SUPERVISOR'S USE ONLY

1

91037

910370

Draw a cross through the box (☒) if you have NOT written in this booklet

+

NZQA | Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Level 1 Mathematics and Statistics 2023

91037 Demonstrate understanding of chance and data

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of chance and data.	Demonstrate understanding of chance and data, justifying statements and findings.	Demonstrate understanding of chance and data, showing 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.

Show ALL working.

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 2–16 in the correct order and that none of these pages is blank.

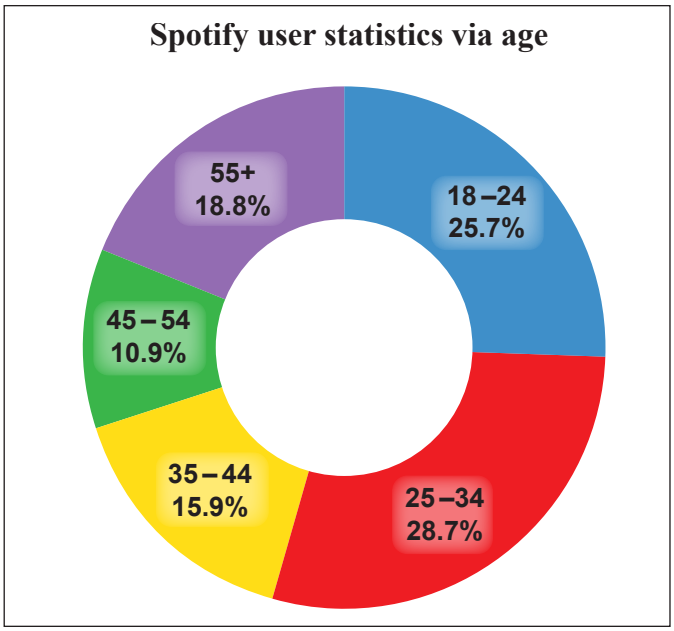
Do not write in any cross-hatched area (DO NOT WRITE IN THIS AREA DO NOT WRITE). This area will be cut off when the booklet is marked.

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

QUESTION ONE

Spotify is one of the largest online music streaming providers, which continues to grow in popularity around the world.

The diagram below shows the ages of the 587 million Spotify users in 2021.



(a) (i) What is the probability that a randomly selected Spotify user is aged 45 or over?

(ii) In terms of gender, 54% of Spotify users identify as male and 46% identify as female.

Assuming that these percentages are true for all age groups, what is the probability that a randomly selected Spotify user is a female aged between 25 and 34 years old?

Show clearly the calculations that give your probability value.

(iii) Niko conducted a survey among his family members and his work colleagues.

Niko surveyed 81 people and the results showed that 63 of them use Spotify.

