Assessment Schedule – 2016

Mathematics and Statistics (Statistics): Evaluate statistically based reports (91584)

Evidence Statement

One	Expected Coverage	Achievement (c)	Merit (j)	Excellence (i)
(a)	The explanatory variable is whether a shopper received price discounts of 12.5 per cent on healthier foods for six months, or whether a shopper received nutrition education for six months. The response variable is the change in the amount of healthier food purchased by each shopper in kg per week at the end of the six month period.	The explanatory variable (need both). AND The response variable are described.		
(b)	This study is an experiment because the shoppers were placed into one of two groups, and then had different treatments applied to them (discounts vs education). This means that the results of the experiment could be used to support the claim that price discounts are more effective than nutrition education in encouraging people to buy healthier foods (with appropriate statistical evidence).	Study is identified as being an experiment with explanation (may not be contextual). OR Explains claim can be made because the study is an experiment.	Study is identified as being an experiment (using a specific contextual example as part of the explanation). AND Explains claim could be made because the study is an experiment.	
(c)	Random allocation was used as part of the design of the experiment to attempt to create two unbiased (fair or balanced) groups for comparison. Since each shopper will already have their own habits and attitudes towards buying food, including possibly having had nutrition education previously or preferring healthier food already, it is important that each group has similar numbers of these shoppers to reduce bias.	Comments on the use of random allocation as a good design feature of an experiment. Note: No bias only = ns	Explains how random allocation is used to reduce bias or to create two fair or balanced groups, since not all factors that could affect the purchase of food can be controlled.	Explains why random allocation is used in an experiment. AND Gives one example of a potential bias.

(d)	Potential issues with extending the results: • The classification of "healthier" foods was based on the National Heart Foundation's "Tick" criteria. This makes it difficult to transfer findings to other countries who may not consider the same foods being classified "healthier". • The response variable is a relative measure of "healthier", and is based on NZ foods. This makes it difficult to transfer the findings to other countries where different kinds of foods are available. • The study was only done with PAK'nSAVE shoppers, and shoppers at this supermarket are likely to be budget conscious and so could be more easily influenced by price discounts than shoppers at other supermarkets. This limits transferring findings to shoppers from other supermarkets. *Accept other valid potential uses with transferring findings.* e.g. Regional findings applied to other regions. (NZ or Global)	Identifies a feature of the study or report that could cause a potential issue in **extending the results.** *Note:* *'ns' – using past… or Confounding variables.*	Describes a potential issue with extending the results. AND Attempts to explain why it could limit extending the results.	Describes a potential issue with extending the results. AND Describes why it could limit extending the results by using specific features of the report / study.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	Attempt at one part of the question.	1 of c	2 of c	3 of c	2 of j	3 of j	1 of i	2 of i

Two	Expected Coverage	Achievement (c)	Merit (j)	Excellence (i)
(a)(i)	Margin of error is approx $\frac{1}{\sqrt{n}} = \frac{1}{\sqrt{3451}}$	Demonstration of how the margin of error is calculated.		
(a)(ii)	The margin of error is needed to take into account the variation in survey percentages due to sampling.	Its use for interpreting survey percentages is explained.		
(b)	Margin of error = 1.7% CI = 59% ± 1.7% [57.3%, 60.7%] I'm pretty sure that the percentage of adult New Zealanders who, at the time of the survey, definitely or possibly favoured a reduction in the serving sizes of sugar drinks is somewhere between 57.3% and 60.7%. There is evidence to support a claim that the majority of adult New Zealanders, at the time of the survey, supported a reduction in the serving sizes of sugar drinks , as lower limit of CI > 50%. *Accept other expressions of some uncertainty with the confidence interval provided such as "It's a fairly safe bet…" or "With 95% confidence…"* *95% certain → illustrates uncertainty*	Confidence interval **correctly** calculated.	Confidence interval **correctly** calculated. AND EITHER Used to write inference statement in context (with target population). OR Used to make a majority claim in context. *Note: 'respondents' → ns for inference.*	
(c)	Potential issues: Respondents were given information about sugar consumption before being asked questions. Most of the information paints a negative picture about sugar in our diets, which is likely to prime respondents to view sugar negatively when answering the survey questions about consumption. However, the information does not contain information about the benefits of taxing sugar. This could explain the high positive responses to the first question provided but not the second question. The last day respondents of this survey could have been influenced by the report released on mortality rates impact with a fizzy drink tax. *Accept other valid potential issues with study design.* e.g. Release of the mortality survey results on the last day → tax on sugar drinks and benefits on death ↓.	Identifies a feature of the study or report that could cause a potential issue.	Describes a potential issue with the design of the survey. AND Attempts to explain how it could affect responses. **General justification.**	Describes a potential issue with the design of the survey. AND Describes how it could affect responses using specific features of the report / study. **Specific contextual knowledge.**

