BINDURA UNIVERSITY OF SCIENCE EDUCATION

Msc Natural Resources/ Msc Climate Change

MCS511/ MG512: ADVANCED RESEARCH METHODS AND STATISTICS

Time: 3 hours

Candidates may attempt THREE questions. Not more than TWO questions may be answered from each section.

SECTION A

Candidates may attempt at most **TWO** questions being careful to number 1 to 2

1. (a) Define the following terms.

   i. Descriptive Statistics. [2]

   ii. Inferential Statistics. [2]

   iii. Hypothesis. [2]

   (b) The following table shows three different airlines row variable and the number of delayed or on-time flights column variable from flightstats.com.

	Delayed	On time	Total
American	112	843	955
South West	114	1416	1530
United	61	896	957
Total	287	3155	3442

   Does on-time performance depend on airline? [12]

   (c) A study was conducted to investigate how effective a new diet was in lowering cholesterol. Results for the randomly selected subjects are shown in the table. The differences have a normal distribution. Are the subjects' cholesterol levels lower on average after the diet? Test at the 5% level whether or not the new diet is efefctive in reducing cholesterol. [7]

Subject	A	B	C	D	E	F	G	H	I
Before	209	210	205	198	216	217	238	240	222
After	199	207	189	209	217	202	211	223	201

2. (a) The training manager of a company that assembles and exports pool pumps wants to know if there is a link between the number of hours spent by assembly workers in training and their productivity on the job. A random sample of 10 assembly workers was selected and their performances evaluated. The results are:

Person	A	B	C	D	E	F	G	H	I	J
Training hours	20	36	20	38	40	33	32	28	40	24
Output	40	70	44	56	60	48	62	54	63	38

    i. Plot a scatter diagram for the data and comment. [2]

    ii. Calculate the correlation coefficient for the data and comment the result. [5, 2]

    iii. Calculate the regression line. [5]

    iv. Estimate the output from '41', '54' and '55' training hours. [3]

    v. Test the significance of the regression line. [8]

SECTION B

Candidates may attempt at most **TWO** questions being careful to number 3 to 5

3. (a) Suppose you are manufacturing concrete cylinders for, say, bridge supports.There are three ways of drying green concrete (say A, B, and C), and you want to find the one that gives you the best compressive strength. The concrete is mixed in batches that are large enough to produce exactly three cylinders, and your production engineer believes that there is substantial variation in the quality of the concrete from batch to batch. A randomised block design was used with 5 batches of green concrete. Test to see if the three drying techniques are equivalent, in terms of conferring compressive strength. Test also if the batches are equivalent.

			Batch			
Treatment	1	2	3	4	5	Treatment Total
A	52	47	44	51	42	...
B	60	55	49	52	43	...
C	56	48	45	44	38	...
Batch Total	....	....	....	....	....	...

[15]

   (b) List the main steps of research process. [5]

   (c) List the main components of a research problem. [5]

4. (a) Discuss some steps that the researchers can take to deal with ethical dilemmas in research [10]

   (b) State and explain some ethical principals that various codes in research ethics address. [15]

5. (a) Explain the following types of research designs.

     i. Exploratory research Design. [4]

     ii. Descriptive and diagnostic research design. [4]

     iii. Hypothesis testing research design. [4]

   (b) State and explain three main qualities of a researcher. [5]

   (c) Distinguish between the following terms.

     i. Conceptual vs Empirical Research. [4]

     ii. Qualitative vs Quantitative Research. [4]