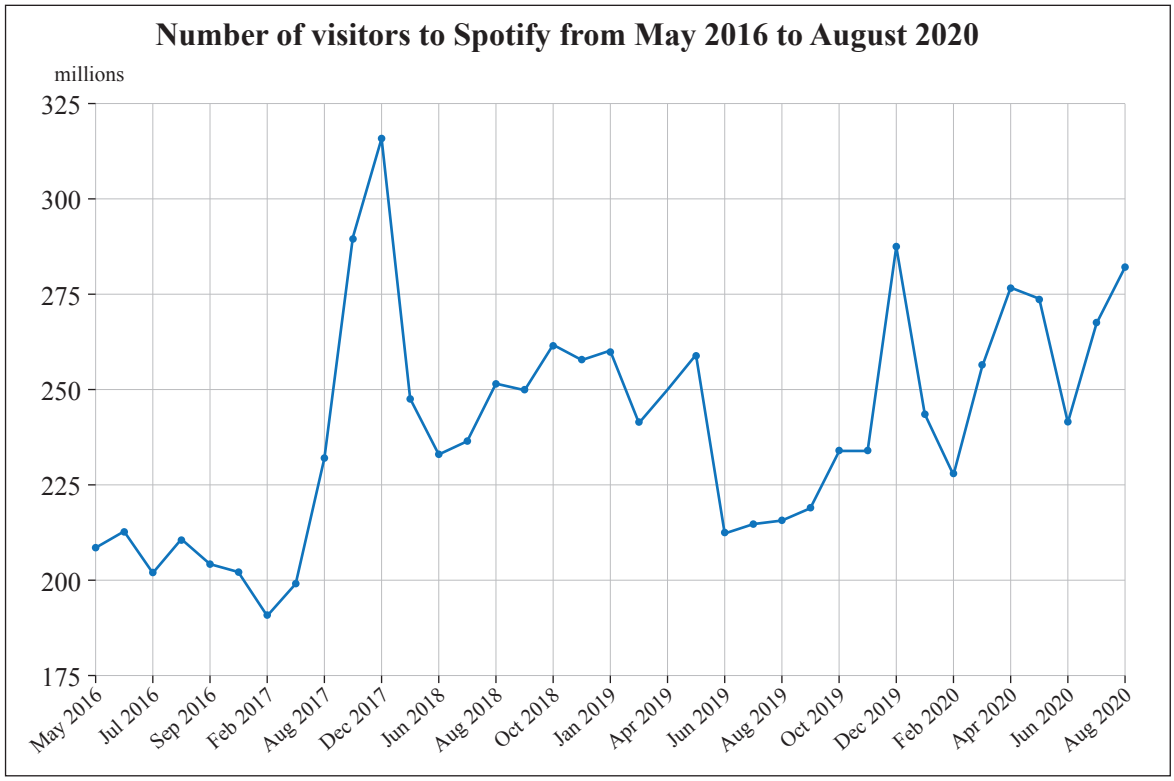
His results indicated that 8 Spotify users out of these 63 Spotify users were aged 55 or over.

Based on his results, and by comparing his results to the diagram on page 2, Niko claims that this result of 8 Spotify users in the age category of 55 years or over is nothing strange, and within what could be expected.

Comment on Niko's claim.

Justify your answer using statistical reasons.

(b) The graph below shows the number of users who visited Spotify from May 2016 through to August 2020.



Adapted from: https://www.statista.com/statistics/244989/number-of-unique-us-visitors-to-spotifycom/

(i) When was the least number of users visiting Spotify recorded in the time period shown in this graph?

Provide evidence from the graph to justify your answer.

(ii) Discuss and describe any trends and unusual features that you notice in the graph above.

Provide evidence from the graph to back up your statements.

Justify your answer using statistical reasons.

In your answer, describe at least THREE key features.

(iii) Margo studied the time series graph and decided that "this is a misleading graph".

