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MAY 2022- ENDSEM EXAM
T.Y. B. TECH. (MECHANICAL) (SEMESTER - II)
COURSE NAME: DATA ANALYTICS
COURSE CODE: MEUA32181D
(PATTERN 2018)

Time: [1 Hr] [Max. Marks: 30]

Instructions to candidates:
1) **Figures to the right indicate full marks.**
2) **Use of scientific calculator is allowed**
3) **Assume suitable data where ever required**

Q. 1 a) Use the data given to test the following hypotheses. Find statistical conclusions for $\alpha =$ 0.05. Pl. comment on the statistical conclusion for $\alpha = 0.1$. $H_0: \mu = 4.30$, $H_a: \mu < 4.30, \bar{x} = 4.156, n = 32, \sigma = 0.574$ [4]

b) A survey of the morning beverage market shows that the primary breakfast beverage for 17% of peoples is milk. A milk producer in a particular city 'ABC', where milk is plentiful, believes the figure is higher for 'ABC'. To test this idea, a random sample of 550 'ABC' residents is taken and they are asked which primary beverage they consumed for breakfast that day. Suppose 115 replied that milk was the primary beverage. Using a level of significance of 0.05, test the idea that the milk figure is higher for 'ABC'. [6]

OR

b) Construct a 95% confidence interval to estimate the difference in the mean gas mileage between the cars using regular gasoline and the cars using premium gasoline for the following given data. [6]

Regular	Premium
$n_r = 50$	$n_p = 50$
$\bar{x}_r = 21.45$	$\bar{x}_p = 24.6$
$\sigma_r = 3.46$	$\sigma_p = 2.99$

Q. 2 a) Describe the following factorial design. How many independent variables are there? How many levels are there for row and column treatments? Compute all degrees of freedom for row, column, interaction, error, and total. Each data value is represented by an x. [4]

	Variable 1			
Variable 2	x_{111}	x_{121}	x_{131}	x_{141}
	x_{112}	x_{122}	x_{132}	x_{142}
	x_{113}	x_{123}	x_{133}	x_{143}
	x_{211}	x_{221}	x_{231}	x_{241}
	x_{212}	x_{222}	x_{232}	x_{242}
	x_{213}	x_{223}	x_{233}	x_{243}

b) Determine the equation of the regression line and calculate the standard error of the estimate. [6]

x	12	21	28	8	20
y	17	15	22	19	24

OR

b) A company has three manufacturing plants, and company officials want to determine whether there is a difference in the average age of workers at the three locations. The following data are the ages of three randomly selected workers at each plant. Perform a one-way ANOVA to determine whether there is a significant difference in the mean ages of the workers at the three plants. Use $\alpha = 0.01$ and note that the sample sizes are equal. [6]

Plant (Employee Ages)		
1	2	3
30	31	24
27	34	25
28	30	26

Q. 3 a) Using the following data, determine the equation of the regression model. How many independent variables are there? Comment on the meaning of these regression coefficients. Determine the predicted value of y for $x_1 = 11$, $x_2 = x_3 = 0$, and $x_4 = 6$. [4]

Predictor	Constant	x_1	x_2	x_3	x_4
Coefficient	380	-0.24	34.6	0.88	-0.032

b) Study the following Excel multiple regression output. How many predictors are in this model? What is the equation of the regression line? Discuss the strength of the model in terms of F. Which predictors, if any, are significant? Why or why not? Comment on the overall effectiveness of the model for $\alpha = 0.01$. [6]

R Square	0.663
Adjusted R Square	0.636
Standard Error	51.761

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	131567.02	65783.51	24.55	0.0000013
Residual	25	66979.65	2679.19		
Total	27	198546.68			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	203.3937	67.518	3.01	0.0059
X_1	1.1151	0.528	2.11	0.0448
X_2	−2.2115	0.567	−3.90	0.0006

OR

b) Using the equation of the regression line from the above Excel regression output, attempt to predict the output when the dependent variable takes values of 50 and 60, respectively. Use the data in the model as is. Comment on the t tests of the regression coefficients, and the values of standard error (se), R^2, and adjusted R^2. [6]

Areas under the one-tailed standard normal curve

Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990

F table values

$F_{0.01,2,6}$	$F_{0.01,6,7}$	$F_{0.01,7,6}$	$F_{0.01,8,7}$	$F_{0.01,7,8}$
10.92	7.19	8.26	6.84	6.18