(d)	The statement appears to be based on the result in Report 2b that 77.2% of respondents supported limiting sugar in drinks. Since this survey percentage (77.2%) is outside the range within which we would use the reported margin of error, the actual MOE would be smaller than the reported MOE. Taking this into account, the lower limit of an approximate 95% confidence interval would be above 50% (or > 75%). E.g. Lower limit of CI = 77.2% – 1.7% = 75.5% As the results were post-weighted to make the sample representative of all New Zealanders, a majority claim can be made for limiting sugar in drinks in general. Note: The question asked (shown in Report 2b) does not limit the drinks to only those "fed to us by the soft-drink industry", and sugar is also found in milk drinks like Primo or Up and Go.	Identifies the relevant survey percentages. AND Links the statement to the survey question concerning limiting sugar in drinks. Note: If only identifies 'soft drink' in 1st paragraph then maximum grade is a 'c'.	Identifies the relevant survey percentages and links the statement to the survey question concerning limiting sugar in drinks. AND Explains how a majority claim can be made for limiting sugar in drinks **in general** using the reported MOE. CI calculated and lower limit of CI is discussed.	Links the statement to the survey question concerning limiting sugar in drinks. **AND** Discusses how a majority claim can be made for limiting sugar in drinks **in general**, making reference to the difference between the actual MOE and the reported MOE, **(e.g. ROT)** and a representative sample.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	Attempt at one part of the question.	1 of c	2 of c	3 of c	2 of j	3 of j	1 of i	2 of i

Three	Expected Coverage	Achievement (c)	Merit (j)	Excellence (i)
(a)	The margin of error is based on sample size, so the 2006 survey involved more cars / people, as the margin of error is smaller than the one for 2008. Sample size calculated for both, approx: 2006 $\frac{1}{\sqrt{n}} = 0.038 \rightarrow n = 693$ 2008 $\frac{1}{\sqrt{n}} = 0.045 \rightarrow n = 494$ So sample sizes are different, $n_{2006} > n_{2008}$.	Indicates that the size of the sample affects the size of the MoE.	Identifies and justifies that the MOE is based on sample size AND therefore $n_{2006} > n_{2008}$. OR Sample size calculated for both AND $n_{2006} > n_{2008}$	
(b)	The reader has made a statement based on the proportion of people who parked in disability parks without a permit who were male being 59%. However, this is not necessarily the same as the proportion of males who parked in disability parks without a permit. Without knowing how many males were in the survey, a statement can not be made about whether there was a higher **proportion** of males who abused parks.	Identifies the reader statement is about counts, but the evidence provided in the report is about proportions. [Proportion vs Counts.]	Identifies the reader statement is about counts, but the evidence provided in the report is about proportions. AND Explains why the statement can not be made without further information.	
(c)	Average margin of error = $\frac{3.8\% + 4.5\%}{2} = 4.15\%$ Comparing two independent groups, so margin of error for comparison $= 1.5 \times 4.15\% = 6.225\%$. The difference between the two survey percentages is 34% – 40% = –6%. An approximate 95% confidence interval for the difference between the two percentages is: (–12.2%, 0.2%) [or [–0.2%, 12.2%]]. I'm pretty sure that the percentage of New Zealand cars / people who used a mobility park without displaying a current permit in 2008 was somewhere between 12.2% lower and 0.2% higher than the corresponding percentage of New Zealand cars / people in 2006. **N.B. [Matches the CI constructed.]** This confidence interval does not support a claim that the percentage of NZ cars / people who used a mobility park without displaying a current permit was lower in 2008 compared to 2006, because the confidence interval is not entirely negative [or not entirely positive or zero is within the CI].	The margin of error for comparing two independent groups is calculated e.g. 6.225%.	The confidence interval for the difference between the two percentages is constructed.	The confidence interval for the difference between the two percentages is constructed. AND Is interpreted as part of the explanation as to whether the claim can be supported or not. OR MoE > Difference % of groups. AND Is interpreted as part of the explanation as to why the claim cannot be supported.

(d)	Potential issues with study design: • The heading implies a causal claim – that the higher fines are what lowered the disability parking abuse. However, this survey is a type of observational study, not an experiment, and so other factors that could also influence a change in parking behaviours have not been taken into account, which means the effect of the higher fines can not be isolated. • The heading implies that the change in mobility parking abuse has happened across all NZ mobility parks. However, about 40 mobility parks near ATMs, council offices and supermarkets were targeted, which could lead to selection bias as the location of these parks were not randomly selected from all the disability parks available in NZ. The behaviour of drivers for these mobility parks could be different from mobility parks in general, leading to biased data.	Identifies a potential issue with the study design **in respect to the heading**. E.g. observational study as no variables were altered over the observational period. Change is implied to **ALL** disabled parking spaces.	Identifies a potential issue with the study design **in respect to the heading.** AND A causal claim cannot be made. Selection bias is identified and justified.	Identifies a potential issue with the study design in respect to the heading. AND Discusses why it is a potential issue by combining features of the report and statistical knowledge. E.g. Confounding variables: other factors identified influencing parking habits of drivers or use of disabled parking spaces.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	Attempt at one part of the question.	1 of c	2 of c	3 of c	2 of j	3 of j	1 of i	2 of i

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0–6	7–12	13–18	19–24