Rewarding Learning

General Certificate of Secondary Education

Centre Number

Candidate Number

Statistics

Unit 2
Higher Tier

GST22

[GST22]
Assessment

Assessment Level of Control:
Tick the relevant box (✓)

Controlled Conditions	
Other	

TIME

2 hours.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all ten** questions.
Any working should be clearly shown in the spaces provided since marks may be awarded for partially correct solutions.
You **may** use a calculator for this paper.

INFORMATION FOR CANDIDATES

The total mark for this paper is 100.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
You should have a calculator, ruler, compasses and protractor.
The formula sheet is on page 2.

For Examiner's use only	
Question Number	**Marks**
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total Marks	

HIGHER TIER FORMULA SHEET

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$

Spearman's Rank Correlation Coefficient

$$r_s = 1 - \left(\frac{6\sum d^2}{n(n^2 - 1)}\right)$$

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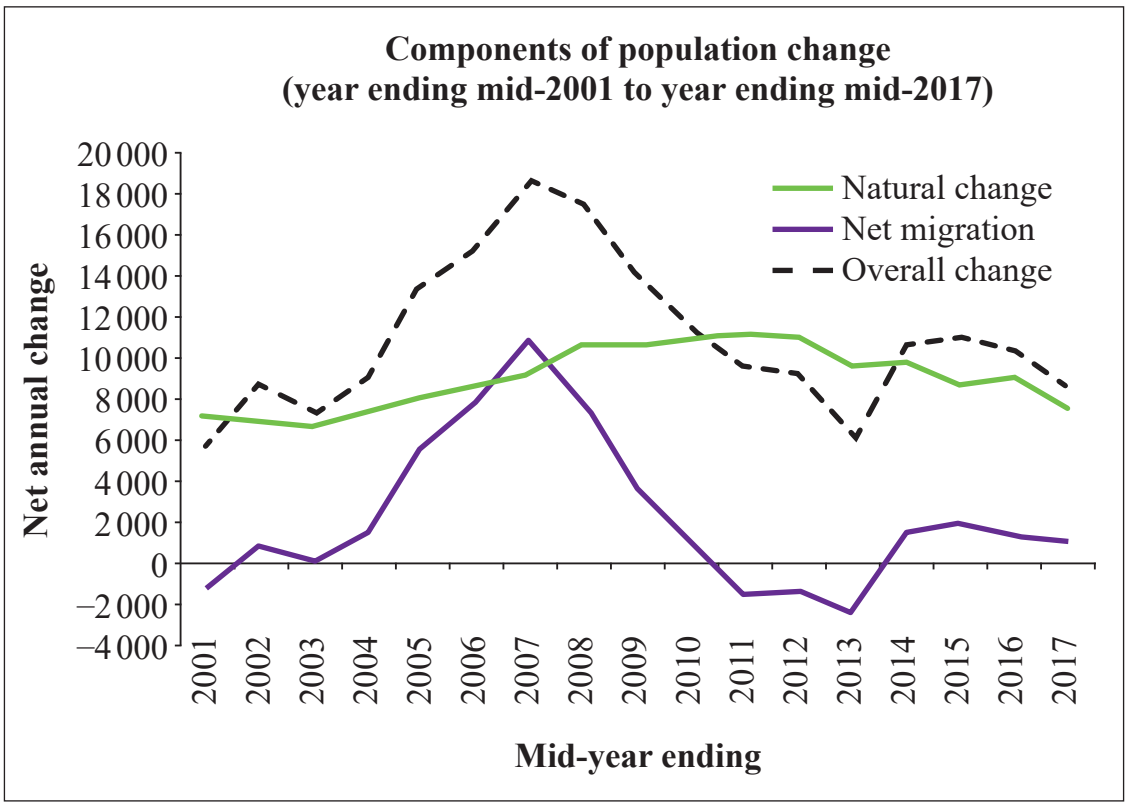
(Questions begin overleaf)

Answer **all** questions

Examiner Only	
Marks	Remark

1 The chart below shows the components of population change between mid-2001 and mid-2017



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(a) (i) Use the graph to estimate the net migration figure for mid-2013

Answer _____ [1]

(ii) Explain the meaning of this value.

