Assessment Report

Level 3 Statistics 2017

Standards 91584 91585 91586

Part A: Commentary

The 2017 papers gave a similar overall distribution of grades as previous papers with the exception of AS9154 (Statistical Reports), where the Excellence rate was considerably higher than in recent years. Candidates who performed well across the standards were able to integrate statistical and probability concepts, calculations and statistical reasoning. This included using contextual information to support their answers. Successful candidates demonstrated strong skills in working with confidence intervals, probability theory and probability distributions, as well as sound reasoning with data and models. Weaker candidates often did not supply numerical evidence to support their responses, or only supplied numerical evidence with no supporting explanations.

Part B: Report on standards

91584: Evaluate statistically based reports

Candidates who were awarded **Achievement** commonly:

- identified and described explanatory and response variables
- used specific skills such as calculating margin of error
- calculated confidence intervals but could not interpret them in context
- read numbers from graphs correctly or identified some key aspects of a report
- understood as sample size increases, the margin of error decreases
- could recall names of non-sampling errors
- had limited understanding of different study designs
- used ‘common sense’ to comment on key features of the report.

Candidates who were assessed as **Not Achieved** commonly:

- did not use information from the provided statistical reports
- did not attempt many question parts
- gave generic or rote learnt answers that were not linked to the report
- did not understand the different types of confidence intervals
- could not read a simple graphical display or interpret text for statistical values
- identified a key feature but failed to describe its relevance to the context.
- failed to identify the need for a margin of error in statistical survey reports

- could not calculate a margin of error
- lacked familiarity with experimental design principles, interpreting statistical inference, interpreting graphs, critiquing causal relationships, and interpreting margins of error.

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

- used specific quotes from statistical reports to support their answers
- understood how to make a call using a confidence interval about claims made in context
- demonstrated understanding of the 30%-70% guidelines for using the rule of thumb margin of error
- described and understood different study designs with some interpretation
- identified and described a relevant non-sampling error in context
- presented an argument that used some statistical reasoning and evidence from the statistical report
- demonstrated understanding of study designs, specifically the use of random allocation of treatments for an experiment.

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

- focused on the specific claims being made and whether the statistical processes described in the statistical report supported the claim
- quoted directly from the report as evidence and used this evidence combined with statistical and contextual knowledge to construct a convincing argument
- responded to a claim concerning the difference between two percentages by constructing and interpreting a confidence interval, and then explaining that a claim could not be made because 0 was included in the interval, or because the values of the confidence interval were either both positive or both negative
- were succinct in their responses and presented clear, well-supported discussion points rather than lengthy generic statements or descriptions
- integrated statistical and contextual knowledge in their responses when discussing issues with a statistical process or claim presented in the statistical report.

Standard specific comments

Every statistical report will have aspects that candidates will not get to discuss, due to time constraints and the need for a balance of questions. Candidates often tried to use non-relevant parts of the statistical report to answer a question that was not asked. For example, in question one, many candidates wanted to discuss examples of confounding variables despite not being specifically asked for this.

Candidates need to look carefully at the question that was asked, including what quotes or headlines from the article they are being asked to discuss. Specific evidence from the report needs to be used to support any arguments or points made. For example, many candidates discussed the use of online surveys for Q2(c)(ii) in general terms, writing what were previously learned responses, without linking to anything specific from the statistical report or explaining why the use of online surveys might cause bias (linking back to the target population and what was being measured through the survey).

Many candidates either did not interpret the confidence intervals constructed in words, or incorrectly combined their interpretation with “making a call” as one sentence.

91585: Apply probability concepts in solving problems

Candidates who were awarded **Achievement** commonly:

- understood concepts, but didn’t supply numerical evidence
- were able to draw and understand a two-way table
- were able to find values in tables and charts

- identified relevant probability concepts and contextual information from the problem.