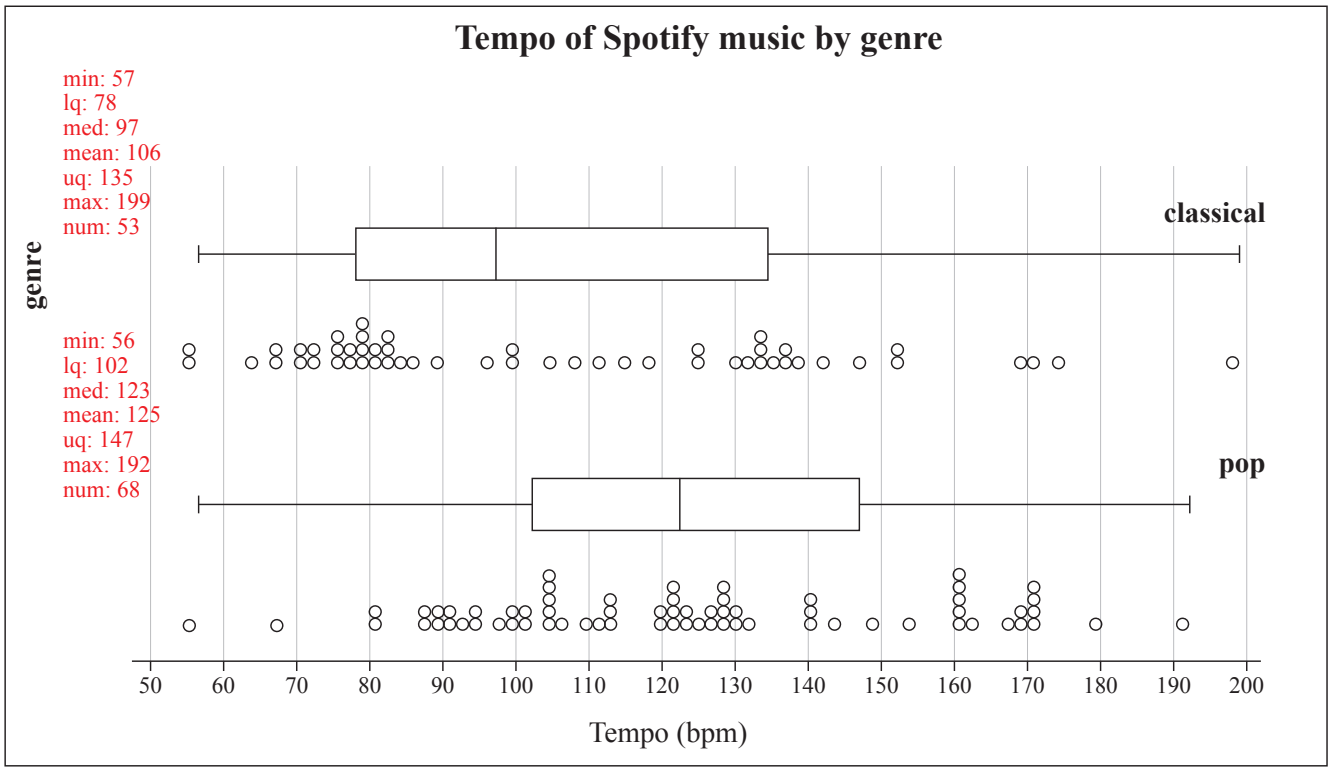
Do you agree?
Justify your answer using the evidence from the graph and statistical reasons.
Explain how any misleading aspects will have an effect.

QUESTION TWO

(a) In musical terminology, tempo is the speed or pace of the piece of music. It is measured as beats per minute (bpm).

Random samples of classical music and pop music are selected from the Spotify collection.

The graph below compares the tempo between the two genres of "classical" and "pop" music.



(i) If two pieces of pop music are randomly selected from the above sample, what is the probability that the tempos of both pieces of music are greater than 147 bpm?

(ii) Compare the distributions of the music tempo shown in the sample data opposite.
Note any similarities and differences considering centre, shift/overlap, shape, spread.
Provide numerical evidence where appropriate.
In your answer, describe at least THREE different key features.

(iii) Thom made a claim that it is not possible to decide that classical music tempo tends to be slower than pop music tempo for all music on Spotify.

