Inferential statistics

Section No. (6)

Chapter (4): Linear Regression

Presented by

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Choose the correct answer.

Suppose we are concerned with the nature of the relationship between the price of a product and its quantity demand per month the data obtained is assumed to follow the normal distribution.

Price	22	17	15	19	24	18	16
Demand	45	52	55	46	44	50	61

1) The appropriate correlation coefficient between the price of a product and its quality demand

a) Cramer	b) spearman	c) chi-square	d) Pearson

2) The correlation coefficient between the price of a product and its quality demand =

a) 0.08	b) 0.87	c) 0.97	d) -0.85

3) The direction and strength of the relation between two variables

a) positive weak	b) positive strong	c) negative weak	d) negative strong

4) The value of the regression coefficient (slope)($\hat{B}_1$) =

a) 1.59	b) 80.27	c) -80.27	d) -1.59

5) The value of intercept ($\hat{B}_0$) =

a) 1.59	b) 80.27	c) -80.27	d) -1.59

6) Which of the following in the regression equation represents how much Y changes when X changes by one unit, and its sign denotes the direction of the relation?

a) intercept	b) regression coefficient	c) coefficient of determination	d) correlation coefficient

7) The percentage of the dependent variable variation that is explained by the independent variable (X) is

a) 71.4%	B) 85%	c) 97%	d) 0.85

8) What is the quality demand predicted when the price is 20?

a) 48.37	b) 80.27	c) 30.27	d) 1.59

9) To test the significance of the model, State the null and alternate hypothesis

a) $H0: \beta_1 = 0$ $H1: \beta_1 \neq 0$	b) $H0: \rho = 0$ $H1: \rho \neq 0$
c) $H0: \beta_i \neq 0$ $H1: \beta_i = 0$	d) $H0: \beta_i = 0 , H1: \beta_i \neq 0$

10) Total sum of squares (SSTO) =

$$SSTO = (n-1) * S_y^2$$

a) 1.59	b) 80.27	c) -80.27	d) 225.71

11) The sum squares of regression (SSR) =

$$SSR = \left(\hat{B}_1\right)^2 * (n-1) * S_x^2$$

a) 1.59	b) 80.27	c) -80.27	d) 161.28

12) The sum squares of residuals or error (SSE) =

$$SSE = SSTO - SSR$$

a) 1.59	b) 80.27	c) -80.27	d) 64.43

13) The mean squares of regression (MSR) =

$$MSR = SSR/df =$$

a) 1.59	b) 80.27	c) -80.27	d) 161.28

14) The mean squares of residuals or error (MSE) =

$$MSE = SSE/n - p - 1 =$$

a) 1.59	b) 80.27	c) -80.27	d) 12.886

15) Choose the appropriate test to test if a linear regression model is significant

a) t-distribution	b) chi-square	c) F-distribution	d) Z-distribution

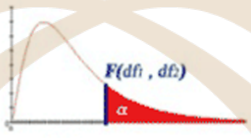
16) The value of the test statistics for the test significance of a linear model

$$F = \frac{MSR}{MSE} = \frac{161.28}{12.886} = 12.52$$

a) 0.095	b) 0.5	c) 0.95	d) 12.52

1) The critical value for the test significance of a linear model

جدول توزيع F (F Distribution Table) عند مستوى معنوية $(\alpha = 0.05)$



		Degree of Freedom for the Numerator $df(1)$														
		1	2	3	4	5	6	7	8	9	10	12	15	20	30	40
Denominator $df(2)$	1	161	200	216	225	230	234	237	239	241	242	244	246	248	250	251
	2	18.5	19.0	19.2	19.2	19.3	19.3	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.5	19.5
	3	10.1	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.74	8.70	8.66	8.62	8.59
	4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.91	5.86	5.80	5.75	5.72
	5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.68	4.62	4.56	4.50	4.46
	6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.00	3.94	3.87	3.81	3.77
	7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.57	3.51	3.44	3.38	3.34
	8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.28	3.22	3.15	3.08	3.04
	9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.07	3.01	2.94	2.86	2.83
	10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.91	2.85	2.77	2.70	2.66
	11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.79	2.72	2.65	2.57	2.53
	12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.69	2.62	2.54	2.47	2.43
	13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.60	2.53	2.46	2.38	2.34

a) 0.095	b) 0.5	c) 0.95	d)6 .61

17) The decision rule is

a) linear model is significant	b) linear model not significant

- **In a study of the relation between the number of police and the number of crimes, the following data was obtained assuming data follows normal distribution and level of significant 0.05**

