M.B.PATEL SCIENCE COLLEGE,ANAND.

S.Y.B.Sc. Third Semester

Statistics (Descriptive Statistics)

Paper : US03CSTA01

Time : 2.00 to 5.00. Date : 19/9/2011. Marks : 60.

Q.1. Select the appropriate choice from the following :- [12]

Attempt any Twelve:-

1 Which measure of location will be suitable to compare

a)heights of students in a class.	b)intelligence of students	c)average sales for various years	d)all of the above.

2 Median = ------- Quatiles

a)second	b)first	c)third	d)fourth

3 The geometric mean of a set of values lies between A.M. and ---------

a)Mode	b)Median	c)Harmonic mean	d)none of theses

4 The point of intersection of the less than and more than ogive curve is

a)Mode	b)Median	c)Harmonic mean	d)none of theses

5 The sum of squares of devaiation is least when measured from--

a)Mode	b)Median	c)Harmonic mean	d)none of theses

If each of a set of observations of a variable is multiplied by a constant value, the variance of resultant variable is

a) is unaltered	b) increase	c) decrease	d) is unknown

7 Ina frequency distribution, the kurtosis is

a)greater than 1	b) less than 1	c) equal to 1	d) None of these

8 The measure of kurtosis is

a) $\beta_2 = 0$	b) $\beta_2 = 4$	c) $\beta_2 = 3$	d) $\beta_2 = 1$

9 Mean - Mode = ? (Mean - Median)

a) 1	b) 2	c) 3	d) 0

10 The limits for quartile coefficient of skewness are

a) ± 3	b) ± 2	c) 0	d) ± 1

11 In a frequency curve , the mode was found to be higher than the mean. This shows that the distribution is

a) positively	b) negatively	c) symmetric	d) normal

skewed	skewed			

A distribution with two modes is ------

a) bi modal	b)multi mode	c)uni-mode	d)none of the above.

The crude death rate usually lies between

a) 8 and 30 per 1000.	b)5 and 35 per 1000.	c)2 and 32 per 1000.	d)none of the above.

If we wants to know more about deaths occurring in different section of the population

a) CDR	b)SDR	c)STDR	d)none of the above.

The crude birth rate usually lies between

a) 10 and 55 per 1000.	b)5 and 35 per 1000.	c)2 and 32 per 1000.	d)none of the above.

Attempt any Six for the given questions:- [12]

From the given data

3, 7, 11, 15, ... 500, 1999 1001

Find i) n (no. of terms) ii) Arithmetic mean.

The mean salary of Male and female employee in a firm is Rs 5200& Rs 4200 respectively. The mean salary of all employee is Rs 5000. Find the percentage of male and female employee. 80 % 20 %

Which measure of the dispersion do you consider the best? Why?

Weights of the students (in kgs) are recorded by a machine as under.

49	57	50	55	61	54	59	64	58	56

If the weighing machine shows weights more by 3 kg., find the correct values of range, standard deviation without calculating the correct weights. R = 64 − 49

What is skewness? Differentiate between positive and negative skewness.

The first four moments about the value 2 of the variable are 1, 16, 40 and 10. Find the mean and variance. Also find β_1 and β_2.

What is Vital statistics? State its uses.

Explain about Crude Death Rate.

Explain about Specific Fertility Rate.

Explain about Total Fertility Rate.

~~Attempt any three question out of five questions~~

$\mu_4 = -57$

$\mu_3 = -16$

$\mu_2 = 15$

$A = 2$

$\mu_1' = \frac{\Sigma(x_i - 2)}{n} = 15$

$\mu_2' = \frac{\Sigma(x_i - 2)^2}{n} = 16$

$\mu_3' = 40$

$\mu_4' = 10$

Attempt any three out of five questions

Q.3. From the following table, showing the wage distribution of worker in a factory. [12]

Daily wage	20-40	40-60	60-80	80-100	100-120	120-140	140-160	160-180	180-200
No.of workers	8	12	20	30	40	35	18	7	5

Determine (i) median wage (ii) the limit for the middle 50% of the wage earners. (iii) % of workers who earned less than Rs. 75. (iv) Mode. (v) the minimum wages of the 25 highest wage workers.

Q.4.(a) Two workers on the same job show the following results over a long period of time. [6]

	Worker A	Worker B
Mean time of completing job (in minutes)	30	25
S.D. (in minutes)	6	4

(i) Which worker appeared to be more consistent in the time required to complete the job?

(ii)Which worker appears to be faster in completing the job? Explain.