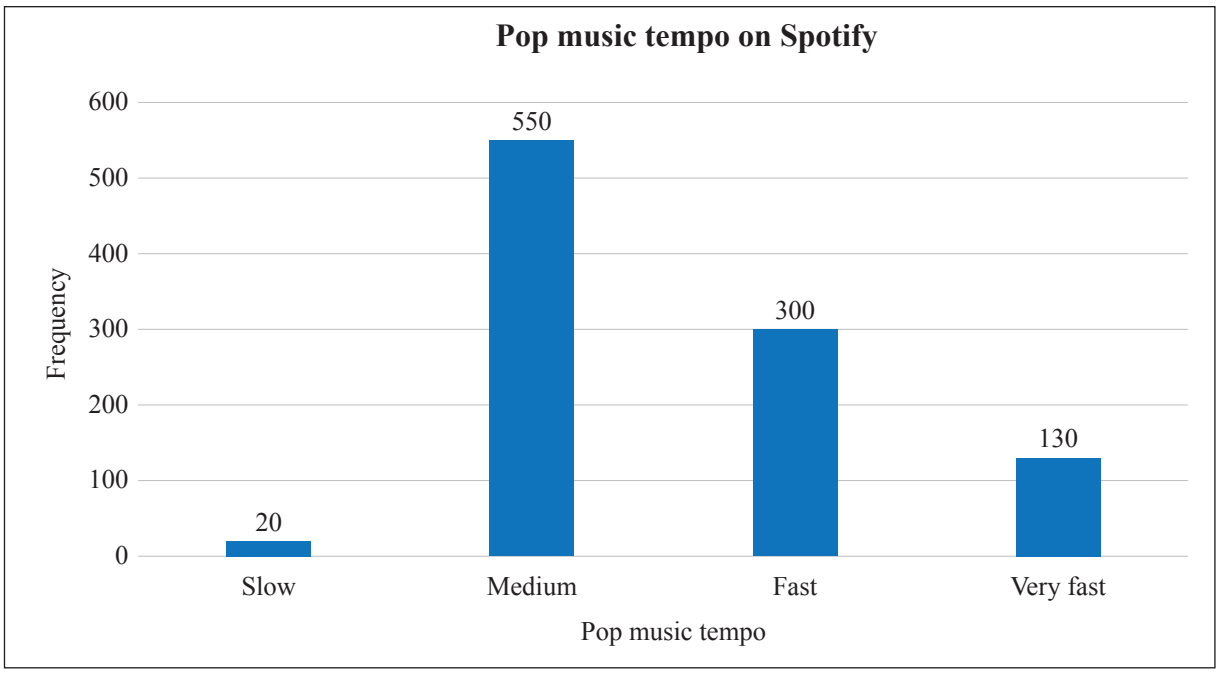
Comment on this claim, based on the sample of music tempo provided (shown in the diagram on page 6).

Justify your answer using statistical reasons, and include numerical evidence where appropriate.

Comment on how confident you are in your answer.

(b) There are four levels of pop music tempo. These are slow, medium, fast, and very fast.

A random sample of **1000 pop songs** selected from Spotify is shown in the graph below.



(i) If a piece of music is randomly selected from this sample, what is the probability that it is NOT a slow tempo or medium tempo piece of music?

(ii) Another sample of 200 pop songs is selected from Spotify.

Describe any similarities and differences that you would expect to see in this new sample compared to the random sample shown.

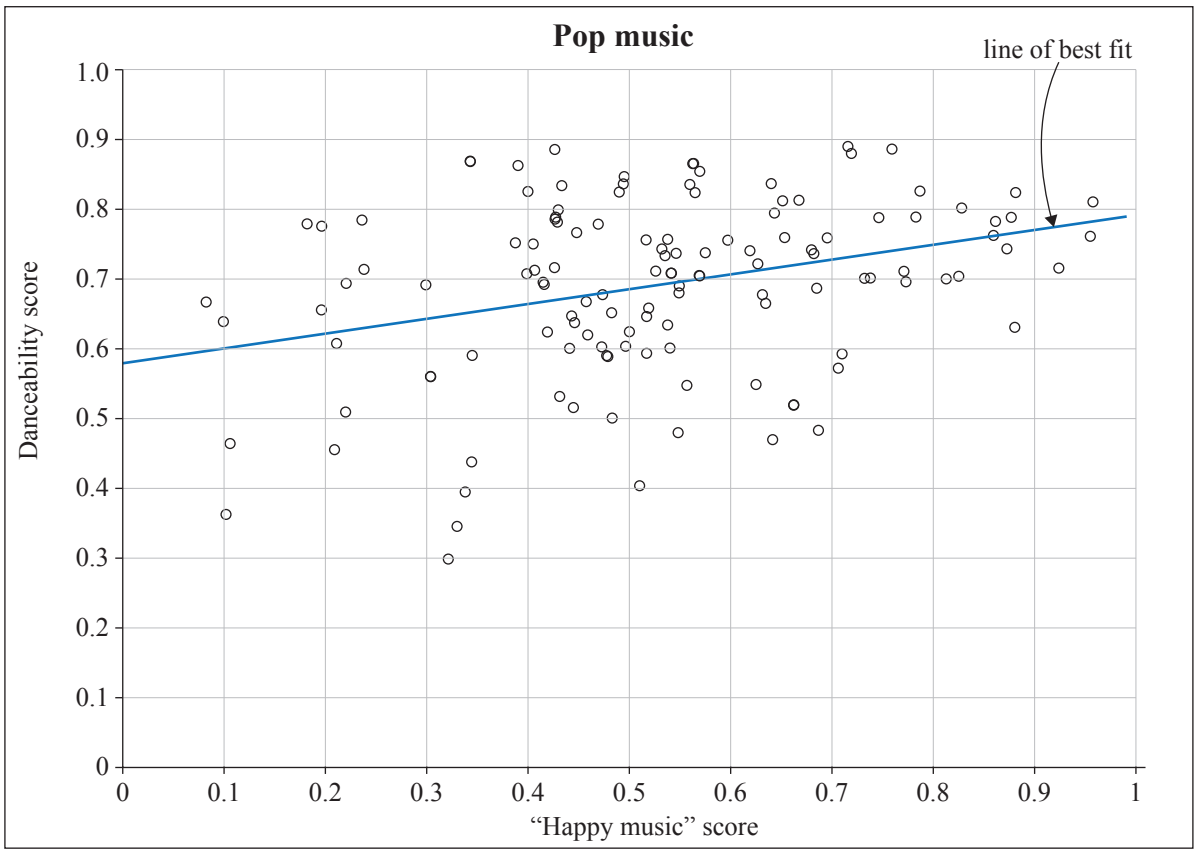
Justify your answer using statistical reasoning.

