

Section III: LONG ANSWER QUESTIONS (Answer Any TWO Questions in this section)

*12. In a clinical trial involving 4,396 patients aged 65-74 whose systolic pressure was between 160 and 209 mmHg and whose diastolic pressure was less than 115 mmHg, patients were randomly assigned to initial therapy with a diuretic or a beta-blocker or a matched placebo, and then followed up for an average of 5.8 years. The main objective was to see if a policy of anti-hypertensive treatment reduces the risk of stroke, coronary heart disease and death. The main results are as follows:

	Active treatment		
	Diuretic *	Beta-blocker	Placebo *
No. of patients	1081	1102	2213
Strokes	45	56	134
Coronary events	48	80	159
Deaths	134 ✓	167	315 ✓

Using confidence intervals in both cases, is there significant evidence for there being differences in the risk of:

- Death between those taking diuretic and those taking placebo? (10 marks)
- Stroke between those taking beta-blocker and those taking placebo? (10 marks)

In an anthropometric study to assess the nutritional status of school-going children in a rural community, the average weight of children at 10-years of age was found to be 25.7 kg with a standard deviation of 4.5. Accept these values as population parameters and that weight is normally distributed.

(a) What is the probability that a given 10-year old child in the community will have a weight greater than 24 kg?



$$Z = \frac{24 - 25.7}{4.5} = \frac{-1.7}{4.5} = -0.37777$$

(b) What is the probability that the average weight of 48 10-year olds will lie between 25 and 27 kg?

$$Z = \frac{25 - 25.7}{\frac{4.5}{\sqrt{48}}} = 0.16$$

$$Z = \frac{27 - 25.7}{\frac{4.5}{\sqrt{48}}} = 0.29$$

(c) What minimum weight do 10 year-olds in the community need to have to be in the top 10% of the children by weight? [7 marks]

- Z_{score} of 0.38 = 0.3520;
- Z_{score} of 3.29 = 0.0005;
- Z_{score} of 1.08 = 0.1401;
- Z_{score} of 1.285 = 0.10

- Z_{score} of 1.96 = 0.025;
- Z_{score} of 1.645 = 0.05;
- Z_{score} of 1.645 = 0.05;

LEVEL IV: BIOSTATISTICS
2008

Problem 1

The following are anxiety scores for 10 patients receiving a new drug and a placebo in random order.

Drug	Patient Number									
Patient No.	1	2	3	4	5	6	7	8	9	10
Drug	19	11	14	17	23	11	15	19	11	8
Placebo	22	18	17	19	22	12	14	11	19	7
Difference (d)	-3	-7	-3	-2	1	-1	1	8	-8	1

Is there any evidence of the difference between the drug and placebo in their effect on anxiety? **Yes. Anxiety scores are higher for those with administration of the placebo.**

Problem 2

In a health survey of school children it is found that the mean haemoglobin level of 55 boys is 10.2 per 100 ml, with a standard deviation of 2.1. Can we consider this group as taken from the population with a mean of 11.0 g/100 ml?

Problem 3

The mean level of prothrombin in the normal population is known to be approximately 20 mg/100 ml plasma and a standard deviation is 4 mg/100 ml.

A sample of 40 patients showing vitamin K deficiency has a mean prothrombin level of 18.50 mg/100 ml. How reasonable is it to assume that the true mean for patients with vitamin K deficiency is the same as that for the normal population?

$CI = \text{estimate} \pm R \cdot C \times SEM$ $18.5 \pm 1.96 \times \frac{4}{\sqrt{40}}$ 17.1
 19.74

Problem 4

A clinical trial was undertaken to assess the value of a new method of treatment (A) in comparison with the old treatment (B). The patients were divided into two groups randomly. Of 257 patients treated with A, 41 died of the 244 patients with treatment B, 64 died.

Test for equality of effectiveness of the two treatments, using both the Chi-square and Standard normal deviate (SND) tests of significance.

Problem 5

In a study of the age of menarche in women in a certain community the following statistics were observed for samples of women aged 21 - 30 and 31 - 40 years.

	Women aged 31 - 40	Women ages 21 - 30
Sample size	66	78
Mean	13.88	12.42
Variance	1.924	1.156

Is there any evidence that on average younger women's age of menarche is lower than that of older women?

