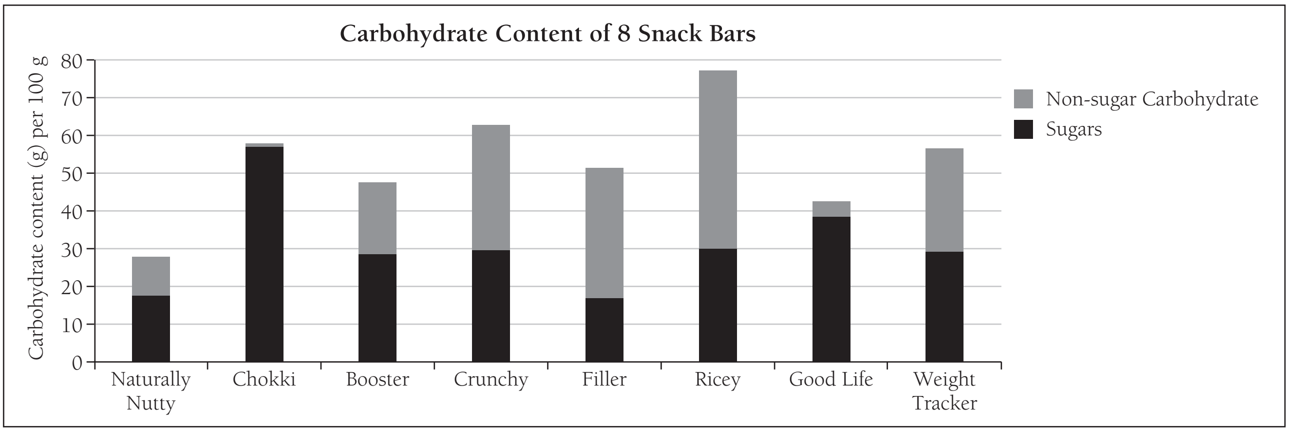
The boys tend to play on the computer and watch TV for longer than girls. The computer-playing times for the boys is spread between 30 minutes and $4\frac{1}{2}$ hours, whereas for most of the girls, it is between 0 and 30 minutes. The middle group of boys' TV-watching time is between 2 and 3 hours, whereas that of the girls is spread between 0 minutes and $3\frac{1}{2}$ hours. (Given the low use of radio or MP3 players by the students, analysis of these in terms of gender is not particularly relevant.)

Pages 22–23: Snack Attack

Activity One

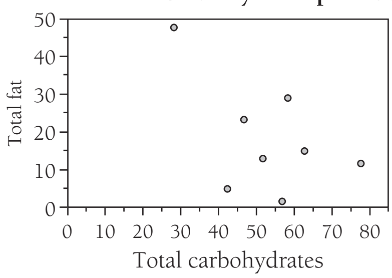
1. Discussion will vary. Examples of comments are:
   - All bars have at least some fat content, although Weight Tracker looks like it only has about 1 g.
   - The amount of unsaturated fat is higher than saturated fat in the Naturally Nutty, Filler, Ricey, and Weight Tracker bars.
   - Naturally Nutty has by far the highest combined fat content, and Weight Tracker has the lowest.
   - Chokki has the highest saturated fat content.
   - Six of the 8 bars have at least 10 g fat content per 100 g, with 3 bars having over 20 g fat content per 100 g.

2. **a.** A possible graph is shown below. Note that sugar is part of the carbohydrate figure, although it is also shown separately. The top of each bar in the graph below shows the total carbohydrate. So this graph has 3 variables: total carbohydrate, non-sugar carbohydrate, and sugars. (You could sort on any one of these variables.)

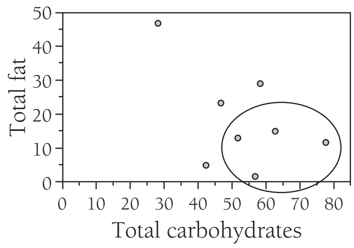


   b. Discussion will vary. Examples of comments are:
   - The carbohydrate content varies greatly from bar to bar.
   - Ricey has the highest carbohydrate content.
   - Chokki has the highest sugar content.
   - Naturally Nutty has the lowest carbohydrate content.
   - Five of the bars have more sugar carbohydrates than non-sugar carbohydrates.

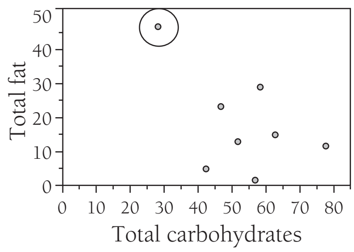
3. **a.** **Total Fat and Carbohydrate per 100 g**



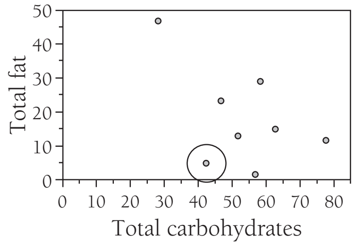
   b. Bars that are relatively low in fat and high in carbohydrate are: Weight Tracker, Filler, Crunchy, and Ricey.



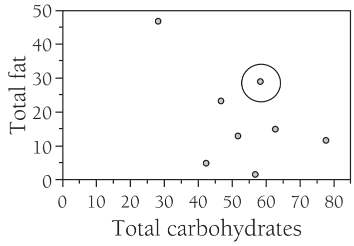
   Only 1 bar is low in carbohydrate but high in fat: Naturally Nutty.



Only 1 bar is relatively low in both fat and carbohydrate: Good Life (although its carbohydrate is mainly sugar, so it's not necessarily a healthy option, despite its name).



Only 1 bar is relatively high in both fat and carbohydrate: Chokki.



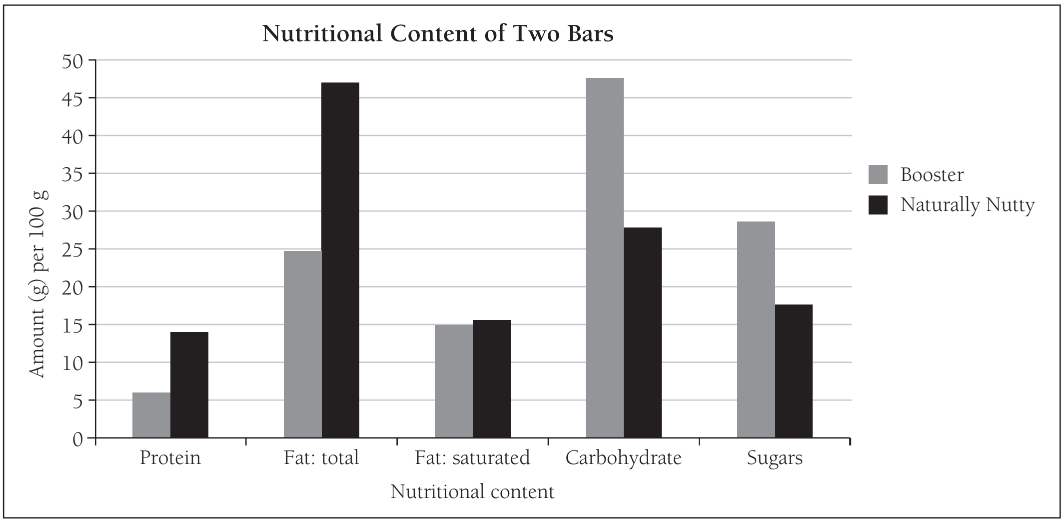
c. Discussion will vary. There may be a tendency for bars that are high in total carbohydrates to be low in fats. The scatter plots give some useful comparisons. Bar graphs (for example, the one on page **22** of the students' book or that shown in the answers for question **2a**) give a more detailed view of one set of variables.

4. a. Discussion will vary. The Booster bar has 1 830 kJ of energy per 100 g. This is one of the higher energy ratings. However, high energy does not always equal goodness. High energy implies high levels of carbohydrates, including sugar. This bar also has more fat than most of the other bars.

b. The Booster bar has 47.6 g of carbohydrate per 100 g, which is the third lowest carbohydrate content of the 8 bars. (Although if you are comparing per serving size, this bar has the second highest carbohydrate content.)

Activity Two

1. Bars chosen will vary. The example below compares Booster with Naturally Nutty.



2. Discussion will vary. Per 100 g gives a more realistic picture of the proportion of contents than the serving size does because of the differences in serving sizes. The per 100 g would be useful for comparing the amount of sugar and fat, for example, in the bars. The mass values here, in grams, immediately become percentages (by mass). On the other hand, because people usually eat one serving rather than 100 g, someone who is watching their weight (or fat intake) or is a diabetic (watching their sugar consumption) may be more interested in the amount of fat or sugar they will consume with 1 serving of each bar.

Page 24: Readers' Polls

Activity

1. **a.** Those readers of *Magazine X* who chose to fill in and return the survey (many readers may not have bothered)

   b. A likely answer is that the readers are young people, probably young males.

   c. The readers of *Magazine X* are from a specific demographic and don't represent the wider population of New Zealand.

2. Not useful at all. The questions and their listed possible answers are narrow and are leading the respondents to answer in a certain way.

Investigation

1. Survey forms and results will vary.
2. Answers will vary. Given the very small sample, this data is unlikely to be of interest to anyone outside the class. You could improve your survey by modifying questions that are not understood or that do not gain useful information. You could improve your data by asking a larger and more representative sample to answer your questions.

Figure It Out

Statistics in the Media

Levels 3⁺–4

Teachers' Notes

Overview of Levels 3^+–4

Title	Focus	Page in students' book	Page in teachers' notes
Dinner Time Ads	Working with "messy", real-life data	1	28
CensusAtSchool	Asking investigative questions of an existing database	2–3	29
Bad News?	Analysing real-life category data	4–5	31
Ad Mad	Analysing and comparing grouped bar graphs	6–7	32
People Meters	Telling stories based on household data	8–9	34
Spin to Win!	Using probability to estimate costs and benefits	10–11	36
Logging On	Analysing and comparing time-series graphs	12–13	38
Ad Appeal!	Collecting and analysing category data	14–15	40
Optimal Velocity	Investigating change over time	16	41
Data Distortion	Critiquing and improving graphs	17–19	42
Scratch, Text, and Win	Investigating and weighing up probabilities	20	43
Electronic Excess?	Finding relationships between two variables	21	44
Snack Attack	Finding patterns and relationships in a multivariate dataset	22–23	46
Readers' Polls	Probing into survey questions and methods of sampling	24	47

What Is Statistics About?

Statistics is defined in *The New Zealand Curriculum* as “the exploration and use of patterns and relationships in data”. Like mathematics, it aims to equip students with “effective means for investigating, interpreting, explaining, and making sense of the world in which they live”.

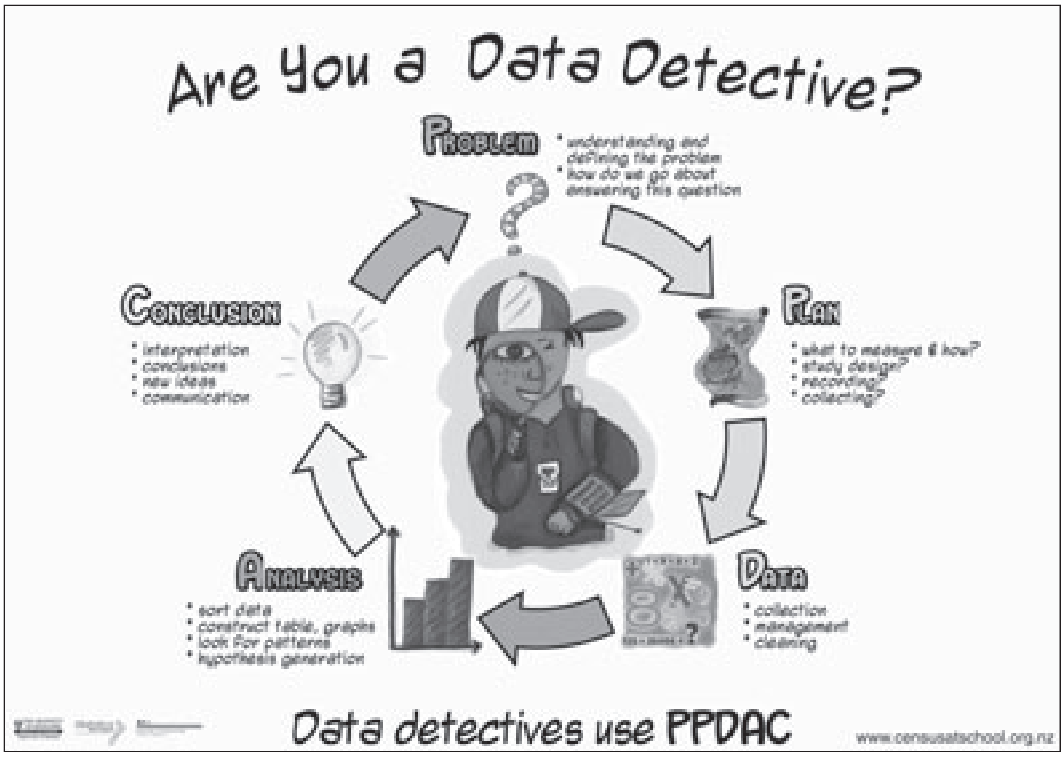
The New Zealand Curriculum goes on to say:

> Mathematicians and statisticians use symbols, graphs, and diagrams to help them find and communicate patterns and relationships, and they create models to represent both real-life and hypothetical situations. These situations are drawn from a wide range of social, cultural, scientific, technological, health, environmental, and economic contexts …
>
> Statistics involves identifying problems that can be explored by the use of appropriate data, designing investigations, collecting data, exploring and using patterns and relationships in data, solving problems, and communicating findings. Statistics also involves interpreting statistical information, evaluating data-based arguments, and dealing with uncertainty and variation.

page 26

The **PPDAC** (Problem, Plan, Data, Analysis, Conclusion) statistical enquiry cycle used for the New Zealand CensusAtSchool resources (see www.censusatschool.org.nz) provides a model for statistical investigation. This approach is used in this Figure It Out *Statistics in the Media* book and in the *Answers and Teachers’ Notes* that accompanies it.

