

Premedical and pre dental course 1997-98
Handling Medical Data
Summer examination May 1998

2 hours
 Answer all questions

1. Write short notes on
- a) the Normal distribution;
 - b) when it is appropriate to use a paired t-test;
 - c) Simpson's paradox.

[15 marks]

2. A clinical trial was performed to compare two methods of stopping bleeding after tonsillectomy, with the following results:

	Ligation	Coagulation	
Unsuccessful	17	24	41
Successful	234	233	467
	251	257	508

What proportion of operations successfully stopped bleeding on the two treatments?

For the table

	Treatment 1	Treatment 2	
Unsuccessful	<i>a</i>	<i>b</i>	<i>n</i> ₁
Successful	<i>c</i>	<i>d</i>	<i>n</i> ₂
	<i>n</i> ₃	<i>n</i> ₄	<i>N</i>

a χ^2 value with one degree of freedom to test the null hypothesis that the proportion of successes is the same on the two treatments may be calculated from the observed and 'expected' values using the formula $\sum \frac{(\text{observed} - \text{expected})^2}{\text{expected}}$. Find the expected values for this table and the χ^2 value for the given data, and obtain limits on the associated P-value using the following table.

<i>P</i>	0.5	0.4	0.3	0.2	0.1	0.05	0.01
χ^2_1	0.46	0.71	1.07	1.64	2.71	3.84	6.64

[15 marks]

3. Use the following MINITAB output to summarise to an appropriate degree of precision the data on systolic blood pressure (in mmHg) which it attempts to describe.

- i) Give the mean and standard deviation.
- ii) Give a range, symmetrical about the mean, within which 95% of the observations in the population would be expected to lie, assuming that the distribution is Normal.
- iii) Give the sample median and quartiles.
- iv) Give an interval, symmetrical about the sample mean, within which you are 95% confident that the population mean lies.

You are reminded that for a Normal variable with mean μ and standard deviation σ , 75% of the population has values below $\mu + 0.675\sigma$.

- v) Below what value will exactly 25% of this population lie?
- vi) If you assumed a Normal distribution for the blood pressure data, and using the above remark and answer to v), what would be your *estimates* of its median and quartiles from the sample mean and standard deviation of the sample.
- vii) By comparing your answers to iii) and vi) comment on the Normality of the distribution of systolic blood pressure.

MTB > print c1

```
C1
146  121  122  121  123  137  105  134  123  133  126
117  117  143  108  127  111  124  123  102  125  136
111  121  117  127  105  140  121  132  123  134  120
124  133  123  135  123  129  120  119  132  132  128
121  124  163  139  159  118
```

Stem-and-leaf of C1 N = 50
Leaf Unit = 1.0

```

1  10 2
4  10 558
6  11 11
11 11 77789
(17) 12 001111112333333444
22 12 567789
16 13 2223344
9 13 5679
5 14 03
3 14 6
2 15
2 15 9
1 16 3
```

MTB > describe c1

	N	MEAN	MEDIAN	TRMEAN	STDEV	SEMEAN
C1	50	125.94	123.50	125.39	11.98	1.69
	MIN	MAX	Q1	Q3		
C1	102.00	163.00	120.00	133.00		

MTB > tint c1

	N	MEAN	STDEV	SE MEAN	95.0 PERCENT C.I.
C1	50	125.94	11.98	1.69	(122.53, 129.35)

[18 marks]

4.

Discuss the main components of a randomized controlled clinical trial, arranged under the headings: i) patient eligibility; ii) treatment allocation; iii) ethical constraints; iv) outcome measurements. Give equal weight to each component and give reasons why each component is needed. While you may illustrate your answers *briefly* using examples you know, note that no credit will be given for extended descriptions of particular trials.

[12 marks]