



Practice Set – VIII

Sub: Statistical Methods & Data Analysis (MA 231)

1. The number of kilograms of steam used per month by a chemical plant is thought to be related to the average ambient temperature (in °C) for that month. The past year's usage and temperatures are shown in the following table:

Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Temp.	-6	-4	0	8	10	15	20	23	17	10	5	-1
Usage/ 1000	84.27	97.28	130.65	192.70	206.19	244.49	281.93	306.20	254.93	205.44	167.81	124.28

Assuming that a simple linear regression model is appropriate, fit the regression model relating steam usage to the average temperature. What is the estimate of expected steam usage when the average temperature is 13°C. Also calculate the coefficient of correlation and standard error of estimate.

2. The following table gives experimental values of the pressure P of a given mass of gas corresponding to various values of the volume V . According to thermodynamic principles, a relationship having the form $PV^\gamma = C$, where γ and C are constants, should exist between the variables. Find the values of γ and C . Estimate P when $V = 100 \text{ in}^3$.

$V (\text{in}^3)$	54.3	61.8	72.4	88.7	118.6	194.0
$P (\text{lb} / \text{in}^2)$	61.2	49.5	37.6	28.4	19.2	10.1

3. Read the attached Case problem on *Unemployment Study*. Determine the regression equation that fits the data best. Also calculate the coefficient of correlation and standard error of estimate.
4. An article reported on the use of an optical correlator to perform an experiment by varying brightness and contrast. The resulting modulation is characterized by the useful range of gray levels. The data follow:

Brightness (%)	54	61	65	100	100	100	50	57	54
Contrast (%)	56	80	70	50	65	80	25	35	26
Useful range (ng)	96	50	50	112	96	80	155	144	255

Fit a multiple linear regression model to these data. Predict the useful range when brightness is 90% and contrast is 80%.

5. The following are data on the number of twists required to break a certain kind of forged alloy bar and the percentages of two alloying elements present in the metal:

# Twist	41	49	69	65	40	50	58	57	31	36	44	57	19	31	33	43
% Element A	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
% Element B	5	5	5	5	10	10	10	10	15	15	15	15	20	20	20	20

Fit a linear regression model and use it to estimate the number of twists required to break one of the bars when percentage of element A is 2.5 and that of B is 12.

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Unemployment Study

Each month the U.S. Bureau of Labor Statistics publishes a variety of unemployment statistics, including the number of individuals who are unemployed and the mean length of time the individuals have been unemployed. For November 1998, the Bureau of Labor Statistics reported that the national mean length of time of unemployment was 14.6 weeks.

The mayor of Philadelphia requested a study on the status of unemployment in the Philadelphia area. A sample of 50 unemployed residents of Philadelphia included data on their age and the number of weeks without a job. A portion of the data collected in November 1998 follows. The complete data set is available in the data file BLS.

Age	Weeks	Age	Weeks	Age	Weeks
56	22	22	11	25	12
35	19	48	6	25	1
22	7	48	22	59	33
57	37	25	5	49	26
40	18	40	20	33	13