CensusAtSchool New Zealand makes available two posters (aimed at different age levels) for the PPDAC cycle. One version is:



The five steps (**PPDAC**) in this model are:

- **P**roblem – deciding what to investigate, and why, and how to go about it;
- **P**lan – determining how to gather the necessary data;
- **D**ata – collecting, managing, and preparing the data for analysis;
- **A**nalysis – exploring the data with the help of graphs and statistical tools and asking what it says;
- **C**onclusion – determining how the data answers the original problem and deciding what to do next.

CensusAtSchool New Zealand provides further information on all these steps in the form of a downloadable PDF (go to www.censusatschool.org.nz and select new curriculum, statistical enquiry cycle).

Much of the information in the following sections is adapted (with permission) from information available on CensusAtSchool New Zealand and Statistics New Zealand (www.stats.govt.nz).

Types of Data

Category data classifies data according to non-numeric attributes (variables), such as gender, colour, style, model, opinion, type, feel. For example, the category "foods" could be sorted into variables such as meat, fish, vegetables, fruit, and cereal.

Numeric data (which is sometimes referred to as **measurement data**) classifies data according to an attribute that can be counted or measured. Numeric data may be either discrete or continuous. **Discrete data** is whole-number, countable data, for example, the number of students in a class. **Continuous data** (also sometimes referred to as measurement data) is data obtained using measurement, for example, time, height, area, mass, age. (When continuous data is rounded to the nearest whole unit, it is effectively treated as discrete.) **Time-series data** is data that is collected from a series of observations over time, with a view to discerning time-related trends, for example, monthly profits, daily rainfall. It is usually numeric data.

A **variable** is an attribute that can vary or take on different values, for example, gender (male or female), time, colour, length, favourite author, number of items, cost, age, temperature. When data on two or more variables is collected for each item or person, the result is a **bivariate** or **multivariate data set**. A list of movies by length is a **univariate data set** (that is, there is a single variable, time); a list of movies by length, genre, and country of origin is a multivariate data set. Multivariate data sets have much greater potential for exploration than univariate data sets.

Graphs

Graphs or charts? *Graph* is the more common usage in New Zealand (except in the case of pie *chart*) but *chart* is the term used by most graphing programs. In statistical contexts, these two terms are used virtually interchangeably.

The activities in the students' book promote graphs as a means of exploring data and communicating findings. It is important that students learn to make and/or "read" graphs, question what they read or see, find the stories in the data, and ask more questions. At any stage, students can devise their own graphical representations, but as they learn more, they need to become familiar with the standard types of graphs and associated conventions. All standard graphs should have a title that states the intent, **axes** (if used) should be labelled clearly, and the measures used should be consistent throughout. The use of these basic conventions enables the stories in graphs to be "read" more clearly. The following descriptions of graphs relate to those that occur in the students' book or that students may use in their answers and investigations.

Bar graphs are used to show the frequency of category data or discrete numeric data. Unlike dot plots and strip graphs, they have two axes, one labelled with the category and the other with the frequency. In basic bar graphs (see page 3 of the Answers), there is always a gap between bars, showing that the categories are quite separate. The bars are normally vertical and, for category data, may be coloured or shaded differently as long as the colours or shades relate to separate category variables (that is, the use of different colours or shades must indicate differences).

On a well-constructed and labelled bar graph, it is easy to see which of the categories is most "popular" and to compare categories. Differences that appear insignificant in a pie chart or strip graph typically show up clearly in a bar graph.

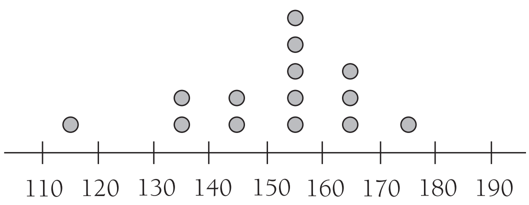
A bar graph can also be used to show multiple data sets. This is sometimes called a **clustered bar graph**. In effect, two or more bar graphs are sharing a common set of axes. The bars for the second variable are displayed side by side without a gap (see pages **6–7** of the students' book). The two variables must be coloured or shaded distinctly and a key provided. This type of graph allows comparisons to be made both within and between data sets. Bar graphs can also be used to show how a numeric quantity (such as mean height) relates to a category variable (such as gender).

In a **stacked bar graph** (see page **22** of the students' book), bars are divided into sections representing each data category. In a **100% stacked bar graph**, as in the sectors in a pie chart, each section is shown as a percentage of the total of that category in the data. However, 100% stacked bar graphs have two advantages over pie charts: they use a percentage scale, which makes it easier to see the extent to which each category contributes to the whole, and their shape means that two or more stacked bars can be placed side by side so that data sets can be compared. Where two or more 100% stacked bars appear on the same graph, they are always the same length, regardless of the size of the groups being studied.

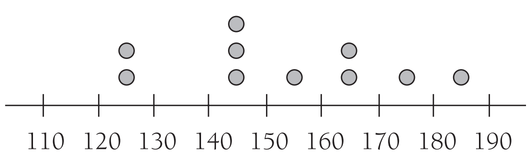
Pie charts (see page **18** of the students' book) and **strip graphs** show the relative size of the categories that make up a whole (whatever the whole may be). The categories are always labelled. The percentage value (and sometimes the actual data value) may also be shown on or alongside each region. Unlike bar graphs, pie charts and strip graphs do not show categories that contain zero data. Students find pie charts difficult to create by hand but easy to create in most graphing programs.

While they have their place, pie charts and strip graphs can only be used for a single variable and can only tell the simplest of stories. (Some statisticians suggest that pie charts should be avoided because angles are harder to relate to quantities than lengths are.)

Dot plots (see page 16 of the Answers) are a variation of the histogram. They are very easy to construct and clearly show the distribution of the data involved (that is, the way in which it is distributed and/or grouped). Dot plots suit discrete numeric data: each dot represents a single piece of data. Continuous (measurement) data is normally rounded to the unit used on the scale (for example, the nearest centimetre). The beginning and end of the scale are dictated by the least and greatest data values. Data can be grouped, as in the following dot plots.



Girls' Arm Span Length (cm)



Boys' Arm Span Length (cm)

Stem-and-leaf graphs are a convenient means of organising and displaying discrete numeric data. Each individual data value retains its identity at the same time as overall patterns emerge. For further information on making and sorting stem-and-leaf graphs, see the section on graphs in the notes for *Statistics: Revised Edition*, Figure It Out, levels 3–4 (available online at www.nzmaths.co.nz/node/1992).

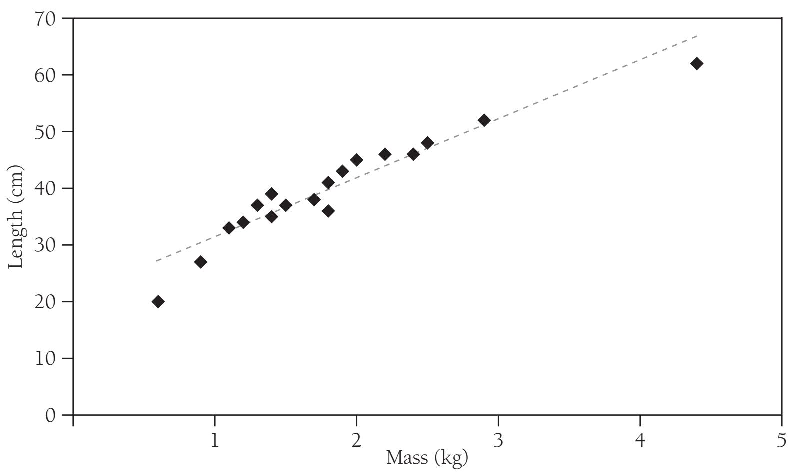
A **histogram** looks similar to a bar graph but, in this case, the bars touch. Histograms are used for continuous data (for example, height). For further information on histograms, see the section on graphs in the notes for *Statistics in the Media*, Figure It Out, levels 4–4+ (available online at www.nzmaths.co.nz/node/1992).

Line graphs relate to two variables, one plotted on the horizontal axis and the other on the vertical. Line graphs are useful for showing one variable in relation to another (for example, your height over time) or making predictions about the results of data that has not yet been decided or recorded (**extrapolations**), for example, visitor numbers to Abel Tasman National Park for the summer of 2012, based on previous visitor numbers for the same season and the general trend visible in several years' worth of data. Line graphs are useful for displaying numeric data or information that changes continuously over time, but they are not suitable for category data.

A **time-series graph** (see page **13** of the students' book) is a line graph in which time is shown on the horizontal axis and the variable being observed is shown on the vertical axis.

A **scatter plot** graphs bivariate data (data with two numeric variables) as a series of separate points, as in the example below (see also page 12 of the Answers). The horizontal axis shows one variable, the vertical axis the other. Some graphing programs call this kind of graph an XY scatter graph. Scatter plots are essential for showing the relationship between the two variables graphed. Students can use a scatter plot to look for clusters, outliers, trends (the shape may be straight or curved in some way), and changes in the vertical spread. It is sometimes useful to pencil in a curve or a straight line and then assess how this will fit the points. A computer can fit a line or various sorts of curves. In the example below, the computer-generated line gives less information than a curve would.

Fish Caught Today



Other Statistical Terms

Axes (singular: **axis**) are the two lines, one horizontal and one vertical, that form the framework for most graphs. If frequency is one of the quantities mapped, it usually goes on the vertical axis.

Bias in statistics exists when the results differ from those that would reasonably be expected (for example, larger or smaller) due to some factor that was overlooked when data was being gathered (for example, a poorly worded survey question that was misunderstood by many respondents or a sample of the population that excluded some relevant age groups).

Collate means to collect and combine.

A **correlation** is said to exist between two variables when there appears to be some kind of relationship between them (for example, smoking and heart disease or latitude and temperature).

Data cleaning is the identification of incomplete, incorrect, inaccurate, or irrelevant parts of the data and the replacement, modification, or deletion of this data so that the data set represents its respondents as well as possible.

A **data display** is any way of displaying data, for example, a table or a graph.

To **extrapolate** is to go beyond the available data and make an educated prediction about what will happen "off the edge of the graph". (For example, using population data for the past few years, a reasonable prediction could be made for New Zealand's population next year or in 5 years.)

To **interpolate** is to estimate a value that lies somewhere among or within known data values. For the purposes of both interpolation and extrapolation, it is assumed that the observable pattern continues within and will continue beyond the available data. This will not necessarily be true. Extrapolation is generally less reliable than interpolation because there is no guarantee that a previous trend will be maintained.

A **frequency table** is a table that organises data by category or interval and gives the frequency for each category or interval. For example:

Weeks between haircuts	2	4	6	8	10	12	14+
Number of classmates	2	6	9	5	2	3	1

The number of data in a category or interval is known as its **frequency**. Frequency can be thought of as the count of individuals in a category.