_____

_____ [1]

(b) Describe the trend in natural change between mid-2001 and mid-2017

_____

_____

_____

_____ [2]

The Natural change line crosses the Overall change line three times.

Examiner Only	
Marks	Remark

(c) (i) When did this happen?

_____ [3]

(ii) Give a possible interpretation, in context, of this observation.

_____

_____

_____ [2]

2 Sam wants to find out about the number of pets owned by the residents in Castlewellan.

She records the number of pets owned by a sample of people.

The table below shows her results.

Number of pets	0	1	2	3	4
Number of people	27	58	11	3	1

(a) How many people were in the sample?

Answer _____ [1]

(b) Calculate the mean number of pets per person.

Answer _____ [3]

(c) Work out the range for this set of data.

Answer _____ [1]

Examiner Only	
Marks	Remark

(d) Suggest a suitable diagram to display the data in the table.

Give a reason for your choice.

_____

_____

_____ [2]

To collect the data for her sample, Sam asked people as they left Castlewellan Forest Park one afternoon.

(e) (i) Write down the name of this method of sampling.

_____ [1]

(ii) Give a reason why the results of the survey may not be reliable.

_____

_____

_____ [1]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

3 Maria is investigating how the age and gender distribution of the population of Northern Ireland has changed between June 2008 and June 2018

She intends to use the statistical enquiry cycle to carry out her investigation.

(a) Write down a suitable question which Maria could use for her investigation.

_____

_____

_____ [1]

(b) What data would Maria need to collect?

_____

_____

_____

_____ [3]

(c) Suggest a suitable source for Maria's data.

_____ [1]

(d) How could Maria present her results in diagrammatic form?

_____

_____

_____ [2]

(e) Suggest a suitable calculation which Maria could use and how she could interpret the result.

_____

_____

_____

_____ [3]

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(Questions continue overleaf)

4 The table below shows the annual population estimates by age group in Northern Ireland between mid-2001 and mid-2017

Annual population estimates by broad age groups, Northern Ireland (mid-2001 to mid-2017)

Mid-Year Ending	Age groups					As a proportion of all ages			
	All ages	0–15	16–64	65+	85+	0–15	16–64	65+	85+
2001	1 688 800	397 500	1 067 200	224 100	23 500	23.5	63.2	13.3	1.4
2002	1 697 500	391 700	1 079 000	226 800	23 700	23.1	63.6	13.4	1.4
2003	1 704 900	385 900	1 089 700	229 400	23 800	22.6	63.9	13.5	1.4
2004	1 714 000	381 200	1 100 600	232 200	24 400	22.2	64.2	13.5	1.4
2005	1 727 700	378 800	1 114 100	234 900	25 900	21.9	64.5	13.6	1.5
2006	1 743 100	377 100	1 127 900	238 100	27 000	21.6	64.7	13.7	1.6
2007	1 761 700	377 100	1 142 700	241 900	27 900	21.4	64.9	13.7	1.6
2008	1 779 200	378 500	1 153 200	247 500	28 900	21.3	64.8	13.9	1.6
2009	1 793 300	379 500	1 160 400	253 400	29 700	21.2	64.7	14.1	1.7
2010	1 804 800	380 000	1 165 200	259 600	30 800	21.1	64.6	14.4	1.7
2011	1 814 300	380 800	1 167 800	265 800	31 800	21.0	64.4	14.6	1.8
2012	1 823 600	382 100	1 168 700	272 800	32 700	21.0	64.1	15.0	1.8
2013	1 829 700	382 600	1 168 000	279 100	33 300	20.9	63.8	15.3	1.8
2014	1 840 500	383 800	1 170 800	285 900	34 400	20.9	63.6	15.5	1. 9
2015	1 851 600	385 200	1 174 600	291 800	35 500	20.8	63.4	15.8	1. 9
2016	1 862 100	388 000	1 176 400	297 800	36 500	20.8	63.2	16.0	2.0
2017	1 870 800	390 700	1 177 200	303 000	37 200	20.9	62.9	16.2	2.0

Examiner Only	
Marks	Remark

(a) What was the estimated total population in mid-2004?

