

Year 8 Term 2 Homework

Student Name: _____	Grade: _____
Date: _____	Score: _____

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4 Year 8 Term 2 Week 4 Homework

4.1 Organising Data

Exercise 4.1.1 This back-to-back stem-and-leaf plot shows the age of male and female patients in a hospital ward.

<i>Males</i>		<i>Females</i>
9 8 5 3 2	1	4 7 8
8 7 7 6 4 3 2 1	2	0 2 5 5 6 7
9 7 6 6 5 4 4 4 3	3	1 3 4 4 7 8 9
7 5 5 4 3 2 0	4	2 3 5 6 6 6 7 8 8
9 7 6 4 1 1	5	0 0 1 1 4 5 5 7 7 8
5 5 3 2	6	1 2 3 5 6

1. What age is the oldest female patients? _____
2. What age is the youngest male patient? _____
3. What is the most common age for a male patient? _____
4. What is the age range of these patients?

5. How many female patients are 30 years or younger? _____
6. How many male patients are 45 years or older? _____
7. Find the average age of the male and the female patients. (answer to the nearest year)

8. What conclusion can you draw about the age of these male and female patients from this data?

4.2 Analysing Data

4.2.1 Collecting Data

Census:

- A census in which the required information is collected from every individual in the population.
- Census is very costly and very slow.
- Census can sometimes be very impractical.

Sample:

- Gather information from a small proportion of the population.
- Do not provide the detail information.
- Not as accurate or as reliable as a census.

Exercise 4.2.1 State whether a census or a sample should be used to determine:

1. the term test results of all Year 8 students at a school _____
2. the average number of a matches in a match box _____
3. the reaction time of drivers in NSW _____
4. the number of people who voted for each party in a state election _____
5. the average time that city traffic lights show red _____
6. the number of people who travel by public transport _____
7. the number of Australians who have spent time in exercise each week _____
8. the number of police officers in NSW _____
9. the number of road accidents that have occurred on Pacific Highway _____
10. the number of adults who have quit smoking in the last year _____
11. colour-blind people in Australia _____
12. the number of teenagers under 18 that are involved in binge drinking _____

4.2.2 Bias in Sampling

For the information obtained from a sample to be of any use, the sample must have the characteristics similar to those of the population.

A sample is said to be biased if each and every element in the sample does not have an equal chance of being chosen. There are many reasons why a sample may be biased:

- the sample chosen was too small
- the sample was not chosen randomly
- the data collected was deliberately changed.

Example 4.2.1 Comment on any possible bias in each of the following:

1. A survey is conducted at a large suburban bus stop between 7:00 am and 9:00 am to find out whether people prefer to use public transport than drive in peak-hour traffic.

Solution: the sample is biased towards people who already use public transport. Although some members of the sample may not have a car, the majority are more likely to have made a deliberate decision to use public transport.

2. A telephone poll is conducted between 10:00 am to 2:00 pm to determine whether more men or women would attend a new gym if it were to open in the area.

Solution: The sample is biased towards women, who are more likely than men to be at home during these hours.

Exercise 4.2.2 Comment on any possible bias in each situation:

1. In a telephone survey the interviewers ring the first person listed on every tenth page.

2. Wanting to evaluate students' opinion on an aspect of school performance, the Principal sends a questionnaire to all the previous year's HSC candidates. The letters are sent to the last known address, but only 32% of the questionnaires are returned.

4.2.3 Generating random numbers

A great deal of work in data analysis involves the selection and use of random numbers. Random numbers are used to choose a sample, such as a group of 10 people from a list of 100 names. This can be done by assigning a number to each name on the list, then generating 10 random numbers. The names corresponding to these number are then chosen as the sample.

Random numbers can be generated by using the random number function on a calculator by using a spreadsheet on a computer.

To generate a random number using a calculator:

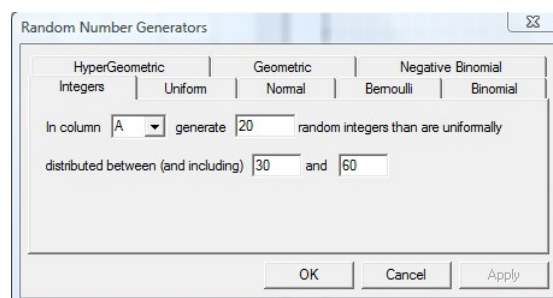
- Press the **RAN** or **RAND** Key.
- The random number is a decimal with 3 decimal places.
- Multiply this decimal by 1000 to obtain random integer.