(b) In usual notation prove that [6]

$$S^2 = \frac{\sum_{ni}^{k} ni(S_i^2 + d_i^2)}{\sum_{i=1}^{k} ni}$$, where di = $\bar{X}_i - \bar{X}$, i= 1,2,...,k

$$\bar{X} = \frac{\sum_{ni}^{k} ni\bar{X}_i}{\sum_{i=1}^{k} ni}$$.

Q.5. Calculate the coefficient of skewness from the following data. Comment on your findings. 12

Weight (lbs)	Under 109	110-129	130-149	150-169	170-189	190 & above
No. of person	15	188	266	96	17	4

Q.6.(a) Compute the crude and standardized death rates of the two populations A and B, regarding A as standard population, from the data given below. [6]

Age -groups (years)	A		B	
	Population	Deaths	Population	Deaths
Under 10	20,000	600	12,000	372
10-20	12,000	240	30,000	660
20-40	50,000	1250	62,000	1612
40-60	30,000	1050	15,000	525
Above 60	10,000	500	3,000	180

29.8
27-4.
31.4.

(b) Estimate the standardized death rates for the two countries from the data given in table. [6]

Death rate per 1000

Age group	Country A	Country B	Standardized population (in lakhs)
0-4	20	5	100
5-14	1	0.50	200
15-24	1.40	1.00	190
25-34	2	1	180
35-44	3.30	2	120
45-54	7	5	100
55-64	15	12	70
65-74	40	35	30
75 and above	120	110	10

7·372
4·7

Q.7.(a) Compute the specific fertility rate, general fertility rate, total fertility rate and gross reproduction rate from the data given below: [6]

Age group	No. of women	No. of lives
15-19	25	800
20-24	20	2400
25-29	18	2000
30-34	15	1500
35-39	12	500
40-44	6	120
45-49	4	10

It is given that out of 7330 the number of female births was 4,000.

32, 720, 111, 100, 41, 20, 2.

GRR
2.52 per women

2.074 per women.

GFR = 73·3

TFR = 2.136
GRR = 1.166

M.B. PATEL SCIENCE COLLEGE, ANAND
S.Y. B.Sc. [Third Semester]
Internal Test [2011-'12]
Subject: Statistics [Probability Theory]
Paper: US03CSTA02

Date: 20/9/'11 Time: 2·00 to 5·00 Marks: 60

Q:1 Choose an appropriate answer for the following [12] questions. Mention your choice in the answer book. Attempt any 12 out of 15.

1) If $\binom{n}{8} = \binom{n}{12}$ then $\binom{n}{18} =$ ____
(a) 160 (b) 170 (c) 180 (d) 190

2) If A and B are mutually exclusive events then $P(A \cup B) =$ ____
(a) $P(A) \cdot P(B)$ (b) $P(A)+P(B)$ (c) $P(A)-P(B)$ (d) 0.

3) The probability of drawing one spade from a pack of 52 card is ____.
(a) $\frac{1}{52}$ (b) $\frac{1}{13}$ (c) $\frac{4}{13}$ (d) $\frac{1}{4}$

4) A die is tossed two times in succession, the number of sample points in a sample space is ____
(a) 6 (b) 12 (c) 24 (d) 36

5) If $P(A \cap B) = \frac{1}{2}$ and $P(A' \cap B') = \frac{1}{2}$ and $2P(A) = P(B) = p$, then the value of p is given by
(a) $\frac{1}{4}$ (b) $\frac{1}{2}$ (c) $\frac{1}{3}$ (d) $\frac{2}{3}$

6) If the events A and B have equal probability and are independent with $P(A \cap B) = p$ then $P(A) =$ ____ (a) p^2 (b) $\frac{p}{2}$ (c) $\sqrt{p}$ (d) p.

7) If $f(x) = k$, $x = 1, 2, 3, 4, 5$.
$= 0$, otherwise then $k =$ ____
(a) $\frac{1}{2}$ (b) $\frac{1}{5}$ (c) $\frac{3}{4}$ (d) $\frac{1}{15}$

8) If $f(x) = \frac{x}{c}$, $0 < x < 4$
$= 0$, otherwise then $c =$ ____
(a) 7 (b) 8 (c) 9 (d) 10

9) If $F(x) = x^3$, $0 < x < 1$ be the c.d.f. of x then the p.d.f of x is given by $f(x) =$ ____

P.T.O

(a) $3x^2$ (b) $\frac{x^4}{4}$ (c) $3x$ (d) $2x^3$.

