Quiz 3

Name that test

Study 1

In a study designed to assess the impact of a television programme on opinions about a politics, 38 voting-age adults were asked to rate on a scale of 0 to 100 their interest level in national political parties. They were then required to watch a thirty minute information film on the history of politics in their country. After watching the programme, the adults were re-interviewed, and again rated their interest level.

Which test would you use to assess whether the programme had had an effect on interest in national political parties ?

Study 2

Researchers questioned the impact of environmental exposure to a toxic chemical on the incidence of a rare cancer. Using medical records, they selected 27 districts in which at least one cancer case was recorded, and found 25 districts - matched to the previous 27 districts for many demographic and socio-economic features - in which no cancer cases were recorded. The 52 districts were then investigated to establish whether the level of the toxic chemical in the environment was above a specified safety threshold. The results were as follows:

27 cancer-incidence districts:	16 above safety level
25 non cancer-incidence districts:	8 above safety level

What kind of study is this ? How would you test for an association between cancer incidence and exposure to the chemical. What is the result of the test ?

Study 3

A university guarantees to offer courses in their academic departments with staff/student ratio on average no greater than 10.0. In a survey of 8 departments in a given faculty, the ratios were observed to be

10.6 11.9 8.2 15.3 10.0 11.1 9.1 13.7

How would you assess whether the university was meeting its commitment on staff/student ratios ?

Study 4

In a study of aromatherapeutic impact on mental capacity, a 16 student volunteers were randomly allocated to one of two groups. In a 'blinded' study, the first group of 8 volunteers where exposed to an environment infused with a particular 'stimulating' aroma, whereas the second group of 8 volunteers were exposed to a room where no infusion was present.

During a one hour period in the room, each subject was asked to complete a challenging test, scored out of 100. At the end of the test, results were compared between the two groups.

How would you use to assess the impact of the aroma on the mental capacity of the volunteers ?

Study 5

In a particular undergraduate course, results of assessments over several years revealed the following pattern of grades

Grade	A	A-	B+	B	B-	C+	C or lower	Total
Frequency	107	200	240	160	40	21	10	778

How would you assess the hypothesis that the proportions of grades follows the pattern

Grade	A	A-	B+	B	B-	C+	C or lower
Proportion	2/16	4/16	4/16	2/16	2/16	1/16	1/16

Study 1

In a study designed to assess the impact of a television programme on opinions about a politics, 38 voting-age adults were asked to rate on a scale of 0 to 100 their interest level in national political parties. They were then required to watch a thirty minute information film on the history of politics in their country. After watching the programme, the adults were re-interviewed, and again rated their interest level.

Which test would you use to assess whether the programme had had an effect on interest in national political parties ?

Answer: Wilcoxon signed rank test (paired data), large sample version

Study 2

Researchers questioned the impact of environmental exposure to a toxic chemical on the incidence of a rare cancer. Using medical records, they selected 27 districts in which at least one cancer case was recorded, and found 25 districts - matched to the previous 27 districts for many demographic and socio-economic features - in which no cancer cases were recorded. The 52 districts were then investigated to establish whether the level of the toxic chemical in the environment was above a specified safety threshold. The results were as follows:

27 cancer-incidence districts:	16 above safety level
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What kind of study is this ? How would you test for an association between cancer incidence and exposure to the chemical. What is the result of the test ?

Answer: Case-control study - use odds ratio test

Study 2

		Exposure		
		Exposed	Not Exposed	Total
Cancer	Disease	16	11	27
	No cancer	8	17	25
	Total	24	28	52

The odds ratio **statistic** is

$$\widehat{\psi} = \frac{n_{11}n_{22}}{n_{12}n_{21}} = \frac{16 \times 17}{11 \times 8} = 3.09$$

Test statistic:

$$Z = \frac{\log \widehat{\psi}}{\text{e.s.e.}(\log \widehat{\psi})} = \frac{\log 3.091}{\sqrt{\frac{1}{16} + \frac{1}{11} + \frac{1}{8} + \frac{1}{17}}} = 1.943$$

yielding a p-value in a two-tailed test of 0.0520 - not quite significant at the $\alpha = 0.05$ level.

Study 3

A university guarantees to offer courses in their academic departments with staff/student ratio on average no greater than 10.0. In a survey of 8 departments in a given faculty, the ratios were observed to be

10.6 11.9 8.2 15.3 10.0 11.1 9.1 13.7

How would you assess whether the university was meeting its commitment on staff/student ratios ?

Answer: Median (or sign) test with null value 10.0.

Study 4

In a study of aromatherapeutic impact on mental capacity, a 16 student volunteers were randomly allocated to one of two groups. In a 'blinded' study, the first group of 8 volunteers where exposed to an environment infused with a particular 'stimulating' aroma, whereas the second group of 8 volunteers were exposed to a room where no infusion was present.

During a one hour period in the room, each subject was asked to complete a challenging test, scored out of 100. At the end of the test, results were compared between the two groups.

How would you use to assess the impact of the aroma on the mental capacity of the volunteers ?

Answer: Mann-Whitney-Wilcoxon test (unpaired, independent samples), small sample version.

Study 5

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Grade	A	A-	B+	B	B-	C+	C or lower
Proportion	2/16	4/16	4/16	2/16	2/16	1/16	1/16

Answer: One-way chisquared test, with $k = 7$ categories

Study 5

Fitted values:

Grade	A	A-	B+	B	B-	C+	Lower	Tot.
Freq.	107.000	200.000	240.000	160.000	40.000	21.000	10.000	778
Fit.	97.250	194.500	194.500	97.250	97.250	48.625	48.625	778

Therefore

$$X^2 = 132.3445$$

which we compare against the 0.95 quantile of the χ^2_6 distribution, which is 12.592.

Therefore we **reject** the hypothesized proportions.