NZQA
New Zealand Qualifications Authority
Mana Tohu Matauranga O Aotearoa

LIVE

Assessment Report

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Level 3 Statistics 2020

Standards 91584 91585 91586

Part A: Commentary

Candidates who were well prepared experienced success in these standards. Some general issues noticed by the marking panels were:

- Candidates need to read all questions carefully to determine what the question is actually asking. They can then maximise their success by focussing their answer on the question at hand rather than providing a standard answer that may be better suited to a different question.
- Candidates should always support their statements with statistical and/or numerical evidence in sufficient detail so that their chain of thinking is evident.
- Candidates should avoid premature rounding of intermediate solutions. Rounding of calculations should only be done at the final step of working.

Part B: Report on standards

91584: Evaluate statistically based reports

Candidates who were awarded **Achievement** commonly:

- calculated a margin of error and could articulate why an MOE is calculated
- calculated a confidence interval (without explanation)
- identified the difference between observational and experimental studies
- recognised random allocation as a key idea in experimental design
- recognised that causal claims can be made from experimental studies
- understood the inverse relationship between MOE and sample size.

Candidates whose work was assessed as **Not Achieved** commonly:

- did not refer to the statistical nature of the reports
- did not use rule of thumb formula to calculate the margin of error
- did not describe why the MOE is used
- failed to use the appropriate margin of error to calculate the relevant confidence interval for a comparison confidence interval
- knew very little about statistical terms and used little statistical terminology
- could not identify random allocation as a key idea in experimental design
- incorrectly focussed on the size of samples to discredit studies.

Candidates who were awarded **Achievement with Merit** commonly:

- identified an issue with a survey and related it to representativeness with a specific population
- identified and described one issue with study design as opposed to survey design
- calculated a comparison confidence interval but could not correctly interpret it within the context or justify why a claim was true
- commented on key features by referring to statistical evidence provided in the reports without specific details
- identified and described a paired experiment and explained why a baseline is important in paired experiments contextually

- understood the inverse relationship between MOE and sample size and were able to calculate the sample size when given the MOE
- had a sound understanding of self-selection or convenience sampling and supported this reasoning with enough context to explain how the sampling frame did not adequately reflect characteristics of the population of interest.

Candidates who were awarded **Achievement with Excellence** commonly:

- described an issue with study design and directly linked it to the strength of a claim in context
- calculated a comparison confidence interval and interpreted it in context, justifying a statistical claim using correct statistical language, including identifying the population
- used and correctly applied statistical language
- recognised that causal claims can be made from experimental studies, and that these causal claims can be strengthened where the experiment has been well designed, and where necessary re-randomisation tests are undertaken
- acknowledged that for randomised experiments, causal statements can be made, however, generalisations or links between variables can only extend to the participants involved in the experiment.

Standard specific comments

Candidates were required to assess the quality of reports using statistical methods indicated by the question, whether it was to do with the design of the study, or to identify potential issues with aspects reported in the study.

Candidates needed to read the report and the questions carefully, and then consider what was being asked of them, perhaps by highlighting or underlining key words, that allows them to focus better their responses. In many cases, candidates provided a great answer that did not answer the specific question at hand, but rather another question elsewhere.

Candidates need to avoid generic, learned answers, for example “old people do not have the internet”, or “This was an experiment because variables were altered” without considering the context of the report or providing necessary explanation to relate their observations back to the statistical reports. Candidates

should not say that there is a need to ‘eliminate bias’. Where bias is being discussed, the term to use is “reduce” or words to that effect.

It is important for candidates to understand the effect of sample size on the margin of error. After calculating comparison confidence intervals candidates need to comment on the claim by describing the confidence interval in context and appropriately discuss the underlying population. For example, if the confidence interval was [6.3%, 15.7%], then candidates needed to interpret this correctly by saying something like “I am pretty sure the true proportion of workers in 2020 who think their weekly hours of work has got worse is between 6.3% and 15.7% lower than in 2019.” before answering the claim. The claim must also be in context and separate from the judgment.

Candidates need to be able to identify, describe and discuss both Experimental and Observational studies and apply that knowledge. Further, it is a good idea that mention what type of study the report is even if it is not clear from the question that it needs to be identified. Candidates must also realise that a causal claim can be inferred from an experimental study, but not from an observational study.

91585: Apply probability concepts in solving problems

Candidates who were awarded **Achievement** commonly:

- were able to choose which probability tool was best suited to solve a problem for each question and then use it to find the appropriate probability
- were able to calculate the correct likelihood ratio but incorrectly interpreted it
- correctly calculated a probability from a partially completed Venn diagram
- partially explained possible issues when using results from a sample
- used correct probability statements as part of their working.

