

# 3

91584



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## Level 3 Mathematics and Statistics (Statistics), 2016

### 91584 Evaluate statistically based reports

2.00 p.m. Thursday 24 November 2016  
Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Evaluate statistically based reports.	Evaluate statistically based reports, with justification.	Evaluate statistically based reports, with statistical insight.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

**You should attempt ALL the questions in this booklet.**

Pull out Resource Booklet 91584R from the centre of this booklet.

Show ALL working.

Make sure that you have the Formulae and Tables Booklet L3–STATF.

If you need more room for any answer, use the space provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–8 in the correct order and that none of these pages is blank.

**YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.**

**Excellence**

**TOTAL**

**19**

ASSESSOR'S USE ONLY

**QUESTION ONE**

Refer to **Report 1** in the resource booklet to answer the following questions.

- (a) Identify and describe the explanatory and response variables for the study.

The explanatory variable is price discounts on healthy food  
The response variable is the change in the amount of  
healthier food purchased by people.

- (b) The report claims that “price discounts are more effective than nutrition education in encouraging people to buy healthier foods”.

Explain whether this study is an observational study or an experiment, and the implications of this for this claim.

This is an experiment as controlled treatment was randomly allocated to people. There was a control test of the amount of healthy food initially purchased to measure the change and take account of the trends before treatment was administered. Experimental studies can make causal claims as they control other variables that may have an effect on the response variable. Therefore the claim that price discounts are more effective than nutrition education in encouraging people to buy healthier foods can be made  $0.28 \text{ kg} > -0.51 \text{ kg}$  so discounts is more ~~effective~~ effective.

- (c) Explain why random allocation was used to form the two groups compared in the study.

As part of your explanation, give specific examples related to the study discussed.

Random allocation was used to account for sampling error. The two groups were randomly allocated to represent the population as there would be no bias to

- (d) A potential issue with a statistical study is extending the results inappropriately.

Discuss ONE potential issue with extending the results of this study.

The study only included those who use Pak'n'Save in the Lower North Island. It does not include those who use different supermarkets or those who live elsewhere, so it does not account for those people. Different supermarkets may have different people going to them which was not included in the study. These people could have a different view to discounts and nutrition education and will therefore will be different to the results given.

Cannot be extended as does not include the extended population.

## QUESTION TWO

Refer to **Reports 2a** and **2b** in the resource booklet to answer the following questions.

Report 2a is a media report that was based on the information provided in Report 2b.

- (a) The reported margin of error is 1.7%.
- (i) Show how this margin of error was calculated.

$$MOE = \frac{1}{\sqrt{n}} = \frac{1}{\sqrt{3451}} = 0.017 \quad n = 3451$$

$$= 1.7\%$$

- (ii) Explain why the margin of error should be included in statistical survey reports.

Margin of error accounts for sampling variability. As it is a sample it will not be the same as the true population proportion of the population and therefore this variation is accounted for by the margin of error.

- (b) The media report states that 59% of the survey respondents definitely or possibly favoured a reduction in the serving sizes of sugar drinks.

Construct a confidence interval using this percentage, and interpret this confidence interval.

$$MOE = 0.017 = 1.7\%$$

$$59 \pm 1.7 = (57.3\%, 60.7\%)$$

We can say with 95% confidence that the true proportion of the population that definitely or possibly favoured a reduction in serving sizes of sugar drinks is between 57.3% and 60.7%.

- (c) Discuss ONE potential issue with the design of the survey and/or questions.

The "Sugar in our diet" background provided facts about how much sugar we should consume. This could have a behavioural effect on people as they are shown what is correct about sugar and how we can be addicted and have health problems from sugar. This might influence the way they answer the survey questions.

- (d) The first paragraph of Report 2a is based on information and results from Report 2b, specifically the survey percentages for the first sugar consumption question headed "Limit sugar in drinks".

Discuss the quality of this paragraph.

$$MOE = 2 + 1.7 = 3.4$$

$$\begin{aligned} \text{Confidence interval} &= 77.2 \pm 3.4 \\ &= (73.8\%, 80.6\%) \end{aligned}$$

We can say with 95% confidence that the population that believes there should definitely or possibly be a limit of sugar in drinks is somewhere between 73.8% to 80.6%.

The claim cannot be made that this is more than 75% as the true population can go as low as 73.8%.

M5

**QUESTION THREE**

Refer to **Report 3** in the resource booklet to answer the following questions.

- (a) The report states the margins of error for the 2006 and 2008 surveys were 3.8% and 4.5% respectively.

Explain why the reported margins of error are different for the two surveys.

There were different sample sizes for the two surveys.  
This resulted in two different margins of error as it  
is dependent on the sample size.

- (b) A reader of this report has made the following statement to a friend: "A higher proportion of males in the 2008 survey parked in disability parks without a permit than females".

Evaluate what statistical evidence, if any, has been presented in the report to support this statement.

There is no statistical evidence backing this  
claim as it is believed that women are more considerate  
than men. This is not valid evidence as it is opinionated  
and therefore there is no evidence to support this claim.

- (c) Assume that the samples of cars/people obtained in 2006 and 2008 are representative of all cars/people in New Zealand in those years.

Can a claim be made that the percentage of New Zealand cars/people who used a disability park without displaying a current permit was lower in 2008 compared to 2006?

Construct ONE confidence interval, and interpret this interval as part of your answer.

$$MOE = (3.8 + 4.5) \div 2 = 4.15\% \times 1.5 = 6.225\%$$

$$\text{Confidence int} = 40 - 34 = 6\%$$

We can say with 95% confidence that the percentage difference of people who use a disability park without a permit from 2006 to 2008 was as low as  $-0.23\%$  to as high as  $12.23\%$ . Claim cannot be made that 2008 is lower than 2006 as the difference can be negative and therefore 2006 could be lower by  $0.23\%$  than 2008.

- (d) The heading for this report is "Higher fines discourage disability parking abuse".

Discuss ONE potential issue with the study design used for the 2008 survey, in respect to the heading for this report.

Was an observation so causal claim cannot be made about this.

Excellence exemplar 2016

Subject:	Mathematics	Standard:	91584	Total score:	19
Q	Grade score	Annotation			
1	E7	<p>1(a) Missing explanatory variable – not stated the receiving of nutritional information</p> <p>1(b) Identifies experiment with reason.</p> <p>1(c) Does not identify a reason to randomly allocate</p> <p>1(d) identifies issue and that the study cannot be extended to other supermarkets outside lower North Island. Links contextually to the two groups and viewpoints of others outside of the study.</p>			
2	M5	<p>2(a)(ii) Sampling variability stated</p> <p>2(b) CI constructed and linked back to the population for an inference</p> <p>2(c) Identifies background information preceding the survey questions influencing respondents.</p> <p>2(d) Incorrect CI constructed. Links the two percentages in the report to 77.2% about limiting sugar.</p>			
3	E7	<p>3(a) Identifies link to sample size only.</p> <p>3(b) Does not identify the link to proportions and counts.</p> <p>3(c) Correct CI constructed. Interprets the CI to why the claim cannot be made with 12.23% and the -0.23% to indicate 2006 is higher.</p> <p>3(d) Does not link to the heading of the report to gain “j” grade as to why it is observational.</p>			