Answer _____ million people [1]

(b) Does the information in the table suggest that the population is continuing to age? Explain your answer.

_____

_____

_____

_____ [2]

Teresa thinks that the totals for all ages in the table have been calculated incorrectly. She says, "In 2001 the total population has been stated as 1 688 800 but the age group totals add up to 1 712 300."

(c) Explain whether or not Teresa is correct.

_____

_____

_____

_____

_____ [3]

Teresa wishes to analyse the trend in estimated total population in Northern Ireland between mid-2001 and mid-2017

(d) Write down the name of one diagram Teresa could use to illustrate this trend.

_____ [1]

Teresa decides to use simple index numbers to analyse the trend in estimated total population in Northern Ireland between mid-2001 and mid-2017

She uses mid-2001 as the base period.

(e) Write down the index number for mid-2001

Answer _____ [1]

Teresa calculates the simple index number for mid-2017 to be 110.8

(f) Use this information to complete the sentence below.

The population in _____ is _____ %

more than it was in _____ . [3]

Examiner Only

Marks	Remark

5 The table below shows the amount of rainfall, in millimetres (mm), recorded over a period of time at a weather station in Armagh.

Rainfall, r, (mm)	Number of days	Cumulative frequency
$0 < r \leqslant 10$	12	
$10 < r \leqslant 20$	20	
$20 < r \leqslant 30$	48	
$30 < r \leqslant 40$	32	
$40 < r \leqslant 50$	8	

(a) Write down the modal class interval for the amount of rainfall.

Answer _____ [1]

(b) Complete the cumulative frequency column in the table above. [2]

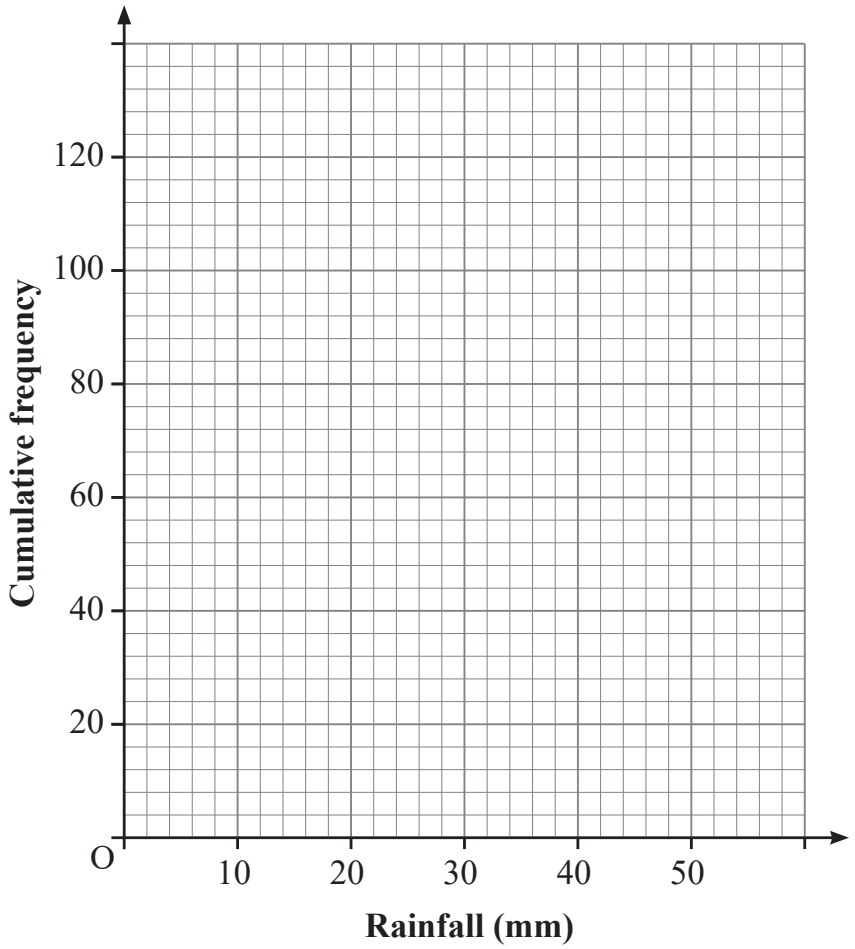
(c) Write down the class interval which contains the median.

