

Primary test for Regression Analysis course

Open textbook , Feb. 24, 2002 2:10pm- 4:10pm

Grade: 12.5 points for each question, No. 9 is option

- 1 .The mean grade point average of the engineering majors at a the National ChungHsing university is 80.5, with a standard deviation of 18.0. In a class of 48 students, find the probability that the mean grade point average of the students is less than 77.5.
- 2 . A survey found that women over the age of 55 consume an average of 1660 calories a day. In order to see if the number of calories consumed by women over age 55 in assisted-living residences is the same, a researcher sampled 43 women over the age of 55 in a large assisted-living facility and found the mean number of calories consumed was 1446. The standard deviation of the sample is 56 calories. At $\alpha=0.05$, test the claim that there is no difference between the number of calories consumed by the residents and that consumed by other women over55.
- 3 .A student suspected the average cost of a Saturday night date was no longer \$ 30.00. To test her hypothesis, she randomly selected 16 men from the dormitory and asked them how much they spent on a date last Saturday. She found that the average cost was \$ 31.5 . The standard deviation of the sample was \$ 6.0. At $\alpha=0.05$, is there enough evidence to support her claim?
- 4 .In a study of women science majors, these data were obtained on two groups, those who left their profession within a few months after graduation (leavers) and those who remained in their profession after they graduated (stayers) . Test the claim that those who stayed had a higher science grade point average than those who left. Use $\alpha=0.05$.

<u>Leavers</u>	<u>Stayers</u>
$\bar{X}_1 = 3.15$	$\bar{X}_2 = 3.30$
$s_1 = 0.52$	$s_2 = 0.46$
$n_1 = 103$	$n_2 = 225$

- 5 .A researcher suggests that male nurses earn more than female nurses. A survey of 16 male nurses and 20 evidence to support the claim that male nurses earn more than female nurses? Use $\alpha=0.05$

<u>Male</u>	<u>Female</u>
$\bar{X}_1 = \$ 23,800$	$\bar{X}_2 = \$ 23,750$

$$\begin{array}{rcl} s_1 = \$ 300 & & s_2 = \$ 250 \\ n_1 = 16 & & n_2 = 20 \end{array}$$

6 .Researchers have long been interested in the effects of alcohol on the human body. The authors of the paper “Effects of Alcohol on Hypoxia” (J. Amer. Med. Assoc. (December 13, 1965 : 135) examined the relationship between alcohol intake and the time of useful consciousness during high-altitude flight. Ten male subjects were taken to perform test. The time at which useful consciousness ended was recorded. Three days later, the experiment was repeated. The time (in seconds) of useful consciousness was again recorded. The resulting data appears below.

Time			
Subject	No Alcohol	Alcohol	Difference
1	261	185	76
2	565	375	190
3	900	310	590
4	630	240	390
5	280	215	65
6	365	420	-55
7	400	405	-5
8	735	205	530
9	430	255	175
10	900	900	0

Please explain how to use the paired t test to determine whether the effect of alcohol on the time?

7 .The authors of the paper “Age, Spacing and Growth Rate of Tamarix as an Indication of Lake Boundary Fluctuations at Sebkheth Kelbia, Tunisia” (J. Arid Environ. (1982) : 43-51) used a simple linear regression model to describe the relationship between $y = \text{vigor}$ (average width in centimeters of last two annual rings) and $x = \text{stem}$ (stems/ m^2) . Data on which the estimated model was based is as follows.

x	4	5	6	9	14	15	15	19	21	22
y	.75	1.20	.55	.60	.65	.55	0	.35	45	.40

a. Summary quantities are $\sum x = 130$, $\sum x^2 = 2090$, $\sum y = 5.5$, $\sum y^2 = 3.875$,

and $\sum xy = 59.95$. Find the estimated regression line.

b. What is your estimate of the average change in vigor associated with a 1-unit increase in stem density?

- c. What would you predict vigor to be for a plant whose density was 17 stems/ m^2 ?
 d. Would you use the estimated regression line from (a) to predict vigor when density was 30 stems/ m^2 ? Why or why not?

8 .Land-treatment wastewater-processing systems work by removing nutrients and thereby discharging water of better quality. The land used is often planted with a crop such as corn because plant uptake removes nitrogen from the water and sale of the crop helps reduce the costs of wastewater treatment. The concentration of nitrogen in the treated water was observed from 1975 to 1979 under wastewater application rates of none, .05 m/week, and .1 m/week. A partially completed ANOVA was performed with the 5 year serving as blocks. A partially completed ANOVA table is given (“Quality of Percolate Water After Treatment of a Municipal Wastewater Effluent by a Crop Irrigation System” J. Environ. Quality (1984) : 256-64) .

Source of Variation	df	Sum of Squares	Mean Square	F
Treatments	2	1835.2		
Blocks	4			
Error		206.1		
Total	14	2134.1		

- a. Complete the ANOVA table.
 b. Is there sufficient evidence to reject the null hypothesis of no difference between the true mean nitrogen concentrations for the three application rates? Use $\alpha = 0.05$.

9. (Option) Three ultrasonic devices (factor A, with levels 20, 30, and 40 kHz) were tested for effectiveness under two test conditions (factor B, with levels plentiful food supply and restricted food supply) . Daily food consumption was recorded for three rats under each factor level combination for a total of 18 observations. Data compatible with summary values given in the paper “Variables Affecting Ultrasound Repellency in Philippine Rats” (J. Wildlife Mgmt. (1982) : 148-55) was used to obtain the sums of squares given in the ANOVA table below. Complete the table and use it to test the relevant hypotheses.

Source of Variation	df	Sum of Squares	Mean Square	F
A main effects		4206		
B main effects		1782		
AB interaction				
Error		2911		
Total		10,846		