$(C-1) \times (C-1)$ Obs est

14	Treatment A	10	10.61
52	Treatment B	64.8	10.5
192		120	10.6

Σ

66
78
144
142

6

CAT Mar 2012

A community diagnosis in Kilambu involving a cluster random sample of 500 households found 450 of the households had VIP latrines or toilets.

- what is the proportion of households with no or poor quality toilet facilities?
- write down a 95% CI for the proportion of households with no toilet facilities in this population.

7

CAT May 2013

In a survey on a community living around a factory suspected to be causing air pollution, the no. of hospital visits in the preceding year for the youngest child < 5yrs is recorded for a sample of households as shown below:

HA No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
No. of visits	4	7	6	6	3	7	4	9	5	8	7	8	4	7	9	7	6	4	7	3

- what is the median number of visits?
- calculate the mean, variance, and SD. (use the individual values)
- calculate the standard error of the mean.
- construct a 95% CI for the mean number of hospital visits for the youngest child < 5yrs in the population from which this random sample was drawn.

Note: $t_{.975}(19) = 2.539$; $t_{.975}(19) = 2.8609$; $t_{.975}(19) = 2.093$; $t_{.975}(20) = 2.8453$.

8

CAT Aug 2013

Following an intervention to improve healthier lifestyles, the following diastolic BP levels were recorded in a sample from the comm. under intervention:

Serial no:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
DBP level mmHg	98	87	79	76	92	87	90	79	85	88	77	78	84	79	90	76	86	84	77	89

- what is the mean BP level?
- calculate the mean variance, SD (use the individual values)
- calculate the standard error of the mean
- construct a 95% CI for the mean BP level in the population from which this random sample was drawn.

Monday 8/03/2010

Community Health Group Work

1. In a study of the age of menarche (in women in a certain community the following statistics were observed for samples of women aged 21-30 and 31-40 years. ✓

	Women aged 31-40	Women aged 21-30
Sample size n	66 ✓	78 ✓
Mean \bar{x}	13.88 ✓	12.42 ✓
Variance s^2	1.924 ✓	1.156 ✓

Is there any evidence that on average younger women's age of menarche is lower than that of older women?

2. The average duration of leprosy is 15 years. If the incidence rate of leprosy is 8 cases per 10,000 population, what is the prevalence?

$$\frac{8}{10,000} \times 15 = 120 \text{ per } 10,000$$

Differentiate between:

3. In 1945, there were 1,000 women who worked in a factory painting radium dials on watches. The incidence of bone cancer in these women up to 1975 was compared to that of 1,000 women who worked as telephone operators in 1945. Twenty of the radium dial painters and four of the telephone operators developed bone cancer between 1945 and 1975.

- What study design is this? (2 marks)
- Present the results in a 2x2 table. (2 marks)
- Calculate and compare the incidence rates of bone cancer in the two groups of women. (6 marks)
- How much more at risk of bone cancer was it for one exposed to radium dial painting than one not exposed? (5 marks)
- How much of bone cancer could be prevented if there was no radium dial painting? (5 marks)

Fasting blood glucose levels (FBGL) are measured on a random sample of 81 clients attending a wellness clinic with the following results:

$$\bar{x} = 5.2 \text{ g/dl}; \quad s^2 = 27.5 \text{ g/dl}^2$$

- a) Calculate the standard error of the mean (2 marks)
- b) Construct a 95% confidence interval for the mean FBGL in the population from which this sample was drawn. (3 marks)

Note: $t_{.975}(80) = 1.9901$

1. Suppose it is known that 10 percent of a certain population is color blind. If a random sample of 25 people is drawn from this population, find the probability that:

- (a) Three or fewer will be color blind (3 marks)
- (b) Four or more will be color blind (2 marks)

2. If the mean number of serious accidents per year in a large factory (where the number of employees remains constant) is five, find the probability that in the current year there will be:

- (a) No accidents
- (b) One accident
- (c) Two or more

3. The probability of experiencing moderate to severe side-effects with a new drug is 0.03. If 200 people take the new drug then:

- (a) What is the probability that more than 8 people will experience moderate to severe side-effects?
- (b) What is the probability that the observed proportion of patients (in the 200) experiencing moderate to severe side-effects is less than 0.01?
- (c) If the number of patients experiencing moderate to severe side-effects is distributed as a Poisson count with a mean of 3, what is the probability that 2 or more people will experience moderate to severe side-effects?