

Advanced Statistics (DS2003)

Date: April 3rd 2024

Course Instructor(s)

Dr. Muhammad Ahmad Raza

Sessional-II Exam

Total Time (Hrs): 1

Total Marks: 60

Total Questions: 3

22L-7518
Roll No

BSDS-4C
Section

H. Khatib
Student Signature

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Attempt all the questions.

CLO #3: CLO statement for questions Q1 and Q2

Analyze the results of different forms of hypothesis tests, and make an informed decision based on sample statistics.

Q1: Fifteen adult males between the ages of 35 and 50 participated in a study to evaluate the effect of diet and exercise on blood cholesterol levels. The total cholesterol was measured in each subject initially and then three months after participating in an aerobic exercise program and switching to a low-fat diet. The data are shown in the accompanying table. Do the data support the claim that low-fat diet and aerobic exercise reduce the mean blood cholesterol levels? Assume that the populations of blood cholesterol levels are normally distributed and use a significance level $\alpha = 0.05$.

[Marks: 20]

Blood Cholesterol Level			
Subject	Before	After	
1	265	229	
2	240	231	
3	258	227	
4	295	240	
5	251	238	
6	245	241	
7	287	234	
8	314	256	
9	260	247	
10	279	239	
11	283	246	
12	240	218	
13	238	219	
14	225	226	
15	247	233	

$$H_1: \mu_1 - \mu_2 < 0$$

$$H_0: \mu_1 - \mu_2 \geq 0$$

$$T = \frac{\bar{d} - d_0}{s/\sqrt{n}}$$

$$\bar{d} = \frac{\sum d_i}{N}$$

Page 1 of 2

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Q2: A study was made to determine if the subject matter in a physics course is better understood when a lab constitutes part of the course. Students were randomly selected to participate in either a 3 credit hours course without labs or a 4 credit hours course with labs. (In the section with labs, 11 students made an average grade of 85 with a sample standard deviation of 4.7, and in the section without labs, 17 students made an average grade of 79 with a sample standard deviation of 6.1. Would you say that the laboratory course increases the average grade by as much as 8 points? Use a 0.05 level of significance and assume the populations to be approximately normally distributed with equal variances.

$$H_1: \mu_1 \neq \mu_2$$

CLO #4: CLO statement for question Q3

Build a greater understanding, theoretical foundation, and tools for applying the linear regression model. With a practical focus, he/she explores the workings of multiple regression and problems that arise in applying it, as well as going deeper into the theory of inference underlying regression and most other statistical methods. Moreover, he/she will be able to understand the new types of models for binary data, emphasizing the need to fit appropriate models to the underlying processes generating the data being explained.

Q3: The data shown in the following table are highway gasoline mileage performance, measured in miles per gallon (MPG), and engine displacement (a vehicular parameter) for a sample of 20 cars. Solve the following parts: [Marks: 10+10=20]

- Fit a simple linear model relating highway miles per gallon (y) to engine displacement (x) using the method of least squares.
- Find an estimate of the mean highway gasoline mileage performance for a car with 150 cubic inches engine displacement.

$\hat{y} = \underline{\hspace{2cm}}$

Make	Model	(y) MPG (highway)	Engine Displacement (in ³) (x)	Make	Model	(y) MPG (highway)	Engine Displacement (in ³) (x)
Acura	Legend	30	97	Ford	Taurus	27	153
BMW	735i	19	209	Ford	Tempo	33	90
Buick	Regal	29	173	Honda	Accord	30	119
Chevrolet	Cavalier	32	121	Mazda	RX-7	23	80
Chevrolet	Celebrity	30	151	Mercedes	260E	24	159
Chrysler	Conquest	24	156	Mercury	Tracer	29	97
Dodge	Aries	30	135	Nissan	Maxima	26	181
Dodge	Dynasty	28	181	Oldsmobile	Cutlass	29	173
Ford	Escort	31	114	Plymouth	Laser	37	122
Ford	Mustang	25	302	Pontiac	Grand Prix	29	173