No. of police	10	8	4	3	5	6
No. of crimes	1	3	9	7	6	4

1) The correlation coefficient between the number of police and the number of crimes

a) 0.93	b) -0.93	c) 11.18	d) -1.03

2) The value of the regression coefficient (slope)($\hat{B}_1$) =

a) 1.59	b) 80.27	c) -1.03	d) -1.03

3) The value of intercept ($\hat{B}_0$) =

a) 1.59	b) 11.18	c) -80.27	d) -1.59

4) Which of the following determines the goodness of fit of the regression model to represent the data or how well the model fits the data?

a) intercept	b) regression coefficient	c) coefficient of determination	d) correlation coefficient

5) The percentage of the dependent variable variation that is explained by the independent variable (X) is

a) 71.4%	B) 86%	c) 97%	d) 0.58

6) What are the predicted numbers of crimes when the number of police is 2 persons?

a) 9.11	b) 80.27	c) 30.27	d) 1.59

7) To test the significance of the regression coefficient, State the null and alternate hypothesis

a) $H0: \beta_1 = 0$ $H1: \beta_1 \neq 0$	b) $H0: \beta_0 = 0$ $H1: \beta_0 \neq 0$
c) $H0: \beta_1 \neq 0$ $H1: \beta_1 = 0$	d) $H0: \beta_i = 0$ $, H1: \beta_i \neq 0$

8) Choose the appropriate test to test if a regression coefficient is significant

a) t-distribution	b) chi-square	c) F-distribution	d) Z-distribution

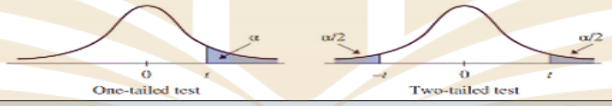
9) The value of the test statistics for the test significance of a regression coefficient

$$t = \frac{\hat{B}_1}{SE(\hat{B}_1)} = SE(\hat{B}_1) = \sqrt{\frac{MSE}{(n-1)*S_x^2}} = -4.9$$

a) 0.095	b) 9.01	c) 0.3	d) -4.9

10) The critical value for the test significance of a regression coefficient

t-distribution table



Degree of Freedom (df)	Confidence Intervals					
	0.20	0.10	0.05	0.02	0.01	0.001
	Level of significance for One-Tailed Test (Alpha)					
	0.10	0.05	0.02	0.01	0.001	0.0005
	Level of significance for Two-Tailed Test (Alpha)					
	0.20	0.10	0.05	0.02	0.01	0.001
1	3.0777	6.3138	12.7062	31.8205	63.6567	636.6192
2	1.8856	2.9200	4.3027	6.9646	9.9248	31.5991
3	1.6377	2.3534	3.1824	4.5407	5.8409	12.9240
4	1.5332	2.1318	2.7764	3.7469	4.6041	8.6103
5	1.4759	2.0150	2.5706	3.3649	4.0321	6.8688
6	1.4398	1.9432	2.4469	3.1427	3.7074	5.9588
7	1.4149	1.8946	2.3646	2.9980	3.4995	5.4079
8	1.3968	1.8595	2.3060	2.8965	3.3554	5.0413
9	1.3830	1.8331	2.2622	2.8214	3.2498	4.7809
10	1.3722	1.8125	2.2281	2.7638	3.1693	4.5869
11	1.3634	1.7959	2.2010	2.7181	3.1058	4.4370
12	1.3562	1.7823	2.1788	2.6810	3.0545	4.3178
13	1.3502	1.7709	2.1604	2.6503	3.0123	4.2208
14	1.3450	1.7613	2.1448	2.6245	2.9768	4.1405

a) 0.095	b) 9.01	c) 0.3	d) 2.77

11) The decision rule is

a) regression coefficient is significant	b) linear model not significant

12) The lower and upper limit of a regression coefficient

$$\hat{B}_1 \pm t(\alpha, n-2) * SE(\hat{B}_1)$$

a) $-0.4383 < \hat{B}_1 < -1.611$

13) To test the significance of the intercept, State the null and alternate hypothesis

a) $H0: \beta_0 = 0$ $H1: \beta_0 \neq 0$	b) $H0: \beta_0 = 0$ $H1: \beta_0 \neq 0$
c) $H0: \beta_0 \neq 0$ $H1: \beta_0 = 0$	d) $H0: \beta_i = 0$ $, H1: \beta_i \neq 0$