"**I wonder**" questions are **investigative questions –** statistical questions or problems to be answered or solved. Investigative questions are questions asked of the data, whereas **survey questions** are questions that are asked to get the data.

Two types of investigative questions are of particular interest at this level:

- **Summary questions**, which usually involve a single variable and require the data to be described in some detail (for example, "I wonder how long it typically takes a year 6 student to run 100 metres?")
- **Comparison questions**, which involve comparing two or more subsets of data, for example, male and female, young and old, in relation to a common variable such as speed (for example, "I wonder whether year 6 girls are typically faster than year 6 boys?").

When continuous (measurement) data is grouped into a frequency table or histogram, the axis is divided into sections called **intervals**. An interval is defined by its limits, for example, "greater than or equal to 3 but less than 4". Intervals can be precisely and economically described using inequality signs and a symbolic variable, for example, $3 \le d < 4$ (read [from the centre] as "distance is greater than or equal to 3 but less than 4").

The **mean** of a numeric variable (in a data set) is a way of defining the "centre" of a distribution (or set of values). It is the "centre of gravity" of a graph. The mean is calculated by dividing the sum of all the values in the data set by the number of values. The mean is sometimes called the **average**.

When analysing any variable (for example, life expectancy) in a data set or distribution, it is important to consider both **central tendency** and **spread**. Central tendency refers to the extent to which data clusters around a "middle" value. The most common measures of central tendency are median and mean. Spread refers to the extent to which data is spread out or dispersed. Simple measures of spread include range and interquartile range, both of which can be clearly seen in a box plot.

The **median** is the middle value in the distribution for a numeric value when all the data values are arranged in order from smallest to largest or largest to smallest.

The **mode** is the most commonly occurring data value (if there is one) in a data set.

An **outlier** is an outlying value in a data set. It is a term that is often used in statistics. An outlier in a scatter plot is a point that is a long way from the rest. (It may be the result of a counting or measurement error, or it may be a record for an unusual individual.) Outliers can affect the average (or mean) quite considerably.

Population means the entire group that a particular investigative question relates to.

A **sample** is a subset of the population.

Probability (see pages **10–11** and **20** of the students' book):

- **Probability** and **chance** relate to the same concept, although one of the terms may be more usual in a particular context.
- **Trial**: performance of an action or actions where the outcome is uncertain (for example, 8 tosses of a coin)
- **Outcome**: the result of a trial (for example, 5 heads and 3 tails, where the trial is a toss of 8 coins)
- **Experiment**: sometimes used interchangeably with trial
- **Experimental probability**: the likelihood that something will happen, based on a number of trials
- **Theoretical probability (expectation)**: the likelihood that something will happen, based on reasoning or calculation from assumptions about the process.

A **questionnaire** is a form containing a set of questions designed to gain statistical information.

Tally marks (/) are used when counting or categorising data by hand. Every fifth stroke is drawn across the previous four, facilitating skip-counting by 5s and 10s. For example, ~~////~~ ~~////~~ // stands for 12.

In a **tally chart** (also called a **frequency table**), information is presented in three columns: category, tally, and frequency (the tally total). For example:

Footware	Tally	Frequency
Shoes	~~////~~	5
Sandals	~~////~~ //	7

A **trendline** (see the example under scatter plot graphs) is a line on a graph that indicates a statistical trend. Some computer programs can assess the plotted values and mark a middle course through them. Any such line must always be assessed against the data to see how well (if at all) it fits the data.

Variation is the term used to refer to the differences among values of the same variable, particularly differences from an expected pattern or trend. Variation can be described and, at later levels, measured, using a variety of measures of spread, from the simple to the sophisticated.

Links to *The New Zealand Curriculum*

Achievement Objectives

Achievement objectives in the Teachers' Notes are from the mathematics and statistics area of *The New Zealand Curriculum*. In the notes for each set of activities in the students' book, the relevant Achievement Objective headings and steps of the **PPDAC cycle** (see pages 21–22) are shaded in the box diagrams below the list of achievement objectives.

Key Competencies

The New Zealand Curriculum identifies key competencies that students will develop over time and in a range of settings. Schools can develop the key competencies within the mathematics and statistics learning area as well as encourage and model values for students.

The five key competencies identified in *The New Zealand Curriculum* are:

- thinking
- using language, symbols, and texts
- managing self
- relating to others
- participating and contributing.

The notes for the student activities in this *Statistics in the Media* book suggest one or more key competencies that relate to each set of activities and give suggestions for how these could be developed. (You may, of course, decide to focus on key competencies other than those suggested.)

Activity Notes

Page 1: Dinner Time Ads

Achievement Objectives

Statistical investigation

- Conduct investigations using the statistical enquiry cycle:
  - gathering, sorting, and displaying multivariate category and whole-number data and simple time-series data to answer questions;
  - identifying patterns and trends in context, within and between data sets;
  - communicating findings, using data displays (Statistics, level 3).

Statistical literacy

- Evaluate the effectiveness of different displays in representing the findings of a statistical investigation or probability activity undertaken by others (Statistics, level 3).

Statistical investigation	Statistical literacy	Probability

P	P	D	A	C

Key Competencies

Dinner Time Ads can be used to develop these key competencies:

- thinking: investigating, making decisions, designing investigations
- using language, symbols, and texts: communicating findings
- managing self: working independently, seeking understanding.

Statistical Ideas

Dinner Time Ads involves the following statistical ideas: using the **PPDAC cycle***, **investigative questions**, **category data**, **tally charts**, and **graphs.**

Activity

In this activity, a young boy asks himself an "**I wonder**" question, which he then follows up with a statistical investigation. It is important that students come to view statistics as a means of investigating and answering questions about their world.

Real data is not neat and tidy; it can be difficult to classify. For example, is a television service "entertainment" or "communications"? (We have provided broad categories on the student page, but you might want your students to think of their own.) Encourage your students to discuss how they classified the ads (within the categories provided or their own). They should understand that, in some cases, either of two possible categories is fine; there is no one "right" answer. What does matter is that the students are consistent in their categorisation: the pizza ad can't be classified as food in one spot and home in another. If too many ads end up in the "other" category, the students should reconsider how they are doing their classifying or add one or more new categories. A large amount of data in the "other" category undermines any conclusions and suggests that not enough thought went into defining suitable categories.

It is good statistical practice to use findings as the basis for further questions (this is why the PPDAC is a cycle). For example, in this case, the students may wonder if food ads are always so prominent at this time of the day, how frequent they are at other times, or if the day of the week influences the types of ads shown. Investigative questions are concerned with patterns (what is typical) rather than single statistics (for example, which is longest/tallest).

* For bolded terms, see What Is Statistics About?, pages 21–26.

Daniel collects data only from 1 day on 1 channel, and from this data, he attempts to generalise about all dinner-time advertising on TV. Discuss with your students whether a generalisation is possible from this data. A useful class exercise would be to have students gather data for different days and different channels. In this way, a much larger sample can be obtained, one that will more accurately reflect reality. Make full use of the PPDAC cycle in planning this investigation. Challenge the students to find ways of minimising differences due to categorisation and data-gathering methods. A common framework will ensure that the data gathered by different students can easily be combined.

When students collect their data for question **4**, they should ensure that they do so with the additional data in mind. Follow up the students' presentations of findings by having them discuss and evaluate the effectiveness of the various **data displays**.

Extension

Advertising (in any medium) offers great potential for statistical investigations. Students could design and conduct a further investigation, this time trying to answer a question that is of personal interest. It could relate, for example, to the kinds of ads that are shown at different times of the day, the lengths of ads, the emotions that ads play on, the relationship between programmes and products, or the advertising of a single product or service.

Pages 2–3: CensusAtSchool

Achievement Objectives

Statistical investigation

- Conduct investigations using the statistical enquiry cycle:
  - gathering, sorting, and displaying multivariate category and whole-number data and simple time-series data to answer questions;
  - identifying patterns and trends in context, within and between data sets;
  - communicating findings, using data displays (Statistics, level 3).

Statistical literacy

- Evaluate the effectiveness of different displays in representing the findings of a statistical investigation or probability activity undertaken by others (Statistics, level 3).

Statistical investigation	Statistical literacy	Probability

P	P	D	A	C

Key Competencies

CensusAtSchool can be used to develop these key competencies:

- thinking: investigating, exploring and using patterns and relationships in data, designing investigations
- using language, symbols, and texts: communicating findings, using ICT as appropriate
- relating to others: working co-operatively
- managing self: planning, persevering, seeking understanding
- participating and contributing: sharing equipment and/or resources.

Statistical Ideas

CensusAtSchool involves the following statistical ideas: using the **PPDAC cycle***, **multivariate category** and **numeric data**, and a range of **graphs** and communicating findings.

* For bolded terms, see What Is Statistics About?, pages 21–26.

Activity

In this activity, students explore the database on the CensusAtSchool website. This database has at least three qualities that make it particularly suitable for statistical explorations by both primary and secondary school students. Firstly, it is huge, removing the need for students to spend time collecting large amounts of data for themselves. Secondly, it introduces the concept of sampling because the database is too big for students to explore in its totality. Thirdly, the database relates directly to the activities of others of their own age.

The data for this activity needs to be downloaded from the CensusAtSchool website www.censusatschool.org.nz. Students download a random sample of responses, keep the demographic data, such as age, gender, year, and location, and the questions relating to media, and delete the data for all the other questions (because it is not relevant to this activity).

In this case, the data sample contains 100 records, which is convenient for a pair of students to collate and analyse. (It also makes calculations and percentage comparisons very easy!) In general, the bigger the sample, the clearer the patterns and relationships become.

You may need to help your students to decipher some of the abbreviated column headings when they are building their media summary tables in question **1b**. It could be a good idea to allow them time to try the random sampler and build summary tables before they start the actual activity.

Before the students work through questions **2** and **3**, you may need to revise the PPDAC cycle with them. For these questions, the students need to pose and explore investigative questions. Using the starter "**I wonder** …" is useful. At this level, questions can be either **summary** or **comparison questions**. Examples of summary questions are:

- I wonder what TV shows are typically favoured by year 7 students?
- I wonder what websites are typically favoured by year 9 students?
- I wonder how much year 8 girls typically spend on cellphones each month?

Examples of comparison questions are:

- I wonder if year 8 girls typically send more text messages than year 8 boys?
- I wonder if parents typically pay for the cellphone usage of younger students more than for that of older students?
- I wonder if high school students typically send more text messages than intermediate school students?
- I wonder if year 9 and 10 students typically send more text messages than year 11 and 12 students?

Note: You will need to discuss the meaning and use of the word "typically" in investigative questions. It acknowledges that there are exceptions to virtually every trend. Even if it is generally true, for example, that "Year 10 students like reality TV shows", there will be plenty of year 10 students who don't. For this reason, "Year 10 students typically like reality TV shows" is a statement that better describes the data.

In their analysis, the students will draw a variety of graphs, depending on the data they have selected. They should write "I notice ..." statements describing the shape, spread, and middle of the data and should cite any appropriate statistics that they have calculated.

As part of question **3**, the students are required to reach conclusions. They should be answering the investigative question they posed, supporting their answer with evidence from the analysis.

Ensure that the students complete the PPDAC cycle by discussing other questions that arise from their own and others' investigations.

Extension
The CensusAtSchool database allows for comparisons between year groups (for example, years 6 and 8) and between census years (for example, 2007 and 2005). The only catch is that the

questions are different for each census, so only some comparisons are possible. You could challenge your students to devise and carry out an investigation that involves cross-group or cross-year comparisons. A number of other countries also offer CensusAtSchool. Students may like to do a comparative investigation between New Zealand and another country.

Pages 4–5: Bad News?

Achievement Objectives

Statistical investigation

- Conduct investigations using the statistical enquiry cycle:
  - gathering, sorting, and displaying multivariate category and whole-number data and simple time-series data to answer questions;
  - identifying patterns and trends in context, within and between data sets;
  - communicating findings, using data displays (Statistics, level 3).

Statistical literacy

- Evaluate the effectiveness of different displays in representing the findings of a statistical investigation or probability activity undertaken by others (Statistics, level 3).

Statistical investigation	Statistical literacy	Probability

P	P	D	A	C

Key Competencies

Bad News? can be used to develop these key competencies:

- thinking: investigating, interpreting, designing investigations, demonstrating statistical literacy
- using language, symbols, and texts: communicating findings, interpreting visual representations such as graphs
- relating to others: working in groups, collaborating
- managing self: seeking understanding.

