Name: ……..

Year Level: …… Date: …….

STATISTICS FORM C

Assessment Booklet

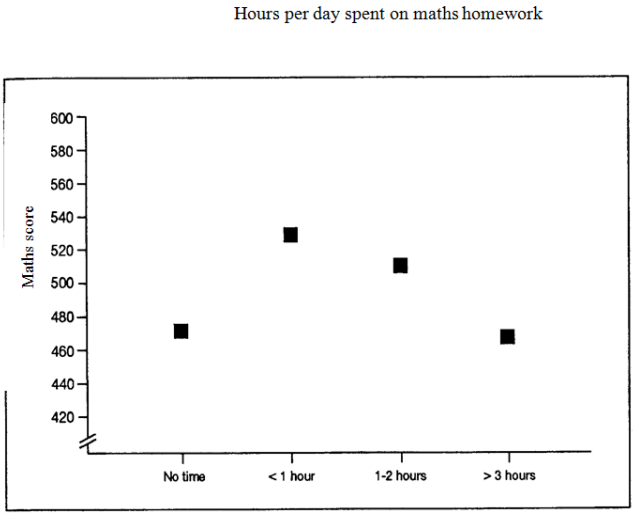
Reframing Mathematical Futures II

An Australian Mathematics & Science Partnership Project (2015-2018)

STATISTICS FORM C

1 Maths Graph

A survey of grades 7 and 8 students produced the information shown in the graph below. It shows the students' maths scores and the amount of time they spent on maths homework each day.



a [SHWKA]

What is the maths score for students who spend 1-2 hours per day on mathematics homework?

b [SHWKB]

What does the graph tell you about maths homework time and maths scores?

c [SHWKC]

Gives some reasons why the graph has the shape it does?

2 Movieworld

a [SMV11]

A class wanted to raise money for their school trip to Movieworld. They could raise money by selling raffle tickets for a Nintendo Game system.

Before they decided to have a raffle they wanted to estimate how many students in the whole school would buy a ticket. They decided to do a survey to find out first.

The school has 600 students in grades 1 – 6 with 100 students in each grade.

Shannon got the names of all 600 students in the school and put them in a hat. Then she pulled out 60 names.

What do you think of Shannon's survey? Explain your answer.

b [SMV12]

Jake asked 10 students at an after-school meeting of the computer games club.

What do you think of Jake's survey? Explain your answer.

c [SMV13]

Claire set up a booth outside the tuck shop. Anyone who wanted to stop and fill out a survey could. She stopped collecting surveys when she got 60 kids to complete them.

What do you think of Claire's survey? Explain your answer.

3 Sample

[SSAMP]

What does "sample" mean?

4 Getting out of bed

a [SFENG]

Consider a newspaper headline:

> **Left is the right way to exit bed**
> Feng shui expert Jan Cisek said getting out of the bed on the left was associated with all that people held dear – family and health, money and power…

Explain what you think of this claim.

b **[SPSYC]**

Also in the same article:

> **Left is the right way to exit bed**
> …Psychologist Pete Cohen said that getting out of bed on the left side helped us to think rationally about the day ahead.

Explain what you think of this claim.

5 Hospitals

[SHOSP]

A town has two hospitals. In the West hospital on one day 45 babies are born. In the East hospital 15 babies are born. In which hospital are there likely to be more than 60% boys born or is the chance the same? Explain why.

6 Rash

[SRASH]

A bottle of medicine has printed on it:

> ***WARNING: For applications to skin areas there is a 15% chance of getting a rash. If you get a rash, consult your doctor.***

What does this mean?

(A) Don't use the medicine on your skin - there's a good chance of getting a rash.

(B) For application to the skin, apply only 15% of the recommended dose.

(C) If you get a rash, it will probably involve only 15% of the skin.

(D) About 15 out of every 100 people who use this medicine get a rash.

(E) There is hardly any chance of getting a rash using this medicine.