10) If x is a discrete random variable with p.m.f $f(x)$ then $E(x)$ exists if ——

(a) $\Sigma x f(x)$ is convergent (b) $\Sigma x f(x)$ is divergent
(c) $\Sigma x f(x) = 0$ (d) $\Sigma x f(x) \neq 0$

11) If x is a random variable with mean μ_1' then the expression, $E(x-\mu_1')^2$ represents

(a) The variance of x (b) second raw moment
(c) Both (a) and (b) (d) None of these

12) If x is a random variable with p.d.f. $f(x)$, then $E(\frac{1}{x})$ is used to find

(a) arithmatic mean (b) harmonic mean
(c) geometric mean (d) none of these

13) If $M_x(t)$ is the m.g.f of x and if $Y=ax+b$ then $M_Y(t) =$ ——

(a) $e^{at}M_x(bt)$ (b) $e^{at}M_x(at)$ (c) $e^{tb}M_x(bt)$ (d) $e^{bt}M_x(at)$.

14) If x is a random variable with p.m.f.

x	0	1
$f(x)$	0	1

then $M_x(t) =$ ——

(a) e^{tx} (b) e^t (c) e^0+e^1 (d) none of these

15) If x is a random variable with $E(x)=12$ and $E(x^2)=180$ then $V(x) =$ ——

(a) 168 (b) 144 (c) 36 (d) 25.

Q:2 : Attempt any 6 out of 10 [12]

1) Which regular polygon has the same number of diagonals as sides

$\frac{n(n-1)}{2} - n = n$

$\binom{n}{2} - n = n$

$n^2 - n - 2n = 0$

$n(n-3) = 0$

2) Give the classical definition of probability. Also give its limitations.

3) Prove in usual notations that $P(A') = 1 - P(A)$.

4) Prove in usual notations that

$$P(A \cap B \cap C) = P(A) \cdot P(B/A) \cdot P(C/A \cap B).$$

5) If the p.m.f of x is given by

x	1	2	3	4	5
$f(x)$	k	$2k$	$3k$	$4k$	$5k$

then find k and $E(x)$. $= \frac{55}{15}$

$\frac{1}{15}$

P.T.O →

6) If $f(x) = 6x(1-x)$, $0<x<1$ $\quad E(x) = 6\frac{\lfloor 3 \rfloor 2}{\lfloor 5} = \frac{6 \cdot 2 \cdot 1}{4 \cdot 3 \cdot 2 \cdot 1} = \frac{1}{2}$
$= 0$, otherwise then find $E(x)$
and $E(2x+5) = 6$

7) Find the expectation of the number on a die when thrown $\quad x = 1, 2, 3, 4, 5, 6$
$f(x) = \frac{1}{6}\ \frac{1}{6}\ \frac{1}{6}\ \frac{1}{6}\ \frac{1}{6}\ \frac{1}{6} \Rightarrow E(x) = \frac{21}{6} = \frac{7}{2} = 3.5$

8) Define (i) r^{th} raw moment
(ii) r^{th} factorial moment.

9) If $M_x(t) = \frac{1}{3}(1-\frac{2}{3})^{-1}$ then find mean $= 2$
and variance of x. $\frac{2/3}{1/9} = 6$

10) Find m. g. f. of X if $f(x) = e^{-x}$, $0<x<\infty$
$= 0$, otherwise.
$M_x(t) = (1-t)^{-1}$

ATTEMPT ANY THREE OF FOLLOWING 5 QUESTIONS

Q:3 (a) A bag contains 3 red, 6 while and 4 blue balls. What is the probability that 3 balls drawn are (i) of the same colours (ii) of different colours [12]

$\binom{3}{3} + \binom{6}{3} + \binom{4}{3}$ $\quad \frac{6 \cdot 5 \cdot 4}{1 \cdot 2 \cdot 3}$
$1 + 20 + 4$ $\quad \frac{120}{2} =$

(b) In an examination a candidate is required to answer 6 out of 10 questions, which are divided into two groups each of 5 questions and not permitted to attempt more than 4 questions from each group. In how many ways can he make up his choice?

(c) Define (i) Random experiment (ii) Event
(iii) Sample Space (iv) Equally likely events.