Statistical Ideas

Bad News? involves the following statistical ideas: classifying **category data***, using **tally charts**, communicating findings using **graphs**, repeating investigations, and using the **PPDAC cycle**.

As with Dinner Time Ads, this activity demonstrates that "real" data can be complex and difficult to categorise.

Activity

Before the students begin their analysis, encourage them to try and reach a shared understanding of what constitutes good, bad, mixed, and neutral news, illustrating each category with exemplars. This process prepares the groundwork for determining appropriate variables and measures (a level 5 achievement objective). In this instance, the variable would be the type of news and the measures would be good, bad, mixed, and neutral. Only if those involved have similar understandings is it possible to pool data and compare the findings for different samples.

Although a standard bar graph is given as an example in the answers for question **2a**, encourage the students to invent their own graphs to display the information.

For question **2b**, Laki is right according to Anna's data, but the sample (1 channel, 3 nights) is too small to support a definite conclusion. A larger data-gathering exercise, perhaps spread over

* For bolded terms, see What Is Statistics About?, pages 21–26.

20 nights (and different channels, as suggested later), would provide a firmer foundation on which to draw a conclusion.

When students share their graphs and conclusions for question **3**, they should also provide each other with feedback on how effectively their data displays communicate their findings.

Investigation One

Investigative questions are likely to be **summary questions**. "**I wonder**" questions can be phrased as suitable investigative questions. For example, "I wonder if most bad news stories are about crime?" could become the investigative question "What are bad news stories typically about?"

The PPDAC cycle starts with the problem, followed by the plan. For any investigation, encourage your students to settle on the question(s) they want to answer and then collate (or find) the data that answers the question(s). To continue the PPDAC cycle, have students share their findings with other classmates, who can help them evaluate how convincingly they have answered their investigative question and how effectively their graphs communicate the important information.

Investigation Two

In this investigation, two different channels could be compared, as could weekend or weeknight news. Is the last news item always positive? Students might like to develop and use a classification system (for example, political, economic, crime, accident, health, human interest, weather, natural disaster) as a basis for their investigation.

Pages 6–7: Ad Mad

Achievement Objectives

Statistical investigation

- Conduct investigations using the statistical enquiry cycle:
  - gathering, sorting, and displaying multivariate category and whole-number data and simple time-series data to answer questions;
  - identifying patterns and trends in context, within and between data sets;
  - communicating findings, using data displays (Statistics, level 3).

Statistical literacy

- Evaluate the effectiveness of different displays in representing the findings of a statistical investigation or probability activity undertaken by others (Statistics, level 3).

Statistical investigation	Statistical literacy	Probability

P	P	D	A	C

Key Competencies

Ad Mad can be used to develop these key competencies:

- thinking: designing investigations, exploring and using patterns and relationships in data
- using language, symbols, and texts: communicating findings, interpreting visual representations such as graphs, diagrams
- relating to others: collaborating, working in groups
- managing self: seeking understanding
- participating and contributing: working in groups with everyone participating, sharing equipment and/or resources.

Statistical Ideas

Ad Mad involves the following statistical ideas: interpreting **clustered bar graphs***, using the **PPDAC cycle**, evaluating the effectiveness of **data displays**, and comparing within and between data sets.

Activity One

A clustered bar graph is, in effect, two or more bar graphs sharing a common set of axes and allows comparisons to be made both within and between data sets. This can be confusing for some students.

The general trend for both radio stations is that the cost of an advertisement reduces as the day progresses. The cost is lowest of all in the evening slot, when both stations charge less than $40. Station A is cheaper than station B for all times except after 7 p.m. This suggests that, while station B is considerably more popular during the day, station A has more listeners in the evening. Perhaps it has a particularly good presenter at that time, someone who has developed a strong personal following. Ask your students what might explain this reversal of popularity in the evenings. As noted in the Answers, the data used for the graphs is an approximation only. The students could find similar data for themselves if required.

Investigation

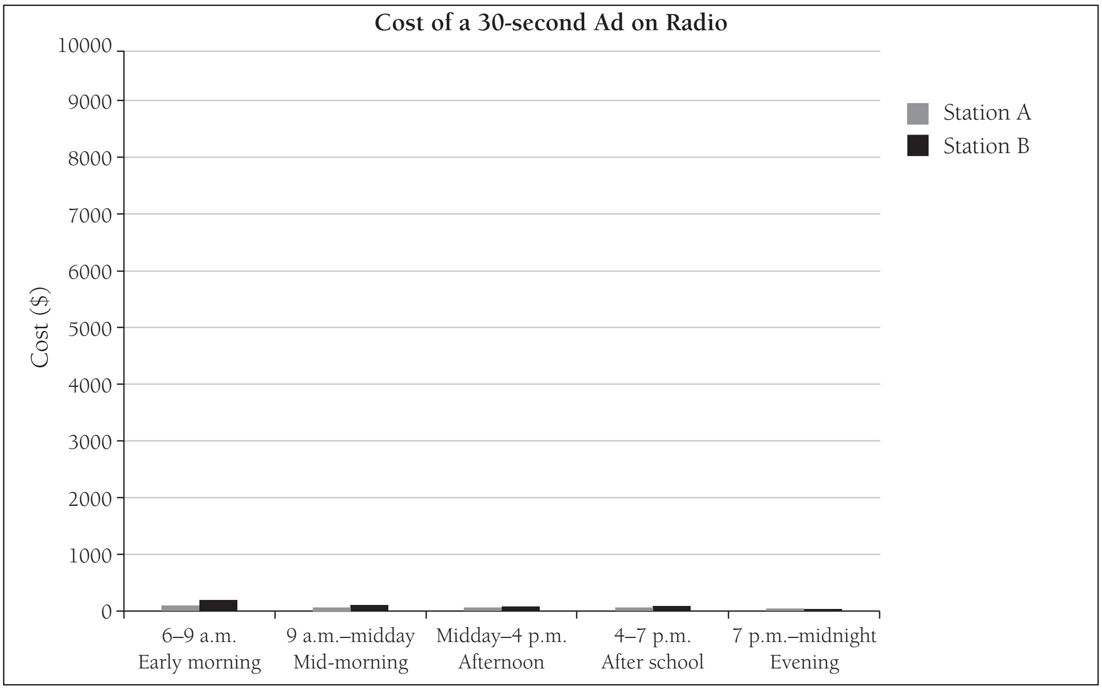
Students need to be guided through the PPDAC cycle when developing their own investigations. One way to do this is to brainstorm "**I wonder**" questions and other ideas for investigation. These will need to be teased out to form appropriate investigative questions. The students are likely to need a lot of support at the problem phase of the cycle. Modelling and conferencing will assist the students in framing their investigative questions before they embark on the planning and data collection phases.

The students need to decide if they will survey one radio station at different times of the day, different stations at the same time of the day, or different stations at different times of the day (a more ambitious undertaking). They also need to decide how long they will listen for and what data they will collect. Encourage them to collect data on a wider selection of **variables** than the one(s) they need to answer their investigative question. This will allow for further analysis later on and for the answering of other questions.

Activity Two

It is important that the students realise that the two graphs in Ad Mad use very different scales on the vertical (cost) axis and that the categories on the horizontal axis are not exactly the same. When two graphs are to be compared, it is usually preferable to draw them to the same scale. However, the costs for radio are so much less than those for TV that a common scale would almost obliterate the radio costs:

* For bolded terms, see What Is Statistics About?, pages 21–26.



Extension

Students could carry out an investigation into TV advertising as they did earlier for radio advertising. They could share their graphs and conclusions with other groups or present them to the class. When your students are giving feedback to others (for example, on aspects such as the use of the PPDAC cycle, the quality of the presentation, and the appropriateness and clarity of the graphs), encourage them to look for the positive features and make constructive suggestions for improvements.

You could also have the students look at a TV guide (magazine or newspaper) to compare scheduling information with the ad prices given in **Activity Two** for various times. Have them find out which TV programmes are likely to earn the TV channel the most revenue (and how much), based on the information in the TV graph. They will also need to know how long ad breaks are in total and whether the length of ad breaks varies at different times of the day. Have them compare this information to the TV ratings found in the newspaper. Ask them what they notice.

Pages 8–9: People Meters

Achievement Objectives

Statistical investigation

- Conduct investigations using the statistical enquiry cycle:
  - gathering, sorting, and displaying multivariate category and whole-number data and simple time-series data to answer questions;
  - identifying patterns and trends in context, within and between data sets;
  - communicating findings, using data displays (Statistics, level 3).

Statistical literacy

- Evaluate the effectiveness of different displays in representing the findings of a statistical investigation or probability activity undertaken by others (Statistics, level 3).

Statistical investigation	Statistical literacy	Probability

P	P	D	A	C

Key Competencies

People Meters can be used to develop these key competencies:

- thinking: interpreting, exploring, and using patterns and relationships in data
- using language, symbols, and texts: communicating findings, using visual representations such as graphs and diagrams, demonstrating statistical literacy, using ICT as appropriate
- relating to others: working in groups, collaborating.

Statistical Ideas

People Meters involves the following statistical ideas: collating **numeric data***, drawing and interpreting **stacked bar graphs**, inventing graphs, evaluating the effectiveness of different **data displays**, and identifying possible "dirty data".

Background Information

Students will need to understand what a people meter is and what it is used for. For this, they can go to www.nztbc.co.nz (The New Zealand Television Broadcasters' Council website) for more information on people meters and for the statistics gleaned from them. Note that a real people meter records more information than the activity suggests, including the channel watched and exact times. This information is collected by market research companies for media companies to use. Visit www.agbnielsen.co.nz and click on What do we do? This allows you to explore the systems this company uses to collect and analyse data. It provides a very interesting model for statistical investigations in the professional context.

Activity One

Data often needs to be analysed and graphed in a variety of ways, with the focus on different variables or features, in order to discover patterns and trends. This usually involves grouping and regrouping data in different ways. For this activity, the students may need the change from 30-minute to 2-hourly slots pointed out to them.

For questions **2** and **3**, encourage your students to design their own graphs to display the data. If a graph is to be able to tell a variety of stories, data loss needs to be minimised. For this reason, pie charts are not suitable for this sort of data because they convey only one feature of a data set and leave no details for the reader to pore over. Have the students evaluate each others' graphs in terms of their effectiveness in helping to communicate the findings.

For question **4**, the students may realise that the guest was probably a babysitter (which explains their lone viewing on Saturday night) and that Zoë evidently forgot to log off when she finished viewing on Wednesday night. Although it is not until level 5 that students are expected to identify "dirty" data and clean it, the concept can be introduced at an earlier level. Dirty data might be an input error (such as a height recorded as 157 metres instead of 1.57 metres) or a deliberately false survey answer (such as giving "Jedi Knight" as one's religion). In this case, it is unlikely that Zoë watched TV all Wednesday night, so this needs to be considered (or possibly adjusted for) when analysing this data. (We don't know if the guest was the babysitter or a friend who forgot to log off, so this data cannot be "tidied".)

For question **5**, the data for 1 week is a sample size of one family. There will be considerable variation from week to week for the family's viewing, so many more weeks' data would be needed before it was possible to say what was typical for the Wade family.

For question **6**, the students need to realise that the data collection agency cannot tell whether people are actually watching the shows they are logged on to. This needs to be kept in mind when interpreting viewer information collected in this way.

* For bolded terms, see What Is Statistics About?, pages 21–26.

Activity Two

Have the students revisit the websites cited above for further information and to spark discussion on the viewing habits of the nation. Further investigative questions could be formulated, based on the much more extensive set of data available.

Extension

Have the students carry out a class-wide investigation into family viewing habits. They will need to decide what data they will collect, when they will collect it (for example, during a certain 5-hour slot on 1 or more days), and how they will record it. (They need to make sure that they get permission from family members to use this data!)

When the students have collected their own family's data, have them collate and graph it, using different graphs. What patterns can they see? What conclusions can they reach? Have them compare their findings with those of a classmate and then pool the data from the whole class. Ask them what conclusions they can make now.

Pages 10–11: Spin to Win!

Achievement Objective

Probability

- Investigate simple situations that involve elements of chance by comparing experimental results with expectations from models of all the outcomes, acknowledging that samples vary (Statistics, level 3).

Statistical investigation	Statistical literacy	Probability

P	P	D	A	C

Key Competencies

Spin to Win! can be used to develop these key competencies:

- thinking: investigating, making decisions, designing investigations
- using language, symbols, and texts: communicating findings
- managing self: working independently, seeking understanding.