Answer _____ [1]

(d) Using the axes opposite, draw a cumulative frequency diagram for the data in the table. [3]

Examiner Only

Marks	Remark



Examiner Only	
Marks	Remark

(e) Use the cumulative frequency diagram to find an estimate of

(i) the median amount of rainfall;

Answer _____ mm [1]

(ii) the interquartile range for the amount of rainfall;

Answer _____ mm [2]

(iii) the percentage of days that had more than 38 mm of rain.

Answer _____ % [3]

(f) Explain why the answers to part **(e)** are estimates.

_____

_____

_____ [1]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

6 The manager of a supermarket is worried that customers are unhappy about how long they have to queue at the checkouts.

He decides to carry out a survey among a sample of customers.

(a) Why would it not be possible for the manager to select a simple random sample?

_____

_____ [1]

To collect the data, each customer is given a link to an online survey at the bottom of their receipt.

(b) Give one advantage and one disadvantage of this method of data collection.

Advantage _____

_____ [1]

Disadvantage _____

_____ [1]

The results of the survey show that most customers think they spend too long in queues.

The manager is considering installing a new checkout to reduce the length of the queues.

The assistant manager suggests carrying out a simulation before installing the new checkout.

(c) Explain why a simulation is an appropriate method of data collection in this case.

_____

_____

_____

_____ [2]

7 Friends Emma and Ronan are tasting different types of cake to serve at their wedding.

They taste eight types of cake and give each one a score out of 20

Their scores are given in the table below.

Type of cake	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**
Emma's score	12	19	7	10	13	15	5	8
Ronan's score	14	17	10	12	18	15	7	10

(a) Calculate Spearman's rank correlation coefficient for the data in the table.

Answer _____ [4]

Examiner Only	
Marks	Remark

(b) How could Emma and Ronan interpret this value?

_____

_____

_____ [2]

(c) Give two reasons why calculating Spearman's rank correlation coefficient is appropriate for the type of data in the table.