14) Choose the appropriate test to test if an intercept is significant

a) t-distribution	b) chi-square	c) F-distribution	d) Z-distribution

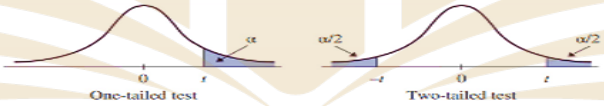
15) The value of the test statistics for the test significance of the intercept

$$t = \frac{\hat{B}_0}{SE(\hat{B}_0)} = SE(\hat{B}_0) = \sqrt{\frac{MSE * \sum x^2}{n(n-1) * S_x^2}} = 124.18$$

a) 0.095	b) 9.01	c) 0.3	d)124.18

16) The critical value for the test significance of the intercept

t-distribution table



Degree of Freedom (df)	Confidence Intervals					
	0.20	0.10	0.05	0.02	0.01	0.001
	Level of significance for One-Tailed Test (Alpha)					
	0.10	0.05	0.02	0.01	0.001	0.0005
	Level of significance for Two-Tailed Test (Alpha)					
	0.20	0.10	0.05	0.02	0.01	0.001
1	3.0777	6.3138	12.7062	31.8205	63.6567	636.6192
2	1.8856	2.9200	4.3027	6.9646	9.9248	31.5991
3	1.6377	2.3534	3.1824	4.5407	5.8409	12.9240
4	1.5332	2.1318	2.7764	3.7469	4.6041	8.6103
5	1.4759	2.0150	2.5706	3.3649	4.0321	6.8688
6	1.4398	1.9432	2.4469	3.1427	3.7074	5.9588
7	1.4149	1.8946	2.3646	2.9980	3.4995	5.4079
8	1.3968	1.8595	2.3060	2.8965	3.3554	5.0413
9	1.3830	1.8331	2.2622	2.8214	3.2498	4.7809
10	1.3722	1.8125	2.2281	2.7638	3.1693	4.5869
11	1.3634	1.7959	2.2010	2.7181	3.1058	4.4370
12	1.3562	1.7823	2.1788	2.6810	3.0545	4.3178
13	1.3502	1.7709	2.1604	2.6503	3.0123	4.2208
14	1.3450	1.7613	2.1448	2.6245	2.9768	4.1405

a) 0.095	b) 9.01	c) 0.3	d)2.77

17) The decision rule is

a) the intercept is significant	b) linear model not significant

18) The lower and upper limit of intercept

$$\hat{B}_0 \pm t(\alpha, n-2) * SE(\hat{B}_0)$$

a) $10.93 < \hat{B}_0 < 11.4$

- To study the relationship between the number of study hours, the number of lectures, and degrees, we selected a random sample of third-year students at the Faculty of Commerce University of Sadat City. We assume the data follow a normal distribution, with a significance level 0.05.

Regression

Correlations

		degrees	study_hours	lectures
Pearson Correlation	degrees	1.000	.237	.758
	study hours	.237	1.000	.313
	lectures	.758	.313	1.000
Sig. (1-tailed)	degrees	.	.326	.040
	study hours	.326	.	.273
	lectures	.040	.273	.
N	degrees	6	6	6
	study hours	6	6	6
	lectures	6	6	6

Model	R	R Square	Std. Error of the Estimate
1	.758[a]	.574	1.95107

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15.413	2	7.707	2.025	.278[b]
	Residual	11.420	3	3.807		
	Total	26.833	5			

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	3.220	2.520		1.278	.291	-4.800	11.240
	study hours	-5.175	.445	.000	.000	1.000	-1.415	1.415
	lectures	.680	.356	.758	1.911	.152	-.452	1.812

1) The value of the regression coefficient of study hours ($\hat{B}_1$) =

a) 1.59	b) 80.27	c) -1.03	d) -5.175

2) The value of intercept ($\hat{B}_0$) =

a) 1.59	b) 3.22	c) -80.27	d) -1.59

3) The value of the regression coefficient of lectures ($\hat{B}_2$) =

a) 1.59	b) 80.27	c) -1.03	d) 0.683

4) coefficient of determination

a) 1.59	b) 80.27	c) -1.03	d) 0.574

5) The decision rule to test the significance of intercept is

a) the intercept is significant	b) the intercept is not significant

6) The decision rule to test the significance of the regression coefficient ($\hat{B}_1$) is

a) regression coefficient is significant	b) regression coefficient not significant

7) The decision rule to test the significance of the regression coefficient ($\hat{B}_2$)is

a) regression coefficient is significant	b) regression coefficient not significant

8) The decision rule to test the significance of the regression model is

a) regression coefficient is significant	b) linear model not significant

9) The lower and upper limit of intercept

a) $-4.8 < \hat{B}_0 < 11.2$

10) The lower and upper limits of ($\hat{B}_1$)

a) $-1.4 < \hat{B}_1 < 1.4$

11) The lower and upper limit of ($\hat{B}_2$)

a) $-0.45 < \hat{B}_2 < 1.8$