Statistical Ideas

Spin to Win! involves the following statistical ideas: using the **PPDAC cycle***, **investigative questions**, **category data**, **tally charts**, and **graphs.**

Activity One

All sectors of the circle are equal, so the chance of the spinner landing in any sector is 1 out of 10. However, some prizes occur in two sectors, so the chance of winning these prizes is 2 out of 10 or $\frac{1}{5}$.

Possible reasoning for question **2** is given in the Answers. Although students at this level would not be required to find "expected values", this is how you would find the expected value in this instance: multiply each probability with its prize value and then add the results together. In this situation, it is: $\frac{1}{10}$ x \$20,000 + $\frac{1}{5}$ x \$500 + $\frac{1}{5}$ x \$5,000 + $\frac{1}{10}$ x \$5 + $\frac{1}{5}$ x \$1,000 + $\frac{1}{5}$ x \$450 = \$2,000 + \$100 + \$1,000 + 50c + \$200 + \$90 = \$3,390.50. This indicates that taking the guaranteed cash prize of \$4,000 is likely to be a better choice because it is higher than the expected value of \$3,390.50. Furthermore, there is only a $\frac{3}{10}$ chance of getting a prize valued higher than the \$4,000 cash amount.

* For bolded terms, see What Is Statistics About?, pages 21–26.

Question **3** focuses on common misconceptions. You could explore this with the students by considering multiple coin tosses. Many people think that if there have been a large number of heads, then the next toss is bound to be tails. It isn't. Heads or tails are still a 50–50 chance (unless the coin is biased) because each toss is independent of the previous tosses.

Activity Two

In relation to question **1**, it may be interesting for students to note that if every contestant spun the wheel and won the $20,000, then the season (10 shows) would cost $200,000. The chance of this happening is extremely low because a contestant's chance of winning $20,000 on a spin is 1 out of 10 or $\frac{1}{10}$ and the chance of $20,000 being won in all 10 episodes is $\frac{1}{10} \times \frac{1}{10} \times \frac{1}{10} \times \frac{1}{10} \times \frac{1}{10} \times \frac{1}{10} \times \frac{1}{10} \times \frac{1}{10} \times \frac{1}{10} \times \frac{1}{10}$ or $(\frac{1}{10})^{10}$. This equals 1 chance in 10 000 000 000 (or one chance in ten billion), which is a very slim chance indeed! (The chance of no one winning the jackpot of $20,000 over the course of a season is $[\frac{9}{10}]^{10}$, which is 0.35 or 35%.)

Although the cost for the season if everyone spun the wheel is somewhere between $50 (the cost of 10 health bars) and $200,000, the "expected cost" is $33,905, based on the assumption that each of the equally likely outcomes occurs once (see the Answers section and the notes for **Activity One**).

By simulating a number of seasons with the whole class (that is, everyone spinning a paper clip around the wheel 10 times and recording prize values), you will generate results for 20 to 30 seasons. This is not quite enough to find an average that will approximate the likely winnings. The greater the number of seasons simulated, the closer the results will be to the expected value of $33,905. 100 seasons would be better; perhaps the students could do 4 seasons each, find the mean, and then combine with the rest of the class to get an overall mean.

Activity Three

In question **1**, students investigate a simulated season. Better results may be achieved if the decision to spin or take the cash is based on the toss of a coin, thus avoiding prejudiced decisions based on earlier results. (To spin the wheel, have the students position the tip of a pen or pencil in the middle of the wheel and spin a paper clip around it with their fingers.)

Combining data with that of other classmates is sound practice. In this case, the greater the number of classmates involved, the closer the result will be to $36,952.50 (calculated as $\frac{1}{2} \times \$33,905 + \frac{1}{2} \times \$40,000$, assuming a 50–50 chance of spinning or taking the cash). Encourage the students to aim for 100 simulated seasons as a basis for discussion.

The following table shows the results of a computer simulation of 10 seasons of *The Winning Wheel*, based on the assumption that, in every show, the winning contestant chooses to spin the wheel. You may like to give your students a photocopy of this information to analyse. They will be able to see that every season is completely different from every other one (and would be even more so if the $4,000 was chosen in some episodes). They will also be able to calculate how many times the different prizes come up and what the total cost of prizes was for each season. They can compare these outcomes with what would have happened if each contestant took the $4,000. The students could add up the prize money for each of the 10 seasons, put them on a dot plot, and observe features such as: the centre (is it near $33,905?), the **spread** (skewed? Are there outliers?), and the top and bottom totals.

Note that the numbers 1–10 represent the 10 sectors of the board; working around the board clockwise from "12 o'clock": 1 is the Kelly Tarlton family day, 2 is the game console, 3 is the $1,000, and so on.

Season 1		Season 2		Season 3		Season 4		Season 5	
Wheel sector	Prize ($)	Wheel sector	Prize ($)	Wheel sector	Prize ($)	Wheel sector	Prize ($)	Wheel sector	Prize ($)
10	20 000	5	5	7	450	4	5 000	9	5 000
1	500	1	500	4	5 000	8	1 000	3	1 000
9	5 000	4	5 000	4	5 000	9	5 000	4	5 000
3	1 000	2	450	6	500	6	500	10	20 000
2	450	4	5 000	2	450	6	500	5	5
4	5 000	7	450	10	20 000	4	5 000	4	5 000
2	450	2	450	2	450	5	5	5	5
10	20 000	3	1 000	4	5 000	2	450	2	450
9	5 000	10	20 000	4	5 000	8	1 000	10	20 000
3	1 000	1	500	3	1 000	9	5 000	5	5

Season 6		Season 7		Season 8		Season 9		Season 10	
Wheel sector	Prize ($)	Wheel sector	Prize ($)	Wheel sector	Prize ($)	Wheel sector	Prize ($)	Wheel sector	Prize ($)
10	20 000	6	500	10	20 000	9	5 000	3	1 000
2	450	9	5 000	7	450	6	500	8	1 000
4	5 000	2	450	1	500	2	450	3	1 000
8	1 000	3	1 000	7	450	6	500	9	5 000
9	5 000	4	5 000	10	20 000	7	450	2	450
10	20 000	10	20 000	6	500	5	5	7	450
5	5	8	1 000	10	20 000	10	20 000	5	5
5	5	8	1 000	7	450	4	5 000	6	500
10	20 000	7	450	5	5	7	450	10	20 000
7	450	10	20 000	8	1 000	1	500	10	20 000

For question **3**, see the comments in the answers for a discussion about profits versus advertising revenue.

Pages 12–13: Logging On

Achievement Objectives

Statistical investigation

- Conduct investigations using the statistical enquiry cycle:
  - gathering, sorting, and displaying multivariate category and whole-number data and simple time-series data to answer questions;
  - identifying patterns and trends in context, within and between data sets;
  - communicating findings, using data displays (Statistics, level 3).

Statistical literacy

- Evaluate the effectiveness of different displays in representing the findings of a statistical investigation or probability activity undertaken by others (Statistics, level 3).

Statistical investigation	Statistical literacy	Probability

P	P	D	A	C

Key Competencies

Logging On can be used to develop these key competencies:

- thinking: investigating, interpreting, exploring and using patterns and relationships in data
- using language, symbols, and texts: communicating findings, using ICT as appropriate
- relating to others: co-operating
- managing self: seeking understanding
- participating and contributing: working in groups with everyone contributing.

Statistical Ideas

Logging On involves the following statistical ideas: creating and interpreting **time-series graphs*** and using the **PPDAC cycle.**

Activity One

A time-series graph shows change in a variable (for example, cost, weight, profit, audience) over time. It is important that students notice that the graph they draw for this activity shows the change in user numbers over the day much more clearly than the table of data does. If students give their **Activity One** graph (see the example in the answers) the same scale as their graph for **Activity Two**, they will find it much easier to make comparisons between the two graphs. (However, graphing both series on the same chart, as suggested below for **Activity Two**, is a very effective way to show the differences.)

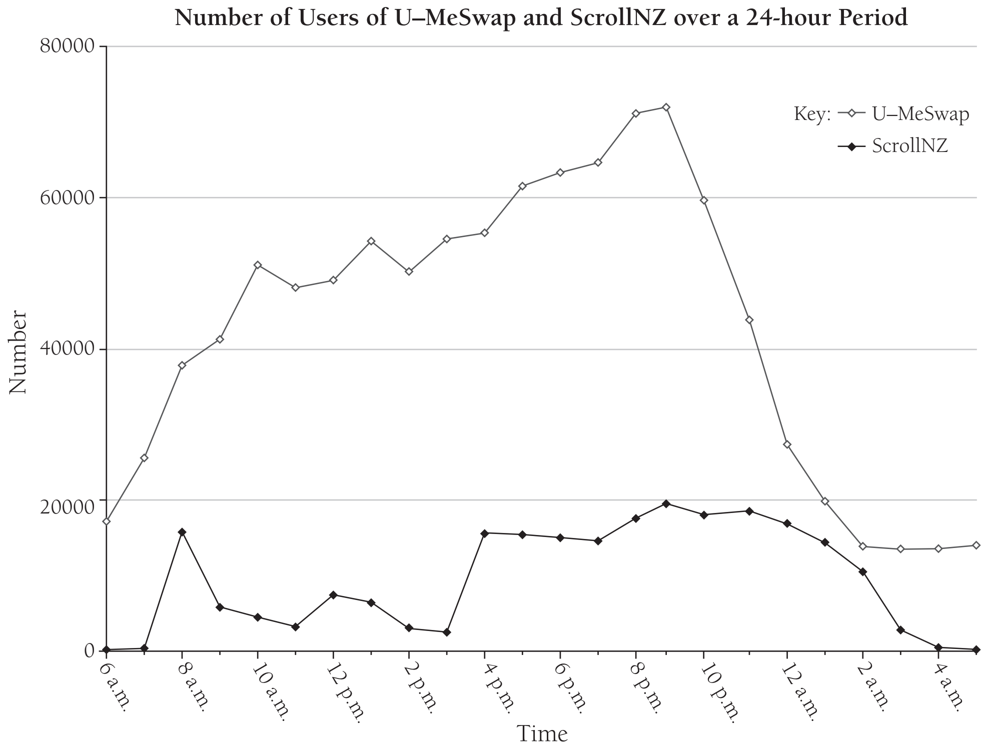
Activity Two

The obvious way to compare the two websites is to graph both series on the same chart. The table supplied here contains the raw data for U–MeSwap, which students can use if they wish to create a graph with both series on the one set of axes (see the graph on the next page). The ScrollNZ data is on the students' book page.

U–MeSwap	
Time	**Users**
6 a.m.	17164
7 a.m.	25568
8 a.m.	37813
9 a.m.	41250
10 a.m.	51092
11 a.m.	48104
12 p.m.	49092
1 p.m.	54248
2 p.m.	50226
3 p.m.	54526
4 p.m.	55348
5 p.m.	61521
6 p.m.	63321
7 p.m.	64651
8 p.m.	71132
9 p.m.	71960
10 p.m.	59650
11 p.m.	43829
12 a.m.	27354
1 a.m.	19834
2 a.m.	13876
3 a.m.	13532
4 a.m.	13565
5 a.m.	14013

* For bolded terms, see What Is Statistics About?, pages 21–26.

The resulting graph would look like this:



Pages 14–15: Ad Appeal!

Achievement Objectives

Statistical investigation

- Conduct investigations using the statistical enquiry cycle:
  - gathering, sorting, and displaying multivariate category and whole-number data and simple time-series data to answer questions;
  - identifying patterns and trends in context, within and between data sets;
  - communicating findings, using data displays (Statistics, level 3).

Statistical literacy

- Evaluate the effectiveness of different displays in representing the findings of a statistical investigation or probability activity undertaken by others (Statistics, level 3).

Statistical investigation	Statistical literacy	Probability

P	P	D	A	C

Key Competencies

Ad Appeal! can be used to develop these key competencies:

- thinking: making connections, analysing, exploring and using patterns in data
- using language, symbols, and texts: exploring different representations, communicating findings
- relating to others: working in groups, collaborating
- managing self: managing time effectively, being self-motivated
- participating and contributing: sharing equipment and/or resources.

Statistical Ideas

Ad Appeal! involves the following statistical ideas: using data cards to collect **multivariate data***, sorting and re-sorting data, making sense of data, and using two-way tables of counts.

* For bolded terms, see What Is Statistics About?, pages 21–26.

Activity One

Data cards contain multivariate data relating to a single person. Data cards are easy to manipulate and collate in different ways. When your students are using data cards, encourage them to group and regroup the data according to different variables. Cards can be stacked above or beside each other to make a **bar** or **strip graph** for a quick and easy **data display**. Students should be able to ask and answer **comparison questions** using the data cards.