Generate random numbers using a spreadsheet:

- Go to **Format** in the toolbar, click on **Cell** then click on **Number** and set the cell to 0 decimal places to obtain a random integer.
- Type **=rand() * 100** then select **Fill Down** to generate a list of 2 digit random numbers.
- Type **=rand() * 1000** then select **Fill Down** to generate a list of 3 digit random numbers.
- Type **=rand() * (b - a) + a** then select **Fill Down** to generate a list of random numbers between **a** and **b**.

Generate 20 random numbers between 30 to 60 using FX Stat 1 software

- Start the FX Stat 1 software.
- Click on the **Tools** and then select **Random Numbers**
- Select the number of random integers and distributed between as the figure shown below.



- Click on **OK** to generate 20 random numbers that lie between 30 to 60.

4.2.4 Sampling Techniques

- A **simple random sample** is chosen so that each member of the population has the same chance of selection, for example drawing name out of a hat, rolling a die.
- A **systematic random sample** is chosen by putting all the members in a random order, then randomly selecting a starting point and choosing members at equally spaced intervals, for example lining 100 students up randomly and selecting every tenth student in the line.
- A **stratified random sample** is chosen by dividing the population into strata, i.e. group that have similar characteristics. Members of each group are then selected at random in the same proportion as they occur in the population. For example, to choose 12 prefects in a school with 700 boys and 500 girls, we would choose 7 boys and 5 girl, that is, one students if chosen from every 100 students in each group.,

Example 4.2.2 A senate committee of 20 politicians is to be formed from members of the Labor and Liberal parties. The number of representatives from each party is to be the same proportion as the number of seats that each party holds in the senate. If Labor holds 64 seats and Liberal hold 44 seats, how many members of each party should be on the committee?

Solution: No. of Labor members = $\frac{64}{108} \times 20 = 11.9$;

No. of Liberal members = $\frac{44}{108} \times 20 = 8.1$

Therefore the committee should consist of 12 Labor members and 8 Liberal members.

Exercise 4.2.3

1. If 6000 computer chips are produced each day on a production line, find at what intervals the manufacturer should test the chip in a systematic sample of 120.

2. A high school has 250 boys and 150 girls. How many boys and girls should be chosen in a stratified sample of 48 students?

3. In a group of 2400 workers, 1400 are male and 1000 are female. A stratified sample of 60 workers is to be selected based on their gender. How many males and females should be selected?

4.2.5 The mean

The mean is what we typically think of as the average.

$$\text{Mean} = \frac{\text{sum of the scores}}{\text{number of scores}}$$

The definition of the mean can also be written using the Greek letter Σ :

$$\bar{x} = \frac{\Sigma x}{n}$$

where \bar{x} is the mean, Σx is the sum of the score, n is the number of scores.

Finding the mean from a frequency distribution table:

$$\bar{x} = \frac{\Sigma fx}{\Sigma f}$$

where \bar{x} is the mean, Σfx is the sum of the score, Σf is the number of score.

Exercise 4.2.4 Complete each frequency distribution table, then find the mean, correct to 2 decimal places.

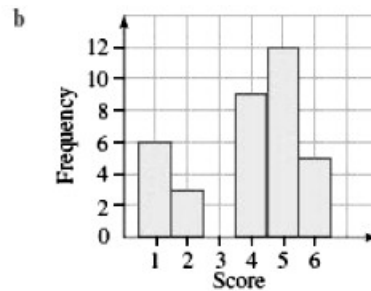
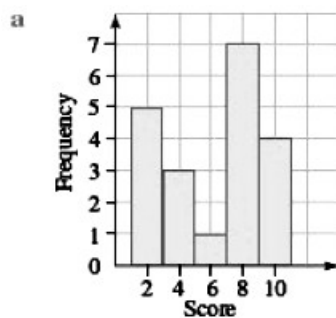
a

Score (x)	Frequency (f)	fx
1	4	
2	1	
3	6	
4	2	
5	7	
	$\Sigma f =$	$\Sigma fx =$

b

Score (x)	Frequency (f)	fx
15	3	
16	4	
17	7	
18	5	
19	2	
	$\Sigma f =$	$\Sigma fx =$

Exercise 4.2.5 For each of these histograms find the mean correct to 2 decimal places:



4.2.6 The median

If a set of scores have been arranged in ascending order:

- the median is the the middle score if there are an odd number of scores
- the median is the average of the two middle scores if there are an even number of scores

When a set of n scores have been arranged in a ascending order, the median is:

- the $(\frac{n+1}{2})$ the score in n is odd
- the average of the $(\frac{n}{2})$ and the $(\frac{n}{2} + 1)$ the scores if n is even.

Example 4.2.3 Find the median of each set of scores.

1. 3, 5, 7, 8, 10, 12, 13.

There are an odd number of scores and 8 is the middle score. Therefore, the median is 8.