Candidates whose work was assessed as **Not Achieved** commonly:

- had difficulty in identifying which probability tool to use to solve problems
- were not able to carry out a test for mutually exclusive or independent events. Many candidates wrote about it but did not back it up with relevant probability

calculations or used numbers rather than probabilities. A number also carried out an independence test for mutually exclusive events

- did not realise that probabilities above 1 indicate an incorrect answer
- did not recognise when to use conditional probability or tried to solve a problem requiring the use of conditional probability by using a likelihood ratio
- could not reason with probabilities
- could not dissect the language of questions correctly
- confused the term ‘proportion’ and left solutions as count/quantity rather than a probability
- tried to answer with logic rather than calculations.

Candidates who were awarded **Achievement with Merit** commonly:

- were able to recognise that conditional probability was required and then go on to solve problems involving this
- compared conditional probabilities by calculating the correct ratio and interpreting as ‘times as likely’
- were able to correctly use the required rules to test mutually exclusive and independent events
- used statistical reasoning, especially when critiquing claims, to back up calculations
- constructed a tree diagram and use it to solve a problem.

Candidates who were awarded **Achievement with Excellence** commonly:

- processed a large amount of information and chose the correct method to solve a complex problem and then were able to interpret the result
- could do the calculations to work out if the data supports the claim made and support their decision with the appropriate statistical statements
- calculated probabilities when sampling without replacement is required and clearly communicated the assumptions made
- were able to prioritise the consideration of over-arching limitations to study design, rather than specific, plan based limitations.

Standard specific comments

Candidates should understand that the term ‘proportion’ is simply a synonym for probability and chance.

Candidates need to learn to carry out an independence test. A common error was to test P(A) = P(B) rather than P(A|B) = P(A).

Candidates should know the difference between ‘as likely’ and ‘more likely’.

Candidates need to recognise situations where sampling without replacement is required.

The impact of a small sample affecting accuracy was often missed.

91586: Apply probability distributions in solving problems

Candidates who were awarded **Achievement** commonly:

- selected appropriate probability distribution models
- calculated simple probabilities using probability distribution models
- understood terms such as ‘at least’ and ‘less than’
- calculated the mean and standard deviation for a discrete random variable
- identified the correct parameters needed to solve a probability distribution problem
- could accurately draw a rectangular distribution graph.

Candidates whose work was assessed as **Not Achieved** commonly:

- applied an inappropriate distribution model to a problem
- could not draw the graph of a rectangular distribution
- could not calculate a given probability for a normal, Poisson, binomial or triangular distribution
- misinterpreted inequalities written as text
- could not calculate the mean and standard deviation from a table showing the probability distribution of a random variable
- gave a probability answer greater than one

- made calculation errors or rounded too severely.

Candidates who were awarded **Achievement with Merit** commonly:

- completed multi-step problems across a range of distributions
- could correctly identify the random variable of a given situation and explain whether the given probability distribution model was appropriate for modelling that variable in the given situation
- understood assumptions made when using probability distribution models and were able to discuss whether these assumptions were likely to be valid in the context of a problem
- understood concepts such as independence and variation and could explain these in terms of the context of a problem
- communicated their thinking using appropriate statements and calculations, e.g. stating the probability distribution model and parameters, correctly using probability notation, providing calculations for any general statements they made and linking these to the problem they were investigating.

Candidates who were awarded **Achievement with Excellence** commonly:

- showed a depth of understanding across a range of distributions, appropriately linking statistical and contextual information
- discussed the appropriateness (or inappropriateness) of a probability distribution model by considering features of the probability distribution, statistical evidence and/or the context of the situation
- understood and devised a strategy to solve multi-step probability distribution problems
- understood statistical concepts like variation and variability
- were able to calculate variance and/or standard deviation of a binomial distribution in order to justify a claim
- could calculate a conditional probability using a probability distribution
- clearly explained their reasoning and justified decisions
- used statistical reasoning to make a recommendation.

Standard specific comments

There was some confusion and misconception around a number of terms and concepts: in particular independence. Many candidates confused independence of an event with the probability of the event.

Candidates need to be able to identify the random variable being discussed in a question and to explain how the conditions of a given probability distribution model are appropriate or inappropriate to the given context of that random variable.

Some candidates were unclear about the conditions of each probability distribution model and when discussing a particular probability distribution frequently confused its conditions with those of other probability distributions.

To gain Merit or Excellence candidates need to demonstrate proficiency in a number of distributions.

When drawing a graph, candidates need to ensure the scales on both sets of axes are clearly shown.

In multi-step problems, numbers should not be rounded prematurely.

Candidates need to be familiar with instructions such as “discuss”, “comment on” and “suggest”. Responses to such questions should include statistical calculations and sufficient working should be shown to indicate the candidate’s thinking and reasoning. Final responses need to be linked back to the question or statement that has been given.

Mathematics and Statistics subject page

Previous years' reports

- 2019 (PDF, 121KB)
- 2018 (PDF, 139KB)
- 2017 (PDF, 52KB)
- 2016 (PDF, 228KB)