Explain your reasoning

7 Hats

[SHAT8]

A mathematics class has 13 boys and 16 girls in it. Each pupil's name is written on a piece of paper. All the names are put in a hat. The teacher picks out one name without looking. Tick the box to show which outcome is more likely

☐ the name is a boy or

☐ the name is a girl or

☐ the name could be a boy or a girl

Please explain your answer using as much mathematics as you can.

STATISTICS FORM C RUBRIC

1. SHWKA

SCORE	DESCRIPTION
0	No response or irrelevant response
1	Correct (500-520)

SHWKB

SCORE	DESCRIPTION
0	No response or irrelevant response
1	Describes what the graph is about (e.g., *It shows the total maths scores / total homework time*) or draws an incorrect conclusion (e.g., *More homework you do the better your scores*), does not recognise the association between variables
2	Appreciates association between variables but conclusion limited to specific observations only (e.g., *Those who did 1 hour got the highest scores*) or assumes causation (e.g., *That it is best to do 1 hour of homework*)
3	Appreciates association between variables and draws more general implications and conclusions from the data (e.g., *If you overload yourself with math homework then your grade will drop but 1 hour a night achieves better results*) and/or acknowledges chance in some way (e.g., *You are more likely to get good grades if you do an hour; Doing 3 hours can be just as bad as doing 1 hour)*

SHWKC

SCORE	DESCRIPTION
0	No response or irrelevant response
1	Little/no hypothesis evident (e.g., *because it shows how the scores go up and down*), may refer to the information in the graph (e.g., *The people that studied 1 hour got the highest mark, those that did not study or did too much got a lower mark*)
2	Creates a hypothesis from the graph based on student abilities or other possible contributing factors (e.g., *because the people who studies for 3 hours maybe over studied and forgot the main information so they got a lower score; The struggling students take more time to do their homework*)

2. SMV11

SCORE	DESCRIPTION
0	No response or irrelevant
1	Inappropriate criticisms focusing on being too random, inaccurate, small sample size, fairness and methodology (e.g., *Not sure, because they could all be in the same grade, Bad, because it wouldn't give an accurate answer, Bad, because it is not really a big enough sample size, Not sure, because it wasn't fair for the rest of the kids, Bad, because it's too time consuming*)
2	Appropriate, non-central appraisals focusing on fairness, sample size and methodology (e.g., *Good, that is a fair way of doing it, Good, 60 is not too many people or too less, Good, it would not take too long*)
3	Appropriate statistical appraisal focusing on random and range (e.g., *Good, because he/she is picking them out randomly, Good, she can get a whole range of students*)

SMV12

SCORE	DESCRIPTION
0	No response or irrelevant response
1	Inappropriate appraisals focusing on creating bias (e.g., *Good, he picked people who would be interested*), sample size (e.g., *Good, he didn't ask so many people*), or methodology and implications (e.g., *Good, it was quick and easy and not taking too long*)
2	Appropriate criticisms, focusing on sample size (e.g., *Bad, wasn't enough people*) or non-representativeness (e.g., *Bad, because most of them would say the same thing*) OR Statistical uncertainty focusing on appropriate criticisms (e.g., *Not sure, because not many different people would go there*) OR Appropriate, non-central criticisms focusing on fairness, methodology and implications (e.g., *Bad, because not everyone has got a chance*)
3	Appropriate and fully integrated criticism focusing on sample size and non-representativeness (e.g., *Bad, because he got an opinion from a small group of people with the same interests; Bad, not enough people and they're game fanatics*)

SMV13

SCORE	DESCRIPTION
0	No response or irrelevant response
1	Inappropriate appraisals focusing on the assumption of range and variation, fairness, free choice and/or methodology (e.g., *Good, she should have a range; Good, because everyone gets a chance*) OR inappropriate criticism focusing on sample size (e.g., *Bad, she could probably get more people*)
2	Statistical uncertainty focusing on appropriate criticisms (e.g., *Not sure, cause only people who could be bothered did it*) OR Appropriate, non-central appraisals focusing on sample size (e.g., *Good, that is a good number of people*)
3	Appropriate criticism focusing on range, variation and overall non-representativeness (e.g., *Bad, they could all be in the one grade or the same sex; Bad, not everyone goes to the tuckshop*)

