T.E(Cmpn & I.T.) Sem 5 (Rev.)
Applied Maths V
09/01/08

Con 5901-07. CD-6027

(REVISED COURSE)

(3 Hours) **[Total Marks : 100**

N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** out of remaining **six** questions.
(3) **Figures** to the **right** indicate **full** marks.
(4) **Use** of **Statistical Tables** is **permitted.**

1. (a) Thirteen cards are drawn simultaneously from a deck of 52. If the aces count 1, face cards 10 and others according to denomination, find the expectation of the total score on 13 cards. **5**

(b) The mean weekly sales of the choclate bar in candy stores was 146·3 bars per store. After an advertising campaign the mean weekly sales in 22 stores for a typical week increased to 153·7 and showed a standard deviation of 17:2. Was the advertising campaign succcssful ? Test at 5% level of significance. **5**

(c) Find the most likely price in Mumbai corresponding to the price of Rs. 70 at calculate from the following data. **5**

	Calcutta	Mumbai
Mean price	65	67
Standard deviation	2·5	3·5

Correlation coefficient between the prices of commodities in two cities is 0·8.

(d) Consider two different types of food stuffs say F_1 and F_2. Assume that these food stuffs contain vitamins V_1, V_2 and V_3 respectively. Minimum daily requirements of these vitamins are 1 mg of V_1, 50 mg of V_2 and 10 mg of V_3. Suppose that the food stuff F_1contains 1 mg of V_1, 100 mg of V_2 and 10 mg of V_3 whereas food stuff F_2 contains 1 mg of V_1, 10 mg of V_2 and 100 mg of V_3. Cost of one unit of food stuff F_1 is Re. 1 and that of F_2 is Rs. 1·50. **5**
Formulate the L.P.P. and solve it graphically to find the minimum cost diet that would supply the body at least minimum requirements of each vitamin.

2. (a) Find the moment generating function of the binomial distribution. Hence find its mean and variance. **6**

(b) In a certain examination the percentage of passes and distinctions were 46 and 9. Estimate the average marks obtained by the candidates, the minimum pass and distinction marks being 40 and 75 respectively, assuming the distribution of marks to be normal. **7**
Also determine what would have been the minimum qualifying marks for admission to re-exam of the failed candidates had it been desired that the best 25% of them would be given another opportunity of being re-examined.

(c) Use Simplex method to solve the following L.P.P. 7

Maximise $Z = 4x_1 + 10x_2$

Subject to $2x_1 + x_2 \leq 50$

$2x_1 + 5x_2 \leq 100$

$2x_1 + 3x_2 \leq 90$

$x_1, x_2 \geq 0$

Does an alternative solution exist ?

If so find the same.

3. (a) (i) Find the probability that the ace of spades will be drawn from a pack of well shuffled cards at least once in 104 consecutive trials. 4

(ii) If the mean "m" of Poisson distribution is 4, find $P(m - \sigma < x < m + \sigma)$ 2

(b) The probability density function of a continuous random variable x is— 7

$f(x) = y_0 e^{-b(x-a)} \quad a \leq x < \infty, b > 0$

where a, b, y_0 are constants show that—

(i) $y_0 = b$

(ii) $a = m - \sigma$

where m and σ are mean and standard deviation of the distribution.

(c) Apply the principle of duality to solve the following L.P.P. 7

Maximise $Z = 3x_1 + 2x_2$

Subject to $x_1 + x_2 \geq 1$

$x_1 + x_2 \leq 7$

$x_1 + 2x_2 \leq 10$

$x_2 \leq 3$

$x_1, x_2 \geq 0$

4. (a) Write the dual of the following problem. 6

Minimise $Z = 3x_1 + - 2x_2 + 4x_3$

Subject to $3x_1 + 5x_2 + 4x_3 \geq 7$

$6x_1 + x_2 + 3x_3 \geq 4$

$7x_1 - 2x_2 - x_3 \leq 10$

$x_1 - 2x_2 + 5x_3 \geq 3$

$4x_1 + 7x_2 - 2x_3 \geq 2$

$x_1, x_2, x_3 \geq 0$

(b) (i) State **True** or **False** with justification—

(I) The correlation coefficient r between x and y is ·9 and the regression coefficient $b_{xy} = -1$. 2

(II) If the two lines of regression are $x + 3y - 5 = 0$, $4x + 3y - 8 = 0$ then the correlation coefficient is 0·5.

(ii) Fit a straight line to the following data— 4

x	0	1	2	3	4	5
y	1	2	3	4·5	6	7·5

(c) When is dual Simplex method applicable ? 8
Use Dual Simplex method to solve the following L.P.P.

Minimise $Z = 6x_1 + 7x_2 + 3x_3 + 5x_4$

Subject to $5x_1 + 6x_2 - 3x_3 + 4x_4 \geq 12$

$x_2 + 5x_3 - 6x_4 \geq 10$

$2x_1 + 5x_2 + x_3 + x_4 \geq 8$

$x_1, x_2, x_3 > 0$

5. (a) Find the even moments about the mean for Normal Distribution. Hence find the variance of the Normal Distribution. 6

(b) A random sample of size 10 has been drawn from a normal population and the observations are found to be 60, 62, 63, 64, 65, 67, 68, 69, 70 and 72 obtain an unbiased estimate of σ^2 and find a 95% confidence limits for μ. 6

(c) The following data represent the marks x and y obtained by 12 students in 2 tests, one held before coaching and the other after coaching. 8

Test 1	55	60	65	75	49	25	18	30	35	54	61	72
Test 2	63	70	70	81	54	29	21	28	32	50	70	80

(i) Find the coefficient of correlation between the two sets of marks.
(ii) Find the rank correlation coefficient between x and y.

6. (a) Four coins are tossed, X is the number of heads that occur. 6
(i) Find the probability density function of X.
(ii) Find the probability distribution of X.
(iii) Calculate the mean and standard deviation of X.

(b) In a survey of 200 boys of which 75 are intelligent, 40 had educated fathers while 85 of the unintelligent boys had uneducated fathers. Do these figures support the hypothesis that educated fathers have intelligent boys at 5%. Level of significance. 6

(c) Solve the following non linear programming problem using the method of Lagrangian multipliers. 8

Minimize $Z = x_1^2 + x_2^2 + x_3^2$

Subject to $x_1 + x_2 + 3x_3 = 2$

$5x_1 + 2x_2 + x_3 = 5$

$x_1, x_2, x_3 \geq 0$

7. (a) The mean height of 50 male students who showed above average participation in college athelitics was 68·2 inches with a standard deviation of 2·5 inches, while 50 male students who showed no interest in such participation had a mean height of 67·5 inches with a standard deviation of 2·8 inches. Test the hypothesis at 5% L.O.S. that male students who participate in college athelitics are toller than other male students. **6**

(b) Sovle the following N.L.P.P. using Kuhn-Tucker conditions. **6**

Maximise $Z = 10x_1 + 4x_2 - 2x_1^2 - x_2^2$

Subject to $2x_1 + x_2 \leq 5$

$x_1, x_2 \geq 0$

(c) (i) Solve the following L.P.P. by Big-M method— **5**

Minimize $Z = 2y_1 + 3y_2$

Subject to $y_1 + y_2 \geq 5$

$y_1 + 2y_2 \geq 6$

$y_1, y_2 \geq 0$

(ii) What do you understand by sensitivity analysis ? Discuss briefly with respect to variation of b_j. **3**