

# 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.**

**Merit**

**TOTAL**

**17**

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.

explanatory: whether the person was given a discount  
or education

response: amount of "healthier" food purchased by  
each shopper (in kg)

- (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.

observational study as there could be other confounding variables contributing to the amount of "healthier" food purchased e.g. change in income, seasonality of food (especially vegetables), price of "healthier" food due to the supermarket, not the experimental group.

because it is observational, a causal claim cannot be made, as confounding variables need to be considered.

- (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 minimise bias. This meant a random spread of income, education, and age across both groups. This meant that shoppers with higher incomes were not all in the group that received discounts, which would cause bias because they would be less likely to be influenced by discounts.

- (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 sampled 1104 shoppers at 8 Pak'n'Save supermarkets in the lower North Island. Pak'n'Save prides itself on low prices everyday, and their customers are those who are focussed on low prices. Extending the results doesn't represent the shoppers at other supermarkets who may prioritise quality over price, or have a higher income.

**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.

$$\text{MOE} = \frac{1}{\sqrt{n}} = \frac{1}{\sqrt{3451}}$$

$$= 0.017 = 1.7\%$$

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

To minimise sampling variability and to get the most accurate percentages of the population.

(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.

$$\text{Confidence interval} = 59\% \pm 1.7\% \text{ margin}$$

the confidence interval is between 57.3% and 60.7%

This means that we can be 95% sure that the percentage of the population of people who definitely or possibly favour a reduction is between 57.3% and 60.7%.

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

Interviewer effects: giving respondents the information about "sugar in our diet" before answering the question may have influenced the respondents answers. It may have changed some of the respondents initial thoughts and created a bias. They could of felt like they had to be anti-sugar after hearing the background.

- (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.

"A majority of Kiwi adults" is extending the results from a small sample of 3541 people. This wording makes it seem as if every Kiwi adult was surveyed, which is misleading. The paragraph does not mention the information that respondents were given before the survey and how that may have influenced results.

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.

Because of the differences in sample size.  
 The 2008 sample size is 500, giving a MOE of  $\frac{1}{\sqrt{500}} = 4.5\%$ . The 2006 sample size is not stated but would be  $\frac{1}{\sqrt{n}} = \frac{3.8}{100}$   $\frac{1}{0.038} = \sqrt{n}$   $\sqrt{n} = 26.3$   
 $\approx 693$  people/cars  $n = 692.52$

- (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.

The report states that "59% of those <sup>observed</sup> ~~surveyed~~ parking in a disability park without a permit are male". What the report doesn't state is the numbers of males and females in the sample, which would be needed to calculate this statement.

- (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.

$$\text{Average MOC} = 3.8 + 4.5 = 8.3 \div 2 = 16.6\%$$

$$\text{Perceived percentage difference} = 40 - 34 = 6\%$$

Confidence interval of percentage difference is between  
-10.6% and 22.6%

This claim cannot be made, as the confidence interval does not include 0, meaning there could have been up to an 10.6% increase from 2006 to 2008, which is not a decrease as the claim claims.

- (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.

There may have been other confounding variables contributing to why the number of people/cars using a disability space without a permit had decreased which the report does not consider, as it makes a causal claim, which cannot be guaranteed to be accurate as it is an observational study.

**Merit exemplar 2016**

<b>Subject:</b>	<b>Mathematics</b>	<b>Standard:</b>	<b>91584</b>	<b>Total score:</b>	<b>17</b>
<b>Q</b>	<b>Grade score</b>	<b>Annotation</b>			
1	E7	<p>1(c) Identifies as a feature to reduce bias to create two balanced groups. Only identifies issue with one group.</p> <p>1(d) Describes an issue of the study with a contextual example to why the study cannot extend the results</p>			
2	M5	<p>2(a)(ii) Does not identify the concept of sampling variability across samples taken of the same size</p> <p>2(b) CI calculated and links to making an inference back to the population</p> <p>2(c) Identifies an issue with information given prior to the questions. This could lead to influencing the respondents' answers. No example given to illustrate this influence from the report to provide contextual information.</p> <p>2(d) No link to combine the two % in the report and table</p>			
3	M5	<p>1(a) Links MOE to sample size. Implies <math>n_{2006} &gt; n_{2008}</math></p> <p>1(b) Identifies that the count of males and females is required. Does not illustrate why it is necessary so that statistical evidence could agree or refute the claim made</p> <p>3(c) The MOE is incorrect</p> <p>3(d) Identifies the study as observational and a causal claim cannot be made. No contextual example is given for confounding variables</p>			