UNIT 20 *Statistics* Revision Test 20.5
(for Grades up to and including Grade A*)

$2\frac{1}{2}$ hours are allowed
Calculators may be used

1. Peter is a music student. During an investigation, he noted the playing times of 40 tracks of music.

Time (t minutes)	*Number of tracks*
$0 < t < 2.0$	8
$2.0 \leq t > 2.5$	10
$2.5 \leq t < 3.0$	6
$3.0 \leq t < 3.5$	8
$3.5 \leq t < 4.0$	4
$4.0 \leq t < 5.0$	4
$5.0 \leq t$	0

(a) Draw the histogram for these data. *(3 marks)*

A fellow music student found that by using her computer she could slow down the playing of a track so that the time was increased by 50%.

She used the same 40 tracks as Peter and she produced a frequency table of new playing times, using the same class intervals as Peter.

(b) Find the minimum number of tracks which she could have timed in the interval $2.0 \leq t < 2.5$. *(1 mark)*

(c) Find the maximum number of tracks which she could have timed in the interval $3.0 \leq t < 3.5$. *(1 mark)*

A similar investigation covering 140 tracks showed that the proportion of tracks lasting between 2 and 3 minutes was the same as in Peter's investigation.

(d) Calculate the number of tracks lasting between 2 and 3 minutes in this larger investigation. *(2 marks)*

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2. During the season 1966-67 the average attendance at Football League matches was 672 000 per week. This was distributed among the four divisions as follows:

Division	*Average attendance per week (thousands)*
1	338
2	173
3	96
4	65
TOTAL	672

(a) Calculate the angles of the sectors in a pie chart that would represent these data, giving your answers to the nearest degree. *(2 marks)*

By the season 1984-85, the average attendance had dropped to 416 000 per week

(b) If a pie chart depicting the 1966-67 average attendance had a radius of 4 cm, what radius should a pie chart for the 1984-85 season have, if it is to reflect accurately the fall in average weekly attendance? *(2 marks)*

(c) The angles of the four sectors in the 1984-85 diagram should be $201°$, $83°$, $50°$ and $26°$ respectively. Using the radii in (b), draw the two pie charts. *(3 marks)*

(d) State *two* conclusions that can be drawn from comparing the two pie charts. *(2 marks)*

3. A village Health Centre invited a random sample of 300 patients to take part in a survey to check blood pressure. The sample consisted of 150 men and 150 women aged between 35 and 50 years. The table below summarises the results of their diastolic blood pressure measured to the nearest millimetre.

Blood pressure (mm)	55–59	60–64	65–69	70–74	75–79	80–84	85–89	90–94
Number of males	2	5	14	25	40	34	18	12
Number of females	1	8	13	35	45	30	15	3

(a) Calculate the mean and variance of these blood pressures for

(i) the males, (ii) the females. *(5 marks)*

(b) What do these results tell you about the difference in blood pressure of males and females in this village? *(1 mark)*

In a national survey, the diastolic blood pressure of a healthy adult is found to be approximately 80 mm.

(c) How do the results for this village compare with the national figure? *(1 mark)*

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4. Mr Khan is checking the time taken for documents to be word processed. The first 12 documents which he samples take the following times, in minutes, to process.

5	12	13	14	16	18	19	23	34	35	40	43

(a) Calculate

(i) the median time,

(ii) the interquartile range. *(3 marks)*

His completed survey gives him the following information.

Time (minutes)	0–	10–	20–	30–	40–	50–	60–	70–80
Number of documents	3	5	12	14	16	7	2	1

(b) Copy and complete the cumulative frequency table for this information. *(2 marks)*

Time less than (minutes)								
Number of documents	3	8	20					

(c) Use your cumulative frequency table to draw a cumulative frequency graph.

Use your graph to find

(i) the median time,

(ii) the interquartile range. *(6 marks)*

You must mark your graph clearly showing how you found your answers.

(d) Compare the median times and the interquartile ranges found in the sample and the completed survey. Suggest a reason for any differences. *(2 marks)*

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5. (a) Whilst out shopping, Mrs Gausden, a pensioner, buys a newspaper which she reads on the bus during her journey home. She cannot believe the headline . . .

– GOVERNMENT – KEEPING PRICES DOWN –

– ONLY 5 PER CENT INCREASE IN THE RETAIL PRICE INDEX FOR THE PAST 3 YEARS!

On arriving home she empties her shopping basket and decides to calculate her own price index using the items from her shopping basket. Her list with prices for 1989 and estimates for 1986, is displayed below along with her calculation of an index of retail prices.

Item	*Estimated price in 1986*	*Actual price in 1989*	*% increase*
Loaf of bread	40p	48p	20%
Jar of coffee	210p	256p	18%
Bottle of milk	20p	32p	38%
Packet of biscuits	45p	57p	18%
Salad cream	78p	80p	3%
Cans of beer	165p	185p	11%
Newspaper	10p	20p	50%

$$\text{Average price increase } = \frac{158}{7} = 23 \text{ per cent over 3 years.}$$

Mrs Gausden writes a letter of complaint, suggesting that she cannot be expected to live on salad cream! Your task is to reply to her letter.

(i) Give THREE reasons why Mrs Gausden's index would NOT represent an Index of Retail Prices for an average household. *(3 marks)*

(ii) Where is the Retail Price Index used and why is it of value? *(2 marks)*

(b) The indices of building costs for the years 1986 to 1989 taking 1988 as base are shown below.