If you use paper card that matches each colour being used (be creative with the colour black …), this will help the students to make a quick association and will aid in generating an effective data display. If this option is unavailable, use white card and have students colour the relevant segment in the colour being surveyed.

For question **2**, the students may need help in finding categories for sorting the data (see the example for green in the students' book). This "making sense of the data" is a key learning experience because real data does not always fall into easy categories. Some widely shared associations may relate to well-known brands that the students are familiar with.

Extension
The physical manipulation of the data cards will help the students to ask and answer their own **investigative questions**, for example, "Do older students tend to have more abstract colour associations than younger students?"

When students present their findings, encourage them to critique and evaluate the effectiveness of their chosen displays. Some students may want to use the actual data cards in their displays.

Activity Two

This activity could be done as a class survey, but extending it to other classes will give the students a larger pool of data to work with. (If they manage to get 100 responses, the percentages will be easy!) When the students are analysing the results, they should look at the cells with the most tally marks as well as at the column totals. If both point towards the same combination of header and pitch, the choice is clear. When the students are communicating findings, they should give results in terms of the number of votes (as done in the Answers).

Page 16: Optimal Velocity

Achievement Objectives

Statistical investigation

- Conduct investigations using the statistical enquiry cycle:
  - gathering, sorting, and displaying multivariate category and whole-number data and simple time-series data to answer questions;
  - identifying patterns and trends in context, within and between data sets;
  - communicating findings, using data displays (Statistics, level 3).

Statistical literacy

- Evaluate the effectiveness of different displays in representing the findings of a statistical investigation or probability activity undertaken by others (Statistics, level 3).

Statistical investigation		Statistical literacy	Probability	
P	P	D	A	C

Key Competencies

Optimal Velocity can be used to develop these key competencies:

- thinking: interpreting, exploring, and using patterns and relationships in data, making decisions
- using language, symbols, and texts: interpreting visual representations such as graphs.

Statistical Ideas

Optimal Velocity involves the following statistical ideas: interpreting **bar graphs***, using graphs such as **scatter plots** for analysis, and using statistics to make decisions.

Activity

Discuss with your students popular computer games that they play. Statistics for the games they play may be available online. The students may find it interesting to analyse these after they have looked at the comparatively simple context in the students' book.

For question **1**, you may need to discuss with the students what is meant by handling and what effects good handling, acceleration, or speed have on the ability to race well.

For question **2**, it is difficult to analyse the race times if they are considered just as a string of numbers. Encourage the students to use graphs to help paint a picture. Scatter plots like those in the Answers work well for this activity. The students will need to separate the times for the three different track types to see any pattern, either with separate graphs (as in the Answers) or by using different colours or symbols.

Extension

Students who have access to and/or interest in a game that gives times or points for performance may be interested in investigating how environmental distractions affect their performance.

You could challenge the students to design an experiment or a "fair test". Suggest that they limit themselves to two variables (for example, silence or loud music while playing the game). They will also need to repeat the experiment under the same conditions a number of times for results to be more reliable.

The students may like to look at some statistics of real cars and discuss what features are important in a decision to buy a car, for example: cost, comfort, reliability, safety, and appearance. A good starting point for this is the free advice available on www.consumer.org.nz (look under Cars, Car buying guide). The students could also discuss which features are important for a family car as opposed to a racing car.

Pages 17–19: Data Distortion

Achievement Objective

Statistical literacy

- Evaluate the effectiveness of different displays in representing the findings of a statistical investigation or probability activity undertaken by others (Statistics, level 3).

Statistical investigation	Statistical literacy	Probability

P	P	D	A	C

Key Competencies

Data Distortion can be used to develop these key competencies:

- thinking: interpreting, thinking critically, analysing, making decisions, engaging in making sense

* For bolded terms, see What Is Statistics About?, pages 21–26.

- using language, symbols, and texts: exploring different representations, interpreting visual diagrams
- relating to others: working in groups, communicating thinking
- participating and contributing: sharing equipment and/or resources.

Statistical Ideas

Data Distortion involves evaluating **data displays***.

Activity One

This activity epitomises statistical literacy at level 3. Unfortunately, not all graphs from various media sources are effective or even accurate, and some may even be distorted (possibly deliberately).

A useful starting point is to revise what a good graph should include (see page **19** of the students' book) or visit the Statistics New Zealand website (www.stats.govt.nz) and go to the schools corner. Other key features of quality graphs are:

- scales divided into equal intervals
- starting at zero (where appropriate)
- bars of the same style and width
- accurate labels and titles
- data displayed simply
- no distortions.

Activity Two

It is important that the students collect examples of good graphs. Encourage them to include non-traditional data displays (invented graphs) that are just as clear as regular graphs. There are often opportunities for students to invent their own graphs, and seeing examples of these will give them plenty of ideas.

Many graphs use colour to show a variable (for example, in population density). For some interesting data displays, see the *National Geographic*, *The New York Times*, scientific journals, or websites devoted to statistical graphics. Encourage your students to look out for maps that convey statistical information.

Page 20: Scratch, Text, and Win

Achievement Objective

Probability

- Use simple fractions and percentages to describe probabilities (Statistics, level 4).

Statistical investigation	Statistical literacy	Probability

P	P	D	A	C

Key Competencies

Scratch, Text, and Win can be used to develop these key competencies:

- thinking: dealing with uncertainty and variations, evaluating, predicting or envisioning outcomes
- using language, symbols, and texts: interpreting word problems.

Statistical Ideas

Scratch, Text, and Win involves calculating **probability***.

* For bolded terms, see What Is Statistics About?, pages 21–26.

Activity

For question **1**, students may need to list every "word" that can be spelt with these letters. Encourage them to do this in a systematic way, as shown in the Answers. There are 4 different letters that can go in the first box, then 3 remaining letters that can go in the second box, leaving two possible letters for the third box and only one for the last box, so 4 x 3 x 2 x 1 = 24. (This is can be written as 4! or 4 factorial.) Alternatively, there are 6 ways to begin with a W, so there will be 6 ways to begin with every other letter (or symbol), hence 6 x 4 = 24 combinations. Note: If each letter could appear more than once, there would be 256 combinations (4 x 4 x 4 x 4).

Questions **2** and **3** deal with probability. Probability is expressed most simply as a fraction: the number of successful outcomes out of the number of possible outcomes. If either of these numbers is unknown, the theoretical probability cannot be calculated. If all the letters and prizes in this instance were equally distributed, there would be 1 chance in 72 of winning the MP3 player because 1 in 24 would win a prize and 1 in 3 prizes would be an MP3 (24 x 3 = 72). However, we have no reason to assume the equal distribution.

Before the students answer questions **4** and **5**, you could discuss with them why manufacturers or businesses have competitions such as these (for example, to increase sales or to entice consumers to change to their brand over that of a competitor). Students may not understand how unlikely they are to win prizes in such competitions (see the extension activity) and may therefore be susceptible to buying goods that they don't really need.

Extension

You could explore the likelihood of winning Lotto by giving the students Lotto numbers as a reward system in the class. At the end of each week, have a draw. Students may be very surprised to see that usually no one wins anything. Often their experiences of lotteries or raffles involve only students in their class or school. In such cases, someone always wins, and this reinforces the idea that lotteries are "easy" to win.

Page 21: Electronic Excess?

Achievement Objectives

Statistical investigation

- Conduct investigations using the statistical enquiry cycle:
  - gathering, sorting, and displaying multivariate category and whole-number data and simple time-series data to answer questions;
  - identifying patterns and trends in context, within and between data sets;
  - communicating findings, using data displays (Statistics, level 3).

Statistical literacy

- Evaluate the effectiveness of different displays in representing the findings of a statistical investigation or probability activity undertaken by others (Statistics, level 3).

Statistical investigation	Statistical literacy	Probability

P	P	D	A	C

Key Competencies

Electronic Excess? can be used to develop these key competencies:

- thinking: investigating, exploring and using patterns and relationships in data, designing investigations
- using language, symbols, and texts: communicating findings
- relating to others: working in groups, comparing and contrasting ideas
- participating and contributing: sharing equipment and/or resources.

Statistical Ideas

Electronic Excess? involves the following statistical ideas: using data cards to collect **multivariate data***, sorting and re-sorting data, and making sense of data by building data graphics (**data displays**) and interpreting them.

Activity

Data cards contain multivariate data relating to a single person. The cards are easy to manipulate and collate in different ways. When the students are using data cards, encourage them to group and regroup the data according to different variables. Cards can be stacked above or beside each other to make **bar** or **strip graphs** or card-built versions of the dot plots in the Answers. Students should be able to ask and answer **comparison questions** using the data cards.

The students can sort the cards into groups (for example, by gender) or by variable (for example, computer). A major strength of the data cards is that all graphs shown in the Answers as dot plots can be made using the cards. (You could help by providing common axes to be used throughout.) The card-built graphics can be photographed (or traced around) before they get recycled for the next graphic.

Before the students begin this activity, ask them to group their set of cards and then explain to a classmate how they decided to group them. Ask them to regroup them for a different variable and then to repeat with yet another variable. Often, students make obvious groups to begin with (such as gender) and become more sophisticated with their groupings as they are forced to make new ones. For example, the students could lay out their cards as a dot plot for computer, then make it grow into a scatter plot by adding a vertical axis for TV and moving the cards up. After the students make these different groupings, questions will arise naturally. It is a good idea to record these questions on a chart to stimulate further questions that students may want to answer later.

For question **2**, students can use the data cards to make graphs such as bar graphs, **dot plots**, or **scatter plots**. These can be more effective if appropriate colour is added to the data cards. For example, the question: "Do class members tend to spend more time playing on the computer than watching TV?" may be more effective if each favourite activity is shaded a particular colour on the cards (and is therefore more visible on the graph made from the cards). This effectively gets students to create a new (category) variable, which can then be explored. "How is choice of e-entertainment influenced by gender?" may also be more effective if boys and girls are shaded in different colours. Have the students evaluate each others' graphs in terms of their effectiveness in answering the **investigative questions**.

Extension

Create another set of data cards (see the blank cards on page 56) for your own class and have them keep a record of their time spent at each activity over 24 hours. Copy these onto paper of a different colour to distinguish them from Ani's class. With the additional variable of class, the data set has now doubled in size. (Note that Ani's data comes from a real year 7 class, so comparisons will be valid.) It may also be interesting to collect a class set of data cards from a much younger or older year level. Have your students ask and answer their own investigative questions using their set of data cards.

* For bolded terms, see What Is Statistics About?, pages 21–26.

Pages 22–23: Snack Attack

Achievement Objectives

Statistical investigation

- Conduct investigations using the statistical enquiry cycle:
  - gathering, sorting, and displaying multivariate category and whole-number data and simple time-series data to answer questions;
  - identifying patterns and trends in context, within and between data sets;
  - communicating findings, using data displays (Statistics, level 3).

Statistical literacy

- Evaluate the effectiveness of different displays in representing the findings of a statistical investigation or probability activity undertaken by others (Statistics, level 3).

Statistical investigation	Statistical literacy	Probability

P	P	D	A	C

Key Competencies

Snack Attack can be used to develop these key competencies:

- thinking: investigating, interpreting, analysing
- using language, symbols, and texts: using ICT as appropriate, using appropriate units
- relating to others: working co-operatively
- participating and contributing: sharing strategies and thinking.

Statistical Ideas

Snack Attack involves the following statistical ideas: interpreting **stacked bar graphs***, creating and interpreting **scatter plots**, analysing **multivariate data sets**, and making comparisons.

Activity One

Before the students begin this activity, it would be useful to look at the nutritional information on the packaging of various food items. The students may need to find out what the various categories mean. For example, sugar is a simple carbohydrate and is therefore part of the total carbohydrate content. They may also be interested in knowing what the benefits of the different nutrients are (for example, carbohydrates give energy, whereas protein is good for muscle regeneration and growth) and, therefore, when one might be interested in eating the product (for example, before or after exercise).

For question **1**, base discussion around the total fat (shown by the length of the bars in the graph) and the proportion of unsaturated fat to saturated fat. (Students may already know that it is necessary to have some fat in the diet and that unsaturated fat is better for you than saturated.)

For question **2**, the students need to again look at the proportions as well as the length of the bars in their graphs. (The carbohydrates that are not sugar are complex carbohydrates that give longer-lasting energy.)