QUESTION THREE

(a) Most people would agree that dancing makes people feel happy. But does "Happy music" encourage people to dance?

A sample of 120 pieces of pop music was selected from Spotify to study the possible relationship between "Happy music" and "Danceability".

Variable	Description
Danceability	A piece of music is given a "Danceability" rating with a score between 0 and 1. This score gives a numerical value to how much the piece of music encourages the listener to dance. E.g. A "Danceability" rating with a low score, lowest of 0, would mean that the piece of music does not encourage the listener to dance. A "Danceability" rating with a high score, highest of 1, would mean that the piece of music is encouraging the listener to "get on their feet and dance".
"Happy Music"	A piece of music is given a "Happy music" rating with a score between 0 and 1. This score gives a numerical value to the feeling of "happiness" in the piece of music. E.g. A "Happy music" rating with a low score, lowest of 0, would mean that the piece of music is a very sad piece of music. A "Happy music" rating with a high score, highest of 1, would mean that the piece of music is cheerful and fun.



(i) If a piece of music has a "Happy music" score of 0.1, what "Danceability" score would you expect it to have?

Comment on how confident you feel with the accuracy of your answer, with justification.

(ii) Describe and interpret at least TWO different **features** of the relationship shown in the graph above of "Danceability" score versus "Happy music" score.

Justify your answer using statistical reasons.

(iii) Meremere believes that this scatter graph would be very useful to predict the "Danceability" score based on a piece of music's "Happy music" score.

Evaluate Meremere's claim using statistical reasoning, giving at least TWO justified statements, providing numerical evidence where appropriate.

Question Three continues on the next page.

(b) A survey was conducted among **500** randomly selected Spotify users.

They were asked how many hours they listened to Spotify in the past week.

The results are shown in the table below.

Spotify weekly usage	**Less than 2 hours**	**Between 2 and 5 hours**	**More than 5 hours**	**Total**
Free subscription	40	133	27	200
Premium subscription	21	187	92	300
Total	61	320	119	500

(i) One Spotify user was randomly selected from this sample.

What is the probability that it is a premium user who listens for more than 5 hours?

(ii) Based on the data from this survey, Meremere claimed that the free subscription users are more likely to spend less than 2 hours per week listening to Spotify than the premium subscription users.

Comment on Meremere's claim using the information in the table, and providing numerical evidence.

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

QUESTION NUMBER

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

QUESTION NUMBER

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

QUESTION NUMBER

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

QUESTION NUMBER