3. SSAMP

SCORE	DESCRIPTION
0	No response or irrelevant response
1	Single idea (refers to a part or a test, not both) (e.g., *It means a little amount*) or provides an example only (e.g., *Getting a sample of water*)
2	Refers to a small part, not all (e.g., *You have a small piece of something; To take a portion of something*)
3	Refers to small part representing a whole and purpose (e.g., *To take something out of something bigger to test; To take a part of something and look into it*)

4. SFENG

SCORE	DESCRIPTION
0	No response or irrelevant response
1	Agree / Disagree with superficial reason
2	Psychology – it might if people believe it will and the belief influences their behaviour OR Evidence – what evidence does the expert have for this conclusion – data?
3	Compare and contrast psychological and evidence issues for both suggestions – combination of two or more ideas

SPSYC

SCORE	DESCRIPTION
0	No response or irrelevant response
1	Agree / Disagree with superficial reason
2	Psychology – it might if people believe it will and the belief influences their behaviour OR Evidence – what evidence does the expert have for this conclusion – data? (e.g., *If you believe this claim it might help as you think it helps but you're really helping yourself*)
3	Compare and contrast psychological and evidence issues for both suggestions – combination of two or more ideas

5. SHOSP

SCORE	DESCRIPTION
0	No response or irrelevant response
1	Incorrect (West or the Same), conclusion based on size (e.g., *It is higher in the West hospital because more than double the babies are born in the West than East hospital*) OR *Same chance because there is a 50% chance no matter how many babies are born, The chance is the same because they both could get more than 60% boys born)*
2	Correct (East) with general descriptive statement (e.g., *Smaller samples have more variation*)
3	Correct (East) supported by analysis that assumes long-term average of 50% boys at each site, that is, 7 or 8 boys per day at East and 22 or 23 boys per day at West. 60% of 15 is 9; 60% of 45 is 27 – assuming 7 boys/day at East, it only requires 3 more boys to be > 9 but at West, assuming 22 boys/day, it would take 6 more boys to be > 27

6. SRASH

SCORE	DESCRIPTION
0	No response or clearly incorrect, that is, B OR C or multiple selections excluding A, D and E
1	Indicates some understanding of chance expressed as a percentage, that is, either E or A , supported by reasonable explanation (e.g., *E because 15 out of 100 is quite small*, or *A because you don't want to get a skin rash and 15% is quite a high chance*)
2	Correct (D) supported by a reasoning that refers to sample in some way (e.g., *15% of all the people who used this got a rash*). May choose D & A or D & E

7. SHAT8

SCORE	DESCRIPTION
0	No response or irrelevant response
1	Incorrect, little/no reasoning (e.g., it's just luck)
2	Incorrect (*e.g., name is a boy or girl*) but reasoning that recognises variation in some way (e.g., depends on mix, same chance, could be anything)
3	Correct (name is a girl) with either no explanation or explanation does not reference total (e.g., 16 is bigger than 13)
4	Correct, fraction included in explanation (e.g., 16/29 chance)

STUDENT SCORE SHEET STATISTICS FORM C

Student Name:	Year Level:

		Score	Comments
1	SHWKA		
	SHWKB		
	SHWKC		
2	SMV11		
	SMV12		
	SMV13		
3	SSAMP		
4	SFENG		
	SPSYCH		
5	SHOSP		
6	SRASH		
7	SHAT8		
Total Raw Score			

RAW SCORE TRANSLATOR FOR STATISTICS FORM C

The following table locates students on the **Learning Progression for Statistical Reasoning** based on their total score for Statistics Form C. Total scores are obtained by adding the rubric scores assigned to each item on the form. Where a total score is very close to the beginning or end of a score range, teachers are advised to use their knowledge of the student to make a decision about the most appropriate Zone.

Students need to have had an opportunity to attempt all tasks for this process to be meaningful.