1986	1987	1988	1989
72	90	100	106

(i) What do the index numbers tell you? *(1 mark)*

(ii) A house cost £80 000 to build in 1986. Calculate, to the nearest £1000, the cost of building an identical house in 1989. *(2 marks)*

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6. The following table summarises some statistics for the town of Norwest.

Age group	*Number of deaths*	*Town population (thousands)*	*Standard population (millions)*
0 – 5	72	8	4
6 – 20	16	16	12
21 – 40	44	22	12
41 – 60	180	30	14
61 – 75	224	14	6
76 & over	720	6	2

(a) Calculate the crude death rate for Norwest. *(2 marks)*

(b) Calculate the standardised death rate for Norwest. *(5 marks)*

(c) Explain the reason for the difference between your answers to parts (a) and (b). *(1 mark)*

(d) The population figures for Norwest are quoted correct to the nearest thousand. Between what limits can you be sure that the death rate for the 21–40 age group lies? *(3 marks)*

7. Rachel works for a garage selling new cars. Her boss tells her that she may lose her job as her average sales are expected to be 50 new cars every two months. Rachel is keen not to lose her job and therefore looks back in her records to find the number of new cars sold by her over the past three years. Her sales figures are shown below.

	Jan/Feb	Mar/Apr	May/Jun	Jul/Aug	Sept/Oct	Nov/Dec
1986	20	15	45	223	134	43
1987	20	15	27	223	140	43
1988	26	21	33	253	158	49

(a) Plot on graph paper this time series. *(4 marks)*

(b) Calculate a suitable moving average for these data and plot this trend on your graph. *(5 marks)*

Rachel is optimistic about her sales figures for 1989.

(c) Estimate Rachel's sales for MAY/JUNE 1989. *(2 marks)*

(d) Explain, using your results, why Rachel should continue to work for the garage during the coming year. *(2 marks)*

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8. It is suggested that the number of vehicles on the roads affects the number of road accident deaths. In order to check this David collects the following data for various countries.

Countries	*Vehicles per 100 population*	*Road deaths per 100 000 population*
Canada	47	30
Denmark	30	23
France	46	32
Great Britain	31	14
Irish Republic	19	20
Italy	35	21
USA	57	35

(a) State one type of statistical diagram that would be suitable for displaying the data in the first column. *(1 mark)*

(b) (i) Copy and complete the table below to calculate Spearman's Coefficient of rank correlation between the 'vehicles per 100 population' and the 'road deaths per 100 000 population'.

Countries	*Can*	*Den*	*Fra*	*GB*	*IR*	*Ita*	*USA*
Rank 'vehicles'	2	6	3	5	7	4	1
Rank 'deaths'	3		2				1
d							
d^2							

(4 marks)

(ii) What does your result suggest? *(1 mark)*

9. Mr Hook bought an antique spring balance and in order to test its accuracy he placed a number of objects of known mass on the balance and recorded the readings shown by the balance. The results are given below.

Actual mass (kg)	3.0	4.0	4.8	6.9	9.0	10.5	12.0	14.6	17.2	20.0
Reading on balance (kg)	4.2	5.1	6.0	7.6	9.2	10.5	11.8	13.7	15.6	18.0

(a) Using the reading on the balance as y and the actual mass as x, plot a scatter diagram of the data. *(4 marks)*

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(b) Making suitable calculations to help you, draw the line of best fit. *(3 marks)*

(c) Find a formula in the form $y = mx + c$, which would enable you to estimate the reading of the spring balance of an object with a known mass. *(3 marks)*

(d) Give a practical interpretation for the value you have obtained for c in your formula. *(1 mark)*

10. Shirley and Terry each took a Statistics examination last year in which the total entry was 8000 candidates. On analysis the results were found to produce a normal distribution with a mean of 40 and standard deviation of 12. It is decided to adjust these marks in order to obtain a mean of 50 and standard deviation of 16.

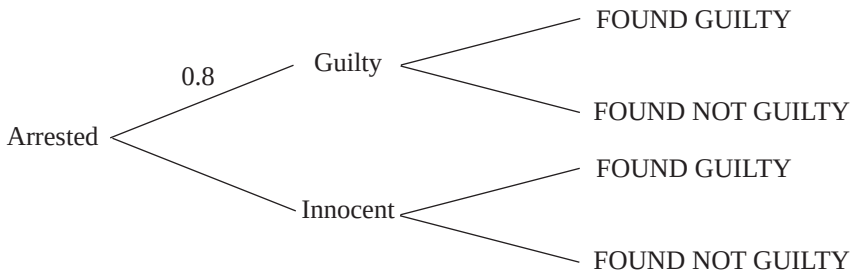
(a) What will be the adjusted marks for Shirley and Terry who had original marks of 31 and 67 respectively? *(3 marks)*

(b) How will the adjustments in mean and standard deviation change the distribution of marks? *(2 marks)*

(c) Draw on the same axes clearly labelled diagrams to illustrate the relationship between these two distributions. *(2 marks)*

11. Eighty per cent of people arrested for unruly behaviour are guilty. All people arrested are tried in court. One in ten of the guilty are FOUND NOT GUILTY by the court, whereas 5% of the innocent ones are FOUND GUILTY.

(a) Copy and complete the following tree diagram representing this situation.



(2 marks)

(b) Hence, or otherwise, calculate the proportion of all people arrested that are FOUND GUILTY. *(3 marks)*

(c) Half of those wrongly FOUND GUILTY are subsequently FOUND NOT GUILTY on appeal.

By extending your tree diagram, or otherwise, calculate the proportion of all people arrested that are FOUND NOT GUILTY at some stage. *(3 marks)*