Statistics Questions

1.

Read the item and then answer the questions that follow.

A psychologist wanted to see if even a brief period of aversion therapy would help smokers reduce their level of smoking. A group of 12 volunteers who smoked regularly recorded the number of cigarettes smoked over a one week period.

The psychologist then exposed them to aversion therapy for one week.

The participants were then allowed to smoke freely recording the number of cigarettes smoked during the week following therapy.

This study involves a repeated measures design.

(a) Explain **one** advantage of using a repeated measures design in this study.

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(2)

(b) The psychologist obtained the following results:

- For two of the volunteers the number of cigarettes smoked increased
- For eight of the volunteers the number of cigarettes smoked decreased
- For two of the volunteers the number of cigarettes smoked stayed the same

The psychologist decides to use a sign test to see if the data are significant.

What is the calculated value of the sign test statistic 'S'? Explain your answer.

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(2)

(c) Look at the table of critical values of 'S' below and then answer the question that follows.

N	.10	.05	.025	.01
4	0			
5	0	0		
6	0	0	0	
7	1	0	0	0
8	1	1	0	0
9	2	1	1	0
10	2	1	1	0
11	2	2	1	1
12	3	2	2	1

To be significant, the calculated/observed value must be equal to or less than the critical/table value.

Using the table of critical values of 'S' above, state whether the findings of the study are significant at $p < 0.05$. Explain your answer.

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(2)

(Total 6 marks)

2.

The psychologists then wanted to see whether the use of diagrams in medical consultations would affect recall of medical information.

In a laboratory experiment involving a medical consultation role-play, participants were randomly allocated to one of two conditions. In Condition A, a doctor used diagrams to present to each participant a series of facts about high blood pressure. In Condition B, the same doctor presented the same series of facts about high blood pressure to each participant but without the use of diagrams.

At the end of the consultation, participants were tested on their recall of facts about high blood pressure. Each participant was given a score out of ten for the number of facts recalled.

(a) In this case, the psychologists decided to use a laboratory experiment rather than a field experiment. Discuss advantages of carrying out this experiment in a laboratory.

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(4)

(b) Identify an appropriate statistical test that the psychologists could use to analyse the data from the follow-up study. Give **one** reason why this test is appropriate.

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(2)

3.

Read the item and then answer the questions that follow.

Following previous research indicating the social benefits of green space in urban areas, two psychology students decided to observe social behaviour in public spaces. They focused on two neighbouring towns, Greensville where most public spaces were planted with flowers and vegetables, and Brownton where most public spaces were paved with concrete.

The students compared the instances of considerate behaviours in the two towns. Considerate behaviour categories included putting litter in the bin, having a dog on a lead and riding a bike with care.

The observations were carried out in four different areas of a similar size in each town on weekdays between the hours of 4.30pm and 6.00pm. The students worked together to ensure inter-observer reliability, recording each target behaviour whenever it occurred.

(a) Should the hypothesis for this research be directional or non-directional? Explain your answer.

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(2)

(b) The students carried out a Chi-square test on their data.

Explain why the Chi-square test was an appropriate test to use in this case.

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(3)

The data for considerate behaviours is shown in the **Table 1**.

Table 1

Considerate behaviours			
	Litter in bin	Dog on lead	Riding bike with care
Greensville	23	12	19
Browntonn	10	17	9

The students noted that overall more considerate behaviours occurred in Greensville than in Brownton.

(c) In order to interpret the results of the Chi-square test the students first needed to work out the degrees of freedom. They used the following formula.

Degrees of freedom (df) = (r–1) x (c–1)
r = number of rows and c = number of columns

Calculate the degrees of freedom for the data in **Table 1**. Show your workings.

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(2)

The calculated value of Chi-square was 6.20. Referring to the **Table 2** below, state whether or not the result of the Chi-square test is significant at the 0.05 level of significance. Justify your answer.

Table 2

df	*Levels of significance for a one-tailed test*			
	0.10	**0.05**	**0.025**	**0.01**
	Levels of significance for a two-tailed test			
	0.20	**0.20**	**0.05**	**0.02**
1	1.64	2.71	3.84	5.41
2	3.22	4.60	5.99	7.82
3	4.64	6.25	7.82	9.84
4	5.99	7.78	9.49	11.67

To be significant at the level shown the calculated value of Chi Square must be equal to or greater than the critical/table value

(3)

4.

Some studies have suggested that there may be a relationship between intelligence and happiness. To investigate this claim, a psychologist used a standardised test to measure intelligence in a sample of 30 children aged 11 years, who were chosen from a local secondary school. He also asked the children to complete a self-report questionnaire designed to measure happiness. The score from the intelligence test was correlated with the score from the happiness questionnaire. The psychologist used a Spearman's rho test to analyse the data. He found that the correlation between intelligence and happiness at age 11 was +0.42.

(a) Write an operationalised non-directional hypothesis for this study.

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(2)

A Spearman's rho test was used to analyse the data. Give **two** reasons why this test was used.

(2)

Extract from table of critical values from Spearman's rho(r_s) test

N (number of participants)	**Level of significance for a two-tailed test**	
	0.10	**0.05**
	Level of significance for a one-tailed test	
	0.05	**0.025**
29	0.312	0.368
30	0.306	0.362
31	0.301	0.356

Calculated r_s must equal or exceed the table (critical) value for significance at the level shown.

The psychologist used a non-directional hypothesis. Using the table above, state whether or not the correlation between intelligence and happiness at age 11 (+0.42) was significant. Explain your answer.

(3)

5.

(a) In an experiment, researchers arranged for participants to complete a very personal and embarrassing questionnaire in a room with other people. Each participant was tested individually. The other people were confederates of the experimenter.

In condition 1: the confederates completed the questionnaire.

In condition 2: the confederates refused to complete the questionnaire and asked to leave the experiment.

The researchers tested 15 participants in condition 1, and 15 different participants in condition 2.

The researchers recorded the number of participants who completed the questionnaire in each condition.

Identify the type of data in this experiment. Explain your answer.

[2 marks]

(b) In order to analyse the difference in the number of participants who completed the questionnaire in each condition, the researchers used a chi-squared test.

Apart from reference to the level of measurement, give **two** reasons why the researchers used the chi-squared test.

[2 marks]

(c) The calculated value of chi-squared in the experiment described on page 2 is **3.97**

Table 1: Critical values for the chi-squared test

Level of significance				
df	0.1	0.05	0.02	0.01
1	2.71	3.84	5.41	6.64

The calculated value of chi-squared should be equal to or greater than the critical value to be statistically significant.

With reference to the critical values in **Table 1**, explain whether or not the calculated value of chi-squared is significant at the 5% level.

[2 marks]