Candidates who were assessed as **Not Achieved** commonly:

- did not use calculations anywhere to support statements
- often gave proportions greater than one
- mixed up the tests for independence and mutually exclusive
- gave answers only
- struggled to relate to or understand the context of the question
- did not show an understanding of the difference between experimental and theoretical probability
- could not calculate conditional probabilities on a tree diagram
- were expecting to see a relative risk question and used it when not needed
- confused sample size with sampling variability.

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

- were able to link their ideas with the relevant probability concept, for example when proving events were not independent nor mutually exclusive
- were able to find the conditional probabilities on the tree diagram
- were able to support their ideas with relevant calculations
- were able to understand data given in different forms
- had clear working and clear answers
- used probability notation correctly
- could construct a 3-event tree diagram.

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

- could correctly construct a 3-event Venn diagram and use it to solve a problem
- were able to calculate appropriate theoretical probabilities for a game involving probability
- showed an understanding of the context when interpreting their answers
- were able to develop a logical chain of reasoning using probability theory to deduce a relevant probability.

Standard specific comments

Candidates showed some lack of understanding about sampling variability and sample sizes and how this affects probabilities.Many candidates did not understand the entries on the second and subsequent columns on the tree diagram are conditional.A very few candidates spent much time drawing huge tree diagrams for Q3b when it was not required because it was a symmetrical distribution. Most candidates did not realise that they had to back up the independence and mutually exclusive proofs with numerical evidence.

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 factors that should be kept constant, when modelling practical situations
- understood terms such as ‘less than’, ‘at least’, ‘more than’, ‘at most’
- calculated the expected value (mean) of a discrete random variable
- calculated the variance of a discrete random variable
- used discrete random variables represented as probability distribution tables
- identified when a particular model may be appropriate or inappropriate to use for experimental data, without clearly justifying and linking limitations of the model to the context.

Candidates who were assessed as **Not Achieved** commonly:

- used incorrect methods, e.g. chose the wrong model or performed incorrect probability calculations
- confused the inequalities and hence, incorrectly calculated probabilities.
- misinterpreted inequalities expressed as text
- could not correctly calculate means, variances and probabilities from a probability distribution table
- were unable to compare features of an experimental distribution with a probability distribution graph or table
- made general statements unsupported by evidence
- did not complete sufficient questions.

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

- linked features of the probability distribution model to the context, e.g. identified appropriate limitations of the model and explained them in terms of the context or gave conditions for a probability distribution in context
- completed multi-step problems across a range of distributions; could link their responses to the stated context and answer the questions asked
- communicated their thinking using appropriate statements, e.g. stating probability distribution model and parameters, correctly using probability notation and providing evidence or calculations for any general statements they made.

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

- devised a strategy to solve multi-step probability distribution problems
- discussed the appropriateness (or inappropriateness) of a model by considering features of the probability distribution, statistical evidence and/or the context
- compared features of an experimental distribution and a probability distribution model and linked these features to the context of the experimental distribution
- clearly explained and justified with evidence their reasoning.

Standard specific comments

The paper identified candidates' confusion/ misconceptions about a number of concepts, particularly; randomness, independence, symmetry and skew, continuous and discrete variables, what a mean represents, the relationship of a mean to variance and standard deviation, and, in the Poisson distribution, what the idea of proportionality means in terms of a rate in a particular context.

When discussing conditions and features of all probability distribution models, many candidates did not consider each condition in terms of the given context. Candidates need to be able to explain how the conditions and/or features of a probability distribution model (e.g. randomness, independence, skew, bell-shaped, upper/lower bounds) are appropriate or inappropriate to the given context.

Given a clear graph displaying the experimental and theoretical proportions for a situation, candidates should use this visual information to construct an argument. Comments should use the graph to compare the theoretical with experimental distributions. Comments need to be supported by specific numerical evidence in context. Many candidates did not support their statements with statistical and/or numerical evidence.

Mathematics and Statistics subject page

Previous years' reports
2016 (PDF, 0KB)