

National University of Ireland, Galway

Master of Medical Science

Spring Examination 2001

Applied Statistics

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3 hours

You must answer FIVE questions; ONE question from each of sections A, B and C; and TWO questions from any of those remaining.

SECTION A – Data types and principles of research

1. Briefly, compare and contrast *four* of the following *five*.
 - (a) Type I and Type II errors
 - (b) Parametric and non-parametric tests
 - (c) Sensitivity and Specificity
 - (d) Odds Ratio and Relative Risk
 - (e) Quantitative and qualitative data
2. What do you understand by the term *random sampling*? What types of sampling are available to researchers and what are the advantages or disadvantages of each?

SECTION B - Significance and Hypothesis testing

3. Adding bran to the diet is believed to help in the treatment of diverticulosis. Dr. Blue wants to test the efficacy of *two* of these preparations, A and B. His chosen outcome is transit time through the alimentary canal. Does transit time differ among the two groups taking the two preparations? The results are shown in Table 1.

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Transit times (hours)	
Treatment A	Treatment B
44	52
51	64
52	68
55	74
60	79
62	83
66	84
68	88
69	95
71	97
71	101
76	116
82	121
91	90
108	92
62	
87	

Table 1 – Intestinal transit times for two alternative dietary supplements

- (a) What are the null and alternative hypotheses?
- (b) Given that you will be using the t-test for analysis, would you use the *independent* t-test or the *paired* t-test to analyse your results? Explain your answer.

The SPSS readout is summarised below:

Group Statistics

	TREATMENT	N	Mean	Std. Deviation	Std. Error Mean
TIME	A	17	69.1176	16.15891	3.91911
	B	15	86.9333	18.44864	4.76342

Independent Samples Test (summary)

	t-test for Equality of Means				95% Confidence Interval of the Difference	
	t					
		df	Sig. (2-tailed) (p-value)	Mean Difference	Lower	Upper
TIME	-2.913	30	.007	-17.8157	-30.30654	-5.32483

- (c) Summarise the results in your own words. How do you interpret the Significance (*p*) value?
- (d) How do you interpret the 95% confidence interval of the difference between groups A and B?

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4. Dr. Green is a researcher with the World Health Organisation. She is interested in the relationship between the availability of trained healthcare personnel for childbirth, and the maternal mortality rate in a number of countries. Her findings are summarised in Table 2.

Nation	Percentage attended	Maternal Mortality Rate per 100,000 live births
Bangladesh	5	600
Belgium	100	9
Chile	98	47
Ecuador	27	190
Hong Kong	92	5
Hungary	99	26
Iran	82	120
Kenya	28	170
Morocco	29	300
Nepal	6	830
Nigeria	40	800
Norway	100	2
Pakistan	24	500
Philippines	57	93
Portugal	87	12
South Korea	70	26
Spain	96	11
Switzerland	99	5
United States	99	8
Venezuela	82	59

Table 2 – comparison of maternal mortality and percentage attendance at childbirth of qualified healthcare personnel

- (a) What are Dr. Green's null and alternative hypotheses?

The SPSS results are summarised below.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	-.815	.664	.646	161.41610

a Predictors: (Constant), PERCENT

Coefficients

		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Model			Std. Error	Beta		
1	(Constant)	607.075	78.542		7.729	.000
	PERCENT	-6.309	1.057	-.815	-5.970	.000

a Dependent Variable: MORTALIT

- (b) Summarise the SPSS readout *in your own words*. How would you describe the relationship between maternal mortality and the presence at childbirth of a qualified healthcare worker?
- (c) How would you interpret both the *r*-value of -0.815 and the r^2 value of 0.664?

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5. Dr. Mauve is involved in research into the effectiveness of bicycle safety helmets in reducing head injuries. He has taken a random sample of 793 individuals who were involved in bicycle accidents over a specified one-year period. Dr. Mauve’s findings are shown in Table 3.

Head Injury	Wearing Helmet		Total
	Yes	No	
Yes	17	218	235
No	130	428	558
Total	147	646	793

Table 3 – effectiveness of bicycle helmets in reducing head injury

- (a) What are Dr. Mauve’s null and alternative hypotheses?

The SPSS readout is summarised below. NB, for coding purposes, “yes” is coded as 1 and “no” is coded as 2.

Chi-Square Tests

	Value	df	Asymp. Sig. (2- sided)	Exact Sig. (2-sided)	Exact Sig. (1- sided)
Pearson Chi-Square	28.255	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	28.220	1	.000		
N of Valid Cases	793				

- a Computed only for a 2x2 table
b 0 cells (.0%) have expected count less than 5. The minimum expected count is 43.56.

Risk Estimate

	Value	95% Confidence Interval	
		Lower	Upper
Odds Ratio for HEAD	.257	.151	.437
N of Valid Cases	793		

- (b) Summarise the statistical analysis in your own words. What conclusions would you draw from the research?
- (d) How would you interpret the 95% confidence intervals for the Odds Ratio?

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SECTION C - Research Methodology

6. Write short notes on *three* of the following:
 - Randomised Controlled Trials
 - Causality
 - Bias
 - Meta-analysis

7. Outline the advantages and disadvantages of EITHER a retrospective study OR a cross-sectional study. Give an example of a clinical or research question that could be answered by your chosen study.