2. 2, 4, 5, 6, 8, 10, 13, 15.

There are an even number of scores and the two middle scores are 6 and 8.

Therefore the median = $\frac{6+8}{2} = 7$

Exercise 4.2.6 Rearrange these scores in ascending order, then find the median.

1. 8, 12, 15, 29, 32, 18 _____

2. 13, 5, 8, 20, 17 _____

3. 37.5, 42.7, 24.9, 45.3, 21.4, 18.2 _____

4. 11.2, 19.4, 14.6, 16.7, 18.5 _____

Exercise 4.2.7 How many scores are there in a distribution:

1. If the number of scores is even and the median lies in the 36th and 37th scores? _____

2. If the number of scores is even and the median lies in the 71th and 72th scores? _____

3. If the number of scores is odd and the median lies in the 39th position? _____

4. If the number of scores is odd and the median lies in the 93rd position? _____

4.2.7 The mode and the range

- The **mode** is the score with the highest frequency.
- The **range** is the difference between the highest and lowest scores.

Example 4.2.4 Find the mode and range for each set of scores given below:

1. 2, 3, 4, 5, 5, 5, 6, 8, 9, 10

The score of 5 occurs three times, therefore the mode is 5. The range is $10 - 2 = 8$.

2. 1, 2, 3, 4, 4, 5, 5, 6

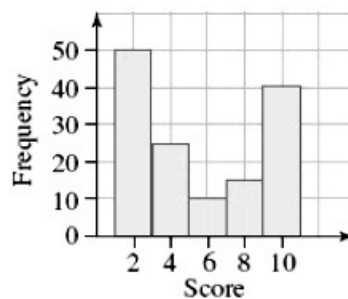
The score of 4 and 5 are both occur twice, which more more than the other scores, therefore the modes are 4 and 5. The range is $6 - 1 = 5$.

3. 34, 36, 45, 53, 66, 68, 80, 83, 92

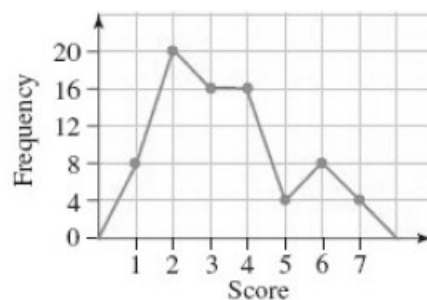
Each score occurs once only, therefore there is no mode. The range is $92 - 34 = 58$.

Exercise 4.2.8 Find the mode and range for each set of scores:

1. mode _____ , range _____



2. mode _____ , range _____



4.3 Miscellaneous Exercises

Exercise 4.3.1 In general, to represent a well-defined populations with n elements, a sample of \sqrt{n} should be taken. This rule of thumb is best applied only to large populations. The larger the population, the better the sample should reflect its overall characteristics. Use this estimate of sample size to answer the following question:

1. What is the minimum number of people who should be surveyed to gather information from the following populations? (answer to nearest 10 people)

(a) 500 _____

(b) 9000 _____

(c) 120,000 _____

2. A sample of 150 people was selected at random from a local community. The people were then surveyed to find the community's view on the need to have a new park. How many people probably live in the area being surveyed? (answer to nearest 100 people).

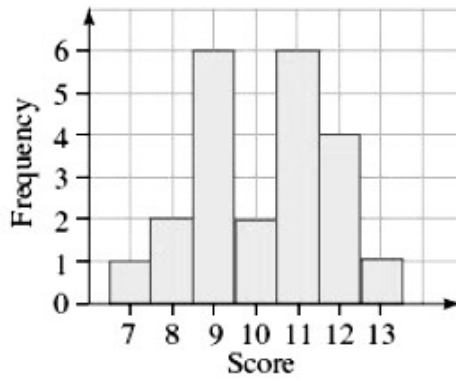
3. If the population of Australia is approximately 21 million, find the minimum number of people who should be surveyed in order to predict the winner of an upcoming federal election. (answer to the nearest 1000 people)

Exercise 4.3.2 A bag contains 81 black marbles and a number of white marbles. Steven chose 30 marbles from the bag without replacement, of which 12 were white. How many marbles were originally in the bag?

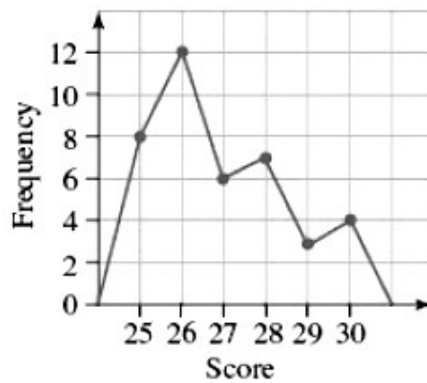
Exercise 4.3.3 The mean of 4 consecutive scores is 18.5. Form an equation and solve it to find the scores.