1. _____

_____ [1]

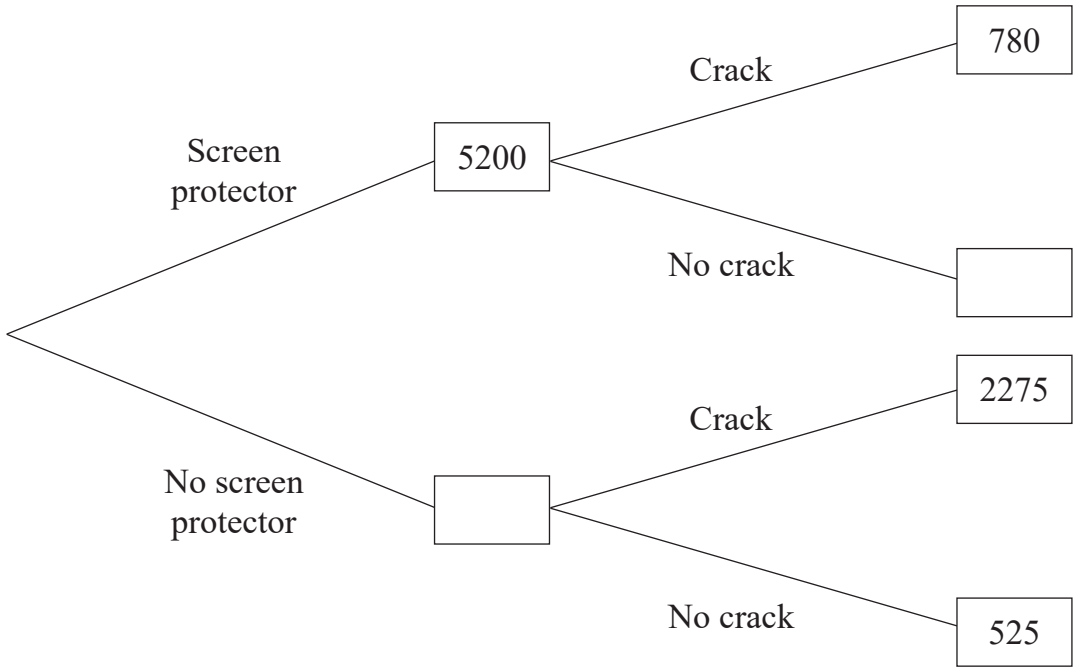
2. _____

_____ [1]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

8 The frequency tree diagram below shows the number of mobile phone owners in a small town who applied a screen protector to their phone and whether their screen had cracked after one year.



(a) Complete the missing frequencies in the tree diagram. [2]

A mobile phone owner from the town is chosen at random.

(b) Calculate the probability that this owner applied a screen protector and their screen had not cracked.

Answer _____ [2]

(c) **(i)** Show that the risk of a mobile phone screen cracking for those who have applied a screen protector is 0.15

[2]

(ii) Find the risk of a mobile phone screen cracking for those who have not applied a screen protector.

Answer _____ [1]

(d) Using your answers to parts **(c)(i)** and **(c)(ii)**, calculate the relative risk of a mobile phone screen cracking for those who have not applied a screen protector compared to those who have applied a screen protector.

Answer _____ [2]

(e) Give an interpretation of your answer to part **(d)**.

_____

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

9 The grouped frequency table below shows the distribution of ages of a sample of people who live in Lisburn.

Age, A, (years)	Frequency		
$0 \leqslant A \leqslant 14$	180		
$15 \leqslant A \leqslant 29$	300		
$30 \leqslant A \leqslant 44$	105		
$45 \leqslant A \leqslant 74$	90		
$75 \leqslant A \leqslant 89$	15		
$A \geqslant 90$	0		

(a) Explain why the width of the $15 \leqslant A \leqslant 29$ class is 15

_____

_____

_____ [2]

(b) On the grid below, draw a histogram to illustrate the distribution of ages of the sample of people who live in Lisburn.

[4]

Examiner Only

Marks	Remark

Paula says that nobody in Lisburn is 90 years old or more.

(c) Explain, with a reason, whether or not you think Paula is correct.

_____

_____

_____

_____ [2]

(d) Would the normal distribution be a suitable model for this data?

Give a reason for your answer.

_____

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

10 The table below shows the average house price and associated chain base index numbers between 2014 and 2018 in Northern Ireland.

The base year is 2013

Year	**2014**	**2015**	**2016**	**2017**	**2018**
Average house price	£110 750	£118 756	£125 059	£129 601	£136 179
Chain base index number	108.7	107.2	105.3	103.6	

(a) What was the average house price in 2013?

Answer £ _____ [3]

(b) Calculate the chain base index number for 2018

Answer _____ [2]

(c) Give an interpretation of your answer to part **(b)**.

_____

_____

_____

_____ [2]

Wayne is working on a project about house prices in Northern Ireland and he wishes to find an average figure of the five index numbers in the table.

Examiner Only	
Marks	Remark

(d) (i) Write down the name of an appropriate calculation Wayne could carry out.

_____ [1]

(ii) Find the value of the calculation you identified in **(d)(i)**.

Answer _____ [2]

Wayne extended his study by looking at the change in average price for different types of house between 2017 and 2018

Taking 2017 as the base year, Wayne collected the following data for a district in Northern Ireland.

	Detached	**Semi-detached**	**Terraced**
Index number for 2018	103.6	107.2	109.1
Number of properties sold	523	671	458

(e) For Wayne's data, calculate the weighted index number for the average house price for 2018

Answer _____ [3]

THIS IS THE END OF THE QUESTION PAPER

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