The data points on the scatter plot produced for question **3** are widely scattered, not in a line. (Straight lines on scatter plots can in fact be of dubious value because they can distract from the real relationships by focusing on irrelevant expectations.) The graph shows that there isn't a clear correlation between fat and carbohydrate. There seems to be a slight tendency for bars that are high in one to be low in the other. To answer question **3b**, the students need to identify the various bars that each point represents. They could label these on a printout of their graph.

The students may find it useful to copy the table below into the spreadsheet. This gives them a

* For bolded terms, see What Is Statistics About?, pages 21–26.

multivariate data set in the usual format. They can use only the required columns when making graphs. (The graphs shown for **3b** in the answers are examples only.) Your students may also be interested in creating other graphs to look at other relationships, such as sugar and total carbohydrates.

	Energy: kJ per 100 g	Protein: g per 100 g	Total fat: g per 100 g	Saturated fat: g per 100 g	Unsaturated fat: g per 100 g	Total carbs: g per 100 g	Sugars: g per 100 g	Non-sugar carbs: g per 100 g
Naturally Nutty	2 480	14	47	15.6	31.4	27.8	17.6	10.2
Chokki	2 200	8.3	29	17.3	11.7	57.9	57.1	0.8
Booster	1 830	6	24.7	14.9	9.8	47.6	28.6	19.0
Crunchy	1 800	6.3	15.5	9.4	6.1	62.8	29.6	33.2
Filler	1 660	9.5	13.3	4.6	8.7	51.5	17.1	34.4
Ricey	1 750	3.3	10.3	4.4	5.9	77.2	30	47.2
Good Life	1 604	33.4	4.9	2.6	2.3	42.6	38.5	4.1
Weight Tracker	1 290	4.6	0.9	0.2	0.7	56.5	29.2	27.3

Question **4** encourages students to be critical of advertising claims. Discuss with your students the ways in which manufacturers can use statistics (or data) to make claims that promote their product. An extension activity would be to think of the aspects of each bar that could be promoted (for example, high levels of protein) by advertisers.

Activity Two

Instead of the task given, you may like to have your students find the nutritional information of two popular lunch products and compare these.

The students could also collect wrappers from their lunches or from home and construct a multivariate data set (in the form above) from the information on the wrappers. They could also add more variables, such as what they like about each bar.

Students need to think about: "Where did this data come from?" "Are the values actually the recipe the manufacturers aim at making?" "Are laboratory tests done, and if so, how often?" "Why are there batch numbers on products?" The answers may be in legislation or on company websites.

Page 24: Readers' Polls

Achievement Objectives

Statistical investigation

- Conduct investigations using the statistical enquiry cycle:
  - gathering, sorting, and displaying multivariate category and whole-number data and simple time-series data to answer questions;
  - identifying patterns and trends in context, within and between data sets;
  - communicating findings, using data displays (Statistics, level 3).

Statistical literacy

- Evaluate statements made by others about the findings of statistical investigations and probability activities (Statistics, level 4).

Statistical investigation	Statistical literacy	Probability

P	P	D	A	C

Key Competencies

Readers' Polls can be used to develop these key competencies:

- thinking: engaging in sense making, discerning if answers are reasonable
- using language, symbols, and texts: communicating findings, demonstrating statistical literacy
- relating to others: understanding others' thinking, accepting and valuing differing viewpoints
- managing self: reflecting.

Statistical Ideas

Readers' Polls involves the following statistical ideas: using **samples*** to make generalisations about **populations** and exploring representation and survey bias.

Activity

It is important for students to have some understanding of how information from a sample group can be used to generalise about a population. Generalising can only be done if the sample is representative of the population. Readers' polls from magazines can only generalise about that magazine's readership group. *Magazine X* readers are not representative of the general population. In this magazine, it may be that the readers' poll is designed to be humorous because the questions are biased and lead the respondent to answer in a certain way. However, the poll can still show the students how bias can impact on conclusions and help them be more discerning in evaluating surveys.

Investigation

Students may enjoy making a deliberately biased survey by asking leading questions and giving limited response options. After they have done this, ask them to rewrite their surveys, removing the bias. They could give both surveys to groups of people and compare the results.

Extension

The students could look for readers' polls in magazines that they read or have access to. Have them analyse and discuss whether these surveys are unbiased and make conjectures about how representative the results would be of a wider demographic. Have the students complete the surveys, give the same surveys to another demographic group, and compare results.

* For bolded terms, see What Is Statistics About?, pages 21–26.

Copymaster: Dinner Time Ads: Daniel's Data

Advertisements that Daniel recorded in the ad breaks between 5 and 7 p.m. one evening

McGregors (takeaways) Meadow Smells Fresh (deodoriser) McDuff's Fab Dinners (frozen meals) Throat Calm (throat lozenges) Get Well (health phoneline) Great Smile (lipstick) Bran Blocks (cereal) Cover-up (blinds) Cheapoutlook (television service)	Bonus Points (investments) Superskinny (dieting company) Herbal Cleaning (shampoo) *Celebrities R Us* (magazine) Aunt Burt's (pudding) *Nick and Nicola* (film on TV) Help Funds (charity) Comfy Sleep (bed underlay)
McDuff's Fab Dinners (frozen meals) Firmin (washing detergent) TBA Finance (financial services) Kate's (drink) Sammy's phones (cellphones) Cheapoutlook (television service) Perfect (cereal)	Cheapoutlook (television service) *Celebrities R Us* (magazine) Flying Breaks (holidays) Chocolate Gold (chocolate bar) Healthy Families (health products) Underground (takeaways)
Meadow Smells Fresh (deodoriser) Underground (takeaways) Meadow Smells Fresh (deodoriser) Get Ready To Go (breakfast drink) Loo Pigeon (toilet cleaner) Cover-up (blinds) Circus (live show) Plugs 'n Pipes (plumbing)	Mobile Communication (cellphones) McGregors (takeaways) Freshly Frozen (frozen meals) Fresh 'n Clean (toothpaste) Chocolate Gold (chocolate bar) *Our Music* (CD) Mobile Communication (cellphones) Shopping Plaza (shopping mall) Bowl Your Heart Out (bowling)
Purcell (shampoo) Mary Jane (jewellers) King & King (baby products) Daffodil Day (charity) SPARC (sports organisation) Meals in a Jiffy (cooking item) Ah Choo! (tissues)	Mobile Communication (Internet) Pizzeria (pizza) World Cup (sport) Chime Tea (teabags) Bran Blocks (cereal) Very White (toothpaste)

Copymaster: Bad News?

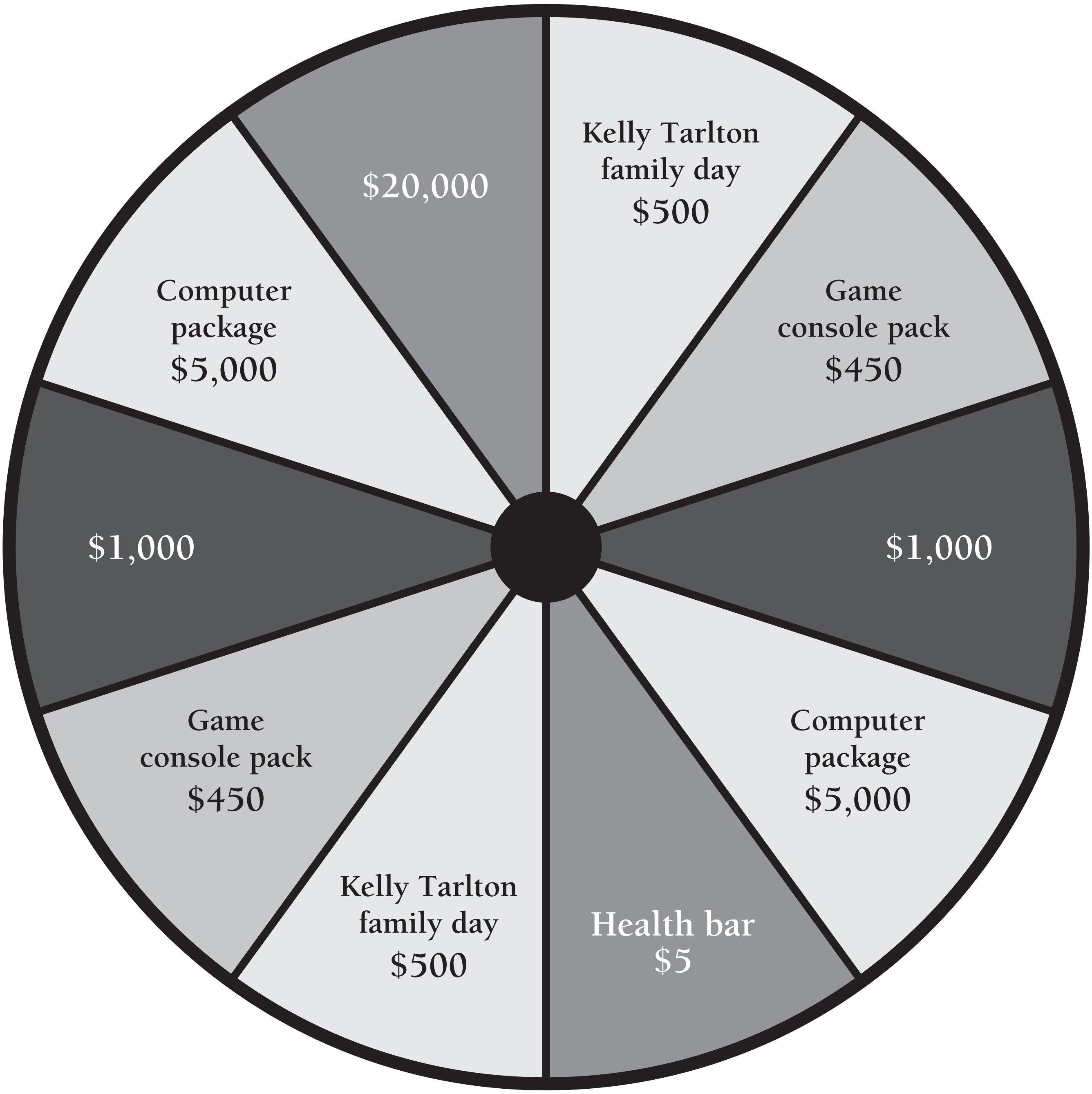
	Night 1		Night 2		Night 3	
1	MP loses job after string of scandals.		Rubbish truck crashes into house.		Robbery victim dies.	
2	House fire investigated.		Heavy swells and rain cause flooding in Otago.		Teenager injured during police chase.	
3	NZ financial situation on a downwards spiral.		Cold weather causing potholes in Otago.		Prisons under pressure due to rise in inmate numbers.	
4	A fifth person arrested in robbery case.		NZ financial situation worrying.		Parole board makes mistake by not informing victim of home detention hearing.	
5	Video store worker attacked.		Cabinet reshuffle likely after MP forced to resign.		National Party conference begins.	
6	Australian officials drop charges against doctor accused of assisting terrorism.		Police recruits dropping in quality.		Faulty baby formula pulled from the market.	
7	Middle-class New Zealanders backing off drugs to avoid criminal convictions.		Former police recruit on trial on criminal charges.		Fungus found that kills white-tailed spiders.	
8	Police investigate alleged assault in jail cell.		Refugee charged with theft is sentenced.		Britain stopping movement of cattle due to outbreak of foot and mouth disease.	
9	NASA rocked by alcohol scandal among pilots.		Christchurch house burnt down.		Death toll in bridge collapse not as high as first thought.	
10	Severe flooding kills two people.		Body of a Palmerston North man found on driveway of chicken farm in Foxton.		20 million people affected by flooding.	

Copymaster: People Meters: The Wade Family's TV Viewing Record

Mum (M), Dad (D), Zoë (Z), Trent (T), Nathan (N), Guest (G)

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
6 a.m.				Z		N	N
6.30				Z		N	N
7.00	M	M	M	M	M	N	N
7.30	M	M	M	M	M	TN	N
8.00	M	M	M	M	M	TN	
8.30						ZTN	
9.00						ZTN	
9.30						ZTN	
10.00						Z	
10.30						Z	
11.00							
11.30				D	D		
12 noon				D	D		
12.30 p.m.							
1.00							
1.30							
2.00							
2.30							
3.00	N	N	N	N	N		
3.30	N	N	N	N	N		
4.00	TN	TN		TN			
4.30	TN	TN		TN		Z	
5.00	TN	TN		TN		Z	
5.30	Z	Z	Z	Z	Z	NT	
6.00	MD	M	M	M	M	MD	MD
6.30	MD	M	M	M	M	MD	MD
7.00	Z	Z	Z	Z	Z		ZT
7.30	Z		Z			ZTG	ZT
8.00			Z			ZTG	
8.30	MD	Z	Z			ZTG	
9.00	MD	Z	Z			ZTG	
9.30		MD	Z			ZTG	
10.00		MD	Z			G	
10.30			Z			G	
11.00			Z			G	
11.30			Z			G	
12 midnight			Z			G	
12.30 a.m.			Z			G	
1.00			Z				
1.30			Z				
2.00			Z				
2.30			Z				
3.00			Z				
3.30			Z				
4.00			Z				
4.30			Z				
5.00			Z				
5.30			Z				

Copymaster: Spin to Win!



