



UNIVERSITY EXAMINATIONS

SECOND SEMESTER 2023/2024 ACADEMIC YEAR

**FOURTH YEAR EXAMINATION FOR THE DEGREE OF
BACHELOR OF SCIENCE (STATISTICS)**

STAT 418: BIOMETRIC METHODS

STREAM: R

TIME: 2 HRS

DAY: THURSDAY [11.30AM – 1.30 PM] DATE: 11/04/2024

THIS QUESTION PAPER CONSISTS OF FIVE (5) PAGES

PLEASE DO NOT OPEN UNTIL THE INVIGILATOR SAYS SO



Instructions: Answer Question One (compulsory) and any Other two questions

- **Show your working clearly**
- **Write your registration number before you open the answer booklet**

QUESTION ONE (30 MARKS)

- a) A 20 year cohort study of British male physicians noted that the proportion per year who died from lung cancer was 0.00140 for cigarette smokers and 0.00010 for non smokers. The proportion who died from the coronary heart disease was 0.00669 for smokers and 0.00413 for non smokers.
- i) Describe the association of smoking with lung cancer and heart disease using the difference of proportion, relative risk, and odds ratio relative risk, and odds ratio **(6 Marks)**
- ii) Which response is more strongly related to cigarette smoking in terms of the reduction in number of deaths that would occur with elimination of cigarettes. **(2 Marks)**
- b) Explain the following design configurations
- parallel design **(4 Marks)**
 - cross over design designs **(4 Marks)**
- c) Explain the difference between clinical outcomes and a surrogate markers. **(4 Marks)**
- d) State the surrogate markers and Clinical endpoints for the following diseases
- Cardiovascular disease **(2 Marks)**
 - Cancer **(2 Marks)**
 - HIV/AIDS **(2 Marks)**
- e) Suppose we want to detect a difference in mean response of 20 units between two treatments with 90% power using a t-test (two-sided) at the .05 level of significance. wanted to find the sample size necessary. Compute the sample size required given that population standard deviation of response σ_Y is approximated to be about 50 units. **(4 Marks)**



QUESTION TWO (20 MARKS)

- a) Explain how randomization is undertaken in clinical trials **(4 Marks)**
- b) State the advantages and disadvantages of randomization **(8 Marks)**
- c) A clinical trial was conducted for calcium intake in patients with three cases, normal bone density, Osteopenia and Osteoporosis. The results are given below.

Normal Bone Density	Osteopenia	Osteoporosis
1200	1000	890
1000	1100	650
980	700	1100
900	800	900
750	500	400
800	700	350

Is there a statistically significant difference in mean calcium intake in patients with normal bone density as compared to patients with osteopenia and osteoporosis? **(8 Marks)**

QUESTION THREE (20 MARKS)

- a) State the factors to consider in selecting a primary variable **(6 Marks)**
- b) The data set consists of 13 children enrolled in a trial to investigate the effects of two bronchodilators in the treatment of asthma. The outcome variable is peak Expiratory Flow Rate (liters per minute) and was measured eight hours after treatment. There as a one-day washout period between treatment periods.



Patient No	patient sequence	salbutamol	formoterol
1	FS	270	310
2	SF	370	385
3	SF	310	400
4	FS	260	310
5	SF	380	410
6	FS	300	370
7	FS	390	410
8	SF	290	320
9	FS	210	250
10	FS	350	380
11	SF	260	340
12	SF	90	220
14	FS	365	330

Perform an analysis of variance using the test

(14 Marks)

QUESTION FOUR (20 MARKS)

a) Explain the terms

(i) Power of a test

(2 Marks)

(ii) Type one error

(2 Marks)

b) Explain the main features of the stages of clinical trials

(8 Marks)

c) Explain what is meant by group sequential design

(4 Marks)

d) Explain the importance of protocol document in research

(2 Marks)



QUESTION FIVE (20 MARKS)

a) In a case-control study conducted by Doll and Hill, there were 120 females. There were 60 females with lung cancer, and 41 of these admitted to smoking. There were 60 females without cancer, and 28 of these admitted to smoking.

i) Calculate the odds ratio for the association between smoking and lung cancer in women, rounding off to two decimal places. **(4 Marks)**

ii) interpret this odds ratio obtained **(2 Marks)**

b) A clinical trial is run to compare the weight loss. Programs and participants are randomly assigned to one of the comparison programs and are counseled on the details of the assigned program. Participants follow the assigned program for 8 weeks. The outcome of interest is weight loss, defined as the difference in weight measured at the start of the study (baseline) and weight measured at the end of the study, measured in pounds. Three popular weight loss programs are considered. The first is a low calorie diet. The second is low fat diet, and the third is low carbohydrate diet. For comparison purposes, a fourth group is considered a control group.

The results are given below:

Low calorie	Low Fat	Low Carbohyfrate	Control
8	2	3	2
9	4	5	2
6	3	4	-1
7	5	2	0
3	1	3	3

Is there a statistical difference in the mean weight loss among the four diets? **(14 Marks)**

