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Level 3 Mathematics and Statistics (Statistics) 2021

91585 Apply probability concepts in solving problems

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Apply probability concepts in solving problems.	Apply probability concepts, using relational thinking, in solving problems.	Apply probability concepts, using extended abstract thinking, in solving problems.

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.

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 extra space provided at the back of this booklet.

Check that this booklet has pages 2–12 in the correct order and that none of these pages is blank.

Do not write in any cross-hatched area (). This area may be cut off when the booklet is marked.

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

QUESTION ONE

A music and dance festival sells two types of ticket: EarlyBird and General Admission tickets. For each ticket type, festival attendees under the age of 16 years are able to buy a 'Child' ticket; otherwise an 'Adult' ticket is required. EarlyBird tickets need to be purchased before a particular date, and are cheaper to purchase than General Admission tickets. For both EarlyBird and General Admission ticket types, Child tickets are cheaper than Adult tickets.

For the 2021 festival, one fifth of tickets sold were EarlyBird type. For these EarlyBird tickets, three quarters were Adult tickets.

For General Admission type tickets, two-thirds of those sold were Adult tickets.

- (a) The festival organisers predicted that 10% of their ticket sales would be Child EarlyBird tickets.

Were they correct in their prediction?

- (b) Calculate the overall proportion of tickets sold that were Adult tickets.

- (c) Was it more likely for an Adult ticket sold to be an EarlyBird ticket or a General Admission ticket?
Support your answer with calculations.

- (d) In order to encourage people to buy their tickets early, the organisers decide for 2022 to increase the price of General Admission tickets compared to EarlyBird tickets.

Note that for 2022, the relative proportions of Adult and Child tickets sold are expected to remain the same for each ticket type.

If increasing the price of the General Admission type tickets in 2022 reduces the proportion of all tickets purchased as General Admission type to one half of the original 2021 proportion, comment on the effect of this change on the proportion of adult tickets that are sold as EarlyBird type.

Support your answer with standard reasoning and/or calculations.

- (e) An aim for the 2022 festival is to increase the proportion of all Child tickets that were EarlyBird type to 30%.

Calculate the overall proportion of tickets that would need to be sold as EarlyBird tickets in order to increase the proportion of all Child tickets that were EarlyBird type to 30%.

QUESTION TWO

Three different festivals are operating over the summer holiday break: Idyll, Escapade, and Serendipity.

(a) Different performing groups or individuals (acts) can be seen at the different festivals. There are 37 acts performing across the three festivals.

- Idyll offers 17 acts, Escapade offers 14 acts, and Serendipity offers 29 acts.
- 5 of the acts seen at Idyll also perform at Escapade.
- 13 of the acts seen at Idyll also perform at Serendipity.
- 3 acts can be seen at all three festivals.

(i) Calculate the proportion of acts at Idyll that are unique to that festival (can be seen only at Idyll).

(ii) Which two festivals have the greatest probability of people seeing the same acts?
Support your answer with statistical statements.

- (iii) A particular festival attendee can afford to attend only one festival. They wish to attend the festival that will give them the highest probability of seeing a unique act (one not able to be seen at a different festival).

Which festival should they choose to attend?

Support your answer with statistical reasoning.

- (b) For people who attend only one festival, a model has been developed that predicts the festival a person will choose to attend, based on various characteristics of that person, including variables such as age, income, and home location. To test the model, a group of 214 people were surveyed and the actual festival chosen by each person was compared to the predicted festival from the model.

The table below shows the results of this survey.

Actual Festival	Predicted Festival		
	Idyll	Escapade	Serendipity
Idyll	80	15	2
Escapade	7	25	33
Serendipity	15	32	5

- (i) Calculate the percentage of the predictions that were correct (the predicted festival was the same as the actual festival chosen for that person).

- (ii) Comment on the appropriateness of the model for predicting attendance at the different festivals.

Support your answer with at least one additional calculation.

- (c) Patrick owns a food caravan, and sells food and drinks at festivals. He purchases a bulk pack of 300 canned drinks, which were advertised as being supplied in equal proportions of cola, lemonade, and orange flavours. Cola is usually the preferred flavour for festival attendees, so consequently Patrick is disappointed when he counts that there are only 85 cola drinks in his pack of 300 cans.

Patrick thinks that his bulk pack is likely to be a representative sample of drinks produced by the manufacturer. He wonders if the proportion of cola drinks supplied is less than the advertised proportion.

Discuss how carrying out a simulation would help Patrick consider whether his bulk pack could indicate that the proportion of cola drinks supplied by the manufacturer is less than one third.

As part of your answer, describe what evidence Patrick would look for in his simulation that would justify making a complaint to the manufacturer.

You do not need to design the simulation.

QUESTION THREE

Festival tickets are sold either online or through a ticket office at the venue. The organisers have gathered data from the first 1000 festival attendees to buy their tickets online. The data summarises the age of the festival attendees (less than 25 years old, or 25 years old and over), and their main motivation for attending the festival (dancing, socialising, or 'other').

750 of the festival attendees are less than 25 years old. The main motivation of 510 of these is to dance. The remainder of these younger attendees are evenly split between those mainly interested in socialising, or those mainly interested for other reasons.

For those older than 25 years old, 160 are mainly interested in socialising. Of the remainder of the older attendees, 60% are mainly interested in dancing.

A festival attendee is chosen at random.

- (a) Calculate the probability that the festival attendee is less than 25 years old and is mainly interested in socialising.

- (b) Festival organisers claim that it is at least twice as likely for younger participants (less than 25 years old) to be mainly interested in dancing compared to older participants (25 years or older).

Does this data support the festival organisers' claim?

Support your answer with statistical evidence.

- (c) (i) Are the events ‘festival attendee is less than 25 years old’ and ‘festival attendee is mainly interested in dancing’ independent?

Support your answer with statistical reasoning.

- (ii) Interpret your answer in part (i) in terms of the relationship between the events ‘festival attendee is less than 25 years old’ and ‘festival attendee is mainly interested in dancing’.

- (d) Give TWO reasons why care should be taken when using this data to predict that a new ticket purchaser buying a ticket will be less than 25 years old and mainly interested in dancing.

**Extra space if required.
Write the question number(s) if applicable.**

QUESTION
NUMBER

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