Copymaster: Ad Appeal!

		Header					Row summary	Percentage
		1	2	3	4	5		
Pitch	1							
	2							
	3							
	4							
	5							
Column summary								
Percentage								

		Header					Row summary	Percentage
		1	2	3	4	5		
Pitch	1							
	2							
	3							
	4							
	5							
Column summary								
Percentage								

		Header					Row summary	Percentage
		1	2	3	4	5		
Pitch	1							
	2							
	3							
	4							
	5							
Column summary								
Percentage								

		Header					Row summary	Percentage
		1	2	3	4	5		
Pitch	1							
	2							
	3							
	4							
	5							
Column summary								
Percentage								

		Header					Row summary	Percentage
		1	2	3	4	5		
Pitch	1							
	2							
	3							
	4							
	5							
Column summary								
Percentage								

		Header					Row summary	Percentage
		1	2	3	4	5		
Pitch	1							
	2							
	3							
	4							
	5							
Column summary								
Percentage								

		Header					Row summary	Percentage
		1	2	3	4	5		
Pitch	1							
	2							
	3							
	4							
	5							
Column summary								
Percentage								

		Header					Row summary	Percentage
		1	2	3	4	5		
Pitch	1							
	2							
	3							
	4							
	5							
Column summary								
Percentage								

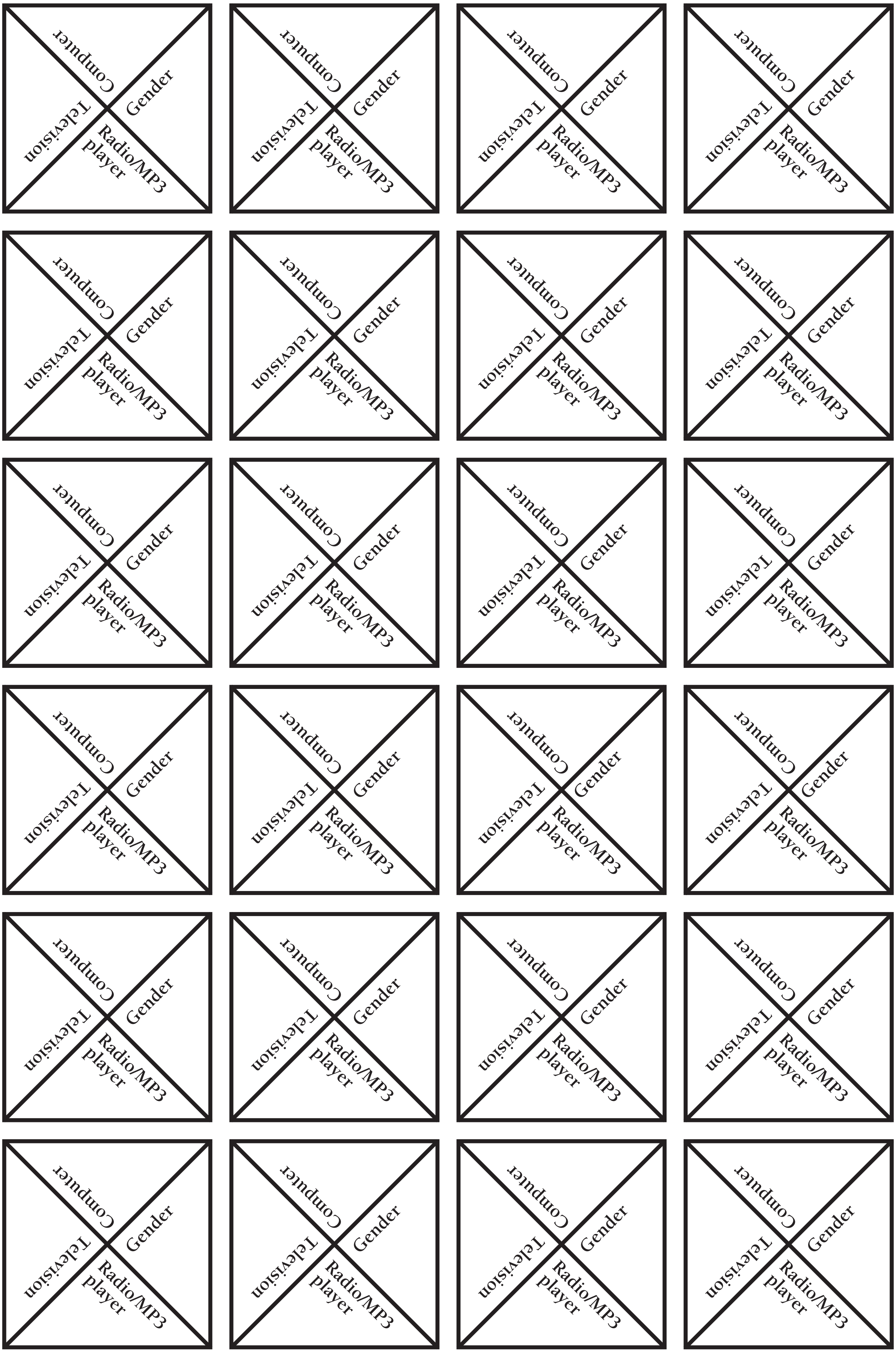
Copymaster: Optimal Velocity

Race Number	Track	Time (minutes and seconds)
1	Hill climb	5:02
2	Drag strip	1:12
3	Drag strip	0:58
4	Drag strip	0:54
5	Drag strip	0:53
6	Circuit	4:09
7	Circuit	3:19
8	Hill climb	4:47
9	Circuit	3:19
10	Circuit	3:08
11	Drag strip	0:31
12	Circuit	2:37
13	Circuit	2:26
14	Drag strip	0:32
15	Hill climb	3:42
16	Drag strip	0:29
17	Circuit	2:19
18	Drag strip	0:28
19	Drag strip	0:30
20	Hill climb	3:34
21	Circuit	2:21
22	Circuit	2:21
23	Circuit	2:25
24	Hill climb	3:01
25	Hill climb	2:52
26	Drag strip	0:26
27	Drag strip	0:25
28	Hill climb	2:54
29	Drag strip	0:27
30	Hill climb	2:59
31	Circuit	2:22
32	Hill climb	3:04
33	Circuit	2:20
34	Hill climb	2:47
35	Hill climb	2:49
36	Hill climb	3:09

Copymaster: Electronic Excess?

Gender M	Computer 30 mins	Television 0	Radio/MP3 player 0
Gender M	Computer 4.5 hrs	Television 2.5 hrs	Radio/MP3 player 0
Gender F	Computer 2.5 hrs	Television 2.5 hrs	Radio/MP3 player 0
Gender F	Computer 20 mins	Television 30 mins	Radio/MP3 player 0
Gender F	Computer 30 mins	Television 1.5 hrs	Radio/MP3 player 0
Gender F	Computer 30 mins	Television 3.5 hrs	Radio/MP3 player 0
Gender M	Computer 2.5 hrs	Television 2.5 hrs	Radio/MP3 player 0
Gender M	Computer 1 hr	Television 1 hr	Radio/MP3 player 30 secs
Gender M	Computer 3 hrs	Television 3 hrs	Radio/MP3 player 0
Gender M	Computer 4 hrs	Television 2 hrs	Radio/MP3 player 1 hr
Gender F	Computer 0	Television 1.5 hrs	Radio/MP3 player 6 hrs
Gender F	Computer 30 mins	Television 2.5 hrs	Radio/MP3 player 0
Gender M	Computer 3 hrs	Television 2 hrs	Radio/MP3 player 1 min
Gender M	Computer 3 hrs	Television 2 hrs	Radio/MP3 player 2 hrs
Gender M	Computer 0	Television 6.5 hrs	Radio/MP3 player 5 hrs
Gender M	Computer 30 mins	Television 5 mins	Radio/MP3 player 0
Gender M	Computer 5 mins	Television 6 hrs	Radio/MP3 player 0
Gender F	Computer 1 hr	Television 3 hrs	Radio/MP3 player 0
Gender M	Computer 1 hr	Television 7 hrs	Radio/MP3 player 30 mins
Gender F	Computer 5 mins	Television 5 mins	Radio/MP3 player 0
Gender F	Computer 0	Television 0	Radio/MP3 player 0
Gender F	Computer 2 hrs	Television 30 mins	Radio/MP3 player 30 mins
Gender F	Computer 30 mins	Television 1 hr	Radio/MP3 player 0
Gender M	Computer 30 mins	Television 2 hrs	Radio/MP3 player 0

Copymaster: Electronic Excess?



Copymaster: Snack Attack

Naturally Nutty		
Nutritional Information		
	Per serving (25 g)	Per 100 g
Energy	620 kJ	2 480 kJ
Protein	3.5 g	14 g
Fat: total	11.7 g	47 g
saturated	4.0 g	15.6 g
Carbohydrate	7 g	27.8 g
Sugars	4.4 g	17.6 g
Sodium	6 mg	25 mg

Booster		
Nutritional Information		
	Per serving (25 g)	Per 100 g
Energy	1 460 kJ	1 830 kJ
Protein	4.8 g	6 g
Fat: total	19.8 g	24.7 g
saturated	11.9 g	14.9 g
Carbohydrate	38 g	47.6 g
Sugars	22.8 g	28.6 g
Sodium	111 mg	139 mg

Filler		
Nutritional Information		
	Per serving (25 g)	Per 100 g
Energy	2 900 kJ	1 660 kJ
Protein	16.7 g	9.5 g
Fat: total	23.3 g	13.3 g
saturated	8 g	4.6 g
Carbohydrate	90.2 g	51.5 g
Sugars	30.0 g	17.1 g
Dietary fibre	10.0 g	5.7 g
Sodium	511 mg	292 mg

Good Life		
Nutritional Information		
	Per serving (25 g)	Per 100 g
Energy	962 kJ	1 604 kJ
Protein	20.0 g	33.4 g
Fat: total	2.9 g	4.9 g
saturated	1.6 g	2.6 g
Carbohydrate	25.6 g	42.6 g
Sugars	23.1 g	38.5 g
Dietary fibre	0.1 g	0.1 g
Sodium	90 mg	150 mg
Potassium	25 mg	40 mg

Chokki		
Nutritional Information		
	Per serving (25 g)	Per 100 g
Energy	1 100 kJ	2 200 kJ
Protein	4.1 g	8.3 g
Fat: total	14.5 g	29 g
saturated	8.7 g	17.3 g
Carbohydrate	28.9 g	57.9 g
Sugars	28.5 g	57.1 g
Sodium	41 mg	82 mg

Crunchy		
Nutritional Information		
	Per serving (25 g)	Per 100 g
Energy	585 kJ	1 800 kJ
Protein	2.0 g	6.3 g
Fat: total	5.0 g	15.5 g
saturated	3.1 g	9.4 g
Carbohydrate	20.4 g	62.8 g
Sugars	9.6 g	29.6 g
Dietary fibre	1.5 g	4.7 g
Sodium	66 mg	203 mg

Ricey		
Nutritional Information		
	Per serving (25 g)	Per 100 g
Energy	390 kJ	1 750 kJ
Protein	0.7 g	3.3 g
Fat: total	2.3 g	10.3 g
saturated	1.0 g	4.4 g
Carbohydrate	17 g	77.2 g
Sugars	6.6 g	30 g
Dietary fibre	0.1 g	0.5 g
Sodium	81 mg	370 mg
Potassium	10 mg	44 mg

Weight Tracker		
Nutritional Information		
	Per serving (25 g)	Per 100 g
Energy	517 kJ	1 290 kJ
Protein	1.8 g	4.6 g
Fat: total	0.3 g	0.9 g
saturated	0.1 g	0.2 g
Carbohydrate	22.6 g	56.5 g
Sugars	11.7 g	29.2 g
Dietary fibre	5.8 g	14.6 g
Sodium	119 mg	298 mg