Exercise 4.3.4 Determine the median score and the mode in each of these.

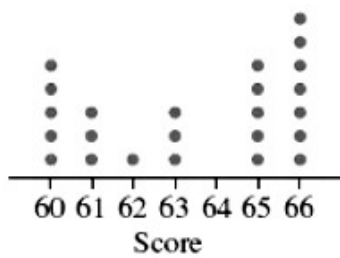
1. median score = _____ , mode = _____



2. median score = _____ , , mode = _____ ,



3. median score = _____ , , mode = _____ ,



Exercise 4.3.5 The table shown below is the population by age group and states of 2001 Census.

Age	NSW	Vic	Qld	SA	Tas	WA	NT	ACT	Australia
0-4	422 341	299 615	242 551	85 529	30 288	122 709	16 386	20 331	1 243 969
5-9	445 983	321 899	260 954	98 229	33 101	132 617	17 047	21 755	1 331 926
10-14	445 026	322 199	259 037	99 350	34 146	137 350	15 712	23 491	1 336 580
15-19	436 626	321 749	257 542	101 047	33 162	136 279	14 236	24 489	1 325 264
20-24	408 719	311 394	237 693	90 895	27 010	123 993	15 867	25 367	1 241 082
25-29	446 515	330 550	249 680	94 318	27 319	127 795	18 237	24 372	1 318 957
30-34	468 524	359 032	260 782	104 332	30 819	137 773	18 347	24 410	1 404 231
35-39	483 003	356 242	266 472	109 556	33 079	141 556	17 121	24 353	1 431 633
40-44	482 318	354 121	269 088	112 652	35 522	142 854	15 624	24 229	1 436 655
45-49	438 277	323 802	249 292	104 518	32 992	133 403	14 147	23 167	1 319 847
50-54	412 967	302 966	240 946	101 153	31 224	123 976	12 960	22 101	1 248 485
55-59	325 330	233 192	192 395	78 307	24 530	92 203	9 533	15 123	970 735
60-64	267 064	189 744	156 102	63 593	20 371	74 824	6 896	10 321	789 007
65-69	228 029	160 191	128 255	54 754	16 901	60 406	4 376	7 626	660 587
70-74	217 237	151 626	117 297	54 489	15 691	53 538	3 056	6 625	619 583
75-79	177 684	125 015	93 338	46 591	13 170	41 646	1 644	5 560	504 654
80-84	114 764	80 238	58 964	30 541	8 506	26 127	849	3 362	323 365
85+	90 761	68 522	45 251	24 988	7 010	22 959	691	2 502	262 689
Total	6 311 168	4 612 097	3 585 639	1 454 842	454 841	1 832 008	202 729	309 184	18 769 249

Source: Australian Bureau of Statistics, 2001 Census.

Note: Figures exclude overseas visitors.

1. What percentage of the Australian population lived in New South Wales in 2001? (correct to 1 decimal place)

2. In 2001, what percentage of the New South Wales population was under 20 years old?

3. Which State had the lowest percentage of its population aged 80 years and over?

4. In which class does the median fall for:

(a) New South Wales? _____

(b) Northern Territory? _____

(c) Victoria? _____

4.4 Math challenge

Exercise 4.4.1

1. A large container is one-third full of rice. 20 kg is added and this makes it half full. How many more kilograms of rice are needed to fill the container?

2. I walk at 4 km/h and run at 6 km/h. I find I can save 3 minutes and 45 seconds by running instead of walking to school in the mornings. How far do I live from school?

3. Alice is waiting for a bus that will arrive at 8:30. When she looked at her watch it was 8:12. When she looked at her watch a short while later, the minute hand had turned 72° . How many more seconds does Alice have to wait for the bus?

4. This bank machine has four rows of buttons. Sam has a 4-digit number that uses one button from each row. How many different possible bank numbers are there?



Exercise 4.4.2

1. Find the value of $\frac{p-q}{q}$ given that $\frac{p}{q} = \frac{1}{3}$.

2. Solve the equation $\frac{x+4}{3} - \frac{3-x}{2} = 4$.

3. A rocket is fired by mistake. It has an average speed of 60 km/min. When the mistake is realised, a second rocket is fired 5 minutes later with a speed of 90 km/min to destroy the first rocket.

(a) Find the time taken by the second rocket to reach the first rocket.

(b) Find the distance the rockets had travelled before destruction occurs?

4. The integer N is the square of a square and has 18 as a factor. What is the smallest value of $\frac{N}{18}$?