Total Score	Zone	Zone Description
29-33	8	Recognises variability relative to context using proportional reasoning to support arguments. Can recognise, coordinate, and integrate all relevant information to make evidence-based decisions using proportional reasoning and relevant context. Applies ideas about central tendency to justify explanations and decisions and is able to make appropriate statistical critiques of sampling using size, method, range, representativeness in justification. Recognises equal chance and interprets chance situations mathematically rather than offering an opinion.
20-28	7	Recognises and describes the spread of data explicitly in a statistical sense using statistically important information and not just a visual image. Recognises variation appropriately including ideas of fairness, equality of outcomes, and distribution as appropriate. Uses all available data to justify decisions or evaluations statistically. Makes reasonable sampling decisions that recognise the importance of randomness and critiques inappropriate non-representative and/or non-random samples. Uses data to justify responses and recognises limitations but may still revert to offering an opinion based on individual beliefs. Recognises variability relative to context and the nature of a distribution to provide a realistic solution.
18-19	6	Interprets and describes the association between two variables and considers the implication in visual contexts. Beginning to work with the association between two variables in a non-graphical format. Constructs reasonable arguments based on an understanding of chance and probability and context. Provides a sensible critique of sampling in relation to method and sample size but is implicit rather than explicit about randomness. Uses measures of central tendency to justify a closed response.
16-17	5	Provides a statistical explanation, but this may be incomplete, and can recognise important information in making comparisons. Intuitively suggests association expressed in non-quantitative ways

		and recognises equal likelihood. Recognises appropriate sample size and provides appropriate critiques of sampling method but does not explicitly include randomness. Recognises simple proportion in chance contexts and orders language of chance qualitatively. Recognises relevant aspects of graphical representation and uses these to reason statistically but may not include all aspects. Recognises key aspects of central tendency but reverts to non-statistical justifications. Implicitly recognises that all combinations of numbers have the same chance of appearing when randomly sampled from a grid with no replacement.
10-15	4	Compares data in two graphs but focuses on single elements only. Can associate two variables with a single value and provides descriptive explanations. Recognises variability and expectation in more complex random situations but explanation refers to uncertainty in general terms and is not quantified or is based on strict probability (expectation). May not recognise the importance of equal likelihood. Recognises relative order in the language of uncertainty but does not appreciate some subtleties. Reasons quantitatively in familiar situations involving related comparisons and in the context of uncertainty. Relies on additive thinking in situations involving measures of central tendency, and is unlikely to question the quality of data. Critiques sampling approaches using single aspects only (i.e., size or method) in an evaluative situation. Falls back on personal beliefs in more complex situations when asked for an explanation.
6-9	3	Recognises expectation but interprets this in terms of strict probability or based on a visual representation. Recognises variation but in graphing situations may explain this based only on visual representation rather than quantitative reasoning. Applies ideas of variation drawing on expectation but only in familiar contexts such as coin flips. Recognises expectation in statistical situations (e.g. value of mean/median) but explanations are limited. Reasons quantitatively using direct comparison but relies on additive thinking (e.g., not recognising proportion. In more complex inference tasks or less familiar contexts, draws on opinion rather than data or retreats to “luck” as an explanation in more complex situations.
4-5	2	Uses reasoning that recognises variation in some way but may not appreciate expectation (chance). Uses the language of 50% or 50:50 but does not appreciate the meaning. Reads information from simple graphs using x and y axes, and can describe what the graph is about but may not recognise association between variables. Is familiar with simple chance experiments but is unable to reason quantitatively and is likely to rely on personal beliefs rather than the data when explaining an outcome (e.g., it’s the way you roll the die). Recognises one aspect of sampling, such as size or method, in a

		familiar context but does not coordinate these ideas to provide a random and representative sample.
1-3	1	Reads a single value from a simple graph on either the x or y axis but does not look at axes values simultaneously. Tends to focus on the highest values unless directed. Variation is considered visually but not otherwise recognised. Is familiar with standard simple probabilistic/chance situations (e.g., dice, coins) but uses these at a superficial level. Can give real world examples of variation (e.g., weather).