OR

$\binom{52}{4} =$

Q:3 (a) What is the chance that a leap year selected at random contains 53 sundays. 2/7 [12]

(b) 4 cards are drawn at random from a well-shuffled pack of 52 cards. Find the probability that (i) all are diamonds $\binom{13}{4}/\binom{52}{4} = \frac{715}{270725} = .0026$
(ii) there is one card of each colours $13^4/\binom{52}{4}$
(iii) there is 2 spades and 2 hearts $\frac{\binom{13}{2}\binom{13}{2}}{\binom{52}{4}} = \frac{6084}{270725} = .0224$

(c) Among the digits 1, 2, 3, 4, 5, at first one

(P.T.O)

is chosen and then second is selected among the remaining four digits. Assume that all possible outcomes are equiprobable. Find the probability that an odd digit will be selected for (i) the first time (ii) the second time and (iii) both the times 6/20 12/20 12/20

Q:4 (a) Give statistical and axiomatic definitions [1. of probability. State their limitations if any.

(b) If A, B are any two events of the sample space then prove that $P(A \cup B) = P(A) + P(B) - P(A \cap B)$. Hence deduce that $P(A \cap B) \geq P(A) + P(B) - 1$.

(C) The probability that a 50 years old m will be alive at 60 is 0.83 and the probabili that a 45 years old woman will be alive at 55 is 0.87. What is the probability a man who is 50 and his wife who is 45 will both alive 10 years hence?.

$P(M) = .83$
$P(W) = .87$
$P(M \cap W)$
$= P(M)P(W)$
$= (.83)(.87)$
$= .7221.$

OR

Q:4 (a) If A and B are independent events [12 then prove that (i) A and B' are independent (ii) A' and B' are independent

(b) State and prove Bayes' theorem

(c) A husband and wife appears in an interview for two vacancies in the same post The probability of husband's selection is $\frac{1}{7}$ and that of wife's selection is $\frac{1}{5}$. What is the probability that

$P(A) = \frac{1}{7}$
$P(B) = \frac{1}{5}$

(i) both of them will be selected $= .0286$
$P(A \cap B) = \frac{1}{7} \cdot \frac{1}{5}$ $= \frac{1}{35}$

(ii) only one of them will be selected $= .2857$
$P(A' \cap B) + P(A \cap B')$
$= P(A) + P(B) - 2P(A \cap B)$
$= \frac{1}{7} + \frac{1}{5} - \frac{2}{35}$
$= \frac{5+7-2}{35} = \frac{10}{35} = .2857$

(iii) none of them will be selected. $= .6857$
$P(A' \cap B')$
$= P(A') \cdot P(B')$
$= \frac{6}{7} \cdot \frac{4}{5} = \frac{24}{35} = .6857$

(P.T.O)

Q:5 (a) A random variable X has the p.m.f. [12]
given by. .1 .2 .4 .7 .72 .83 .97 1.
x : 1 2 3 4 5 6 7 8
$P(X=x)$: k, k, $2k$, $3k$, $2k^2$, k^2+k, $4k^2+k$, $3k^2$
.1 .2 .3 .02 .11 .14 .03
Find (i) k (ii) c.d.f. of X and hence or otherwise find (iii) $P(X<6)$, $P(X>5)$ and (iv) $P(1<X<6)$; $P(1\le X\le 6)$
(=.72) (=.3) (=.62) (=.93)

(b) If X is a continuous random variable with p.d.f. given as

$f(x)=\frac{2}{13}x$, $0<x\le 2$
$=\frac{2}{13}$, $2<x\le 5$
$=0$, otherwise.

$\frac{2}{13}\frac{x^2}{2}\Big|_0^x=\frac{x^2}{13}$, $0\le x<2$
$=1-\frac{(5-x)^2}{13}$, $2\le x<5$
$=1$, $x\ge 5$

$P(0<X<2)+P(2<X<2)=\frac{4}{13}+\frac{2}{13}\frac{(5-x)^2}{2}\Big|_x^2$
$=\frac{4}{13}+\frac{1}{13}[9-(5-x)^2]$

Obtain c.d.f of x and hence find $P(1<X<3)$, $P(X>3)$ and $P(2\le X)=P(X\ge 2)$
$=F(3)-F(1)$ $=1-P(X<3)$ $=1-P(X<2)$
$=(1-\frac{4}{13})-\frac{1}{13}$ OR $=1-F(3)=1-(1-\frac{4}{13})$ $=1-\frac{4}{13}$ (=9/13)
(=8/13) $=$ (4/13)

Q:5 (a) If $f(x)=k$, $-2<x<2$ [12]
$=0$, otherwise then
$F(x)=0$, $x<-2$
$=\frac{x+2}{4}$, $-2<x<2$ find (i) $k=\frac{1}{4}$ (ii) $P(X<1)=\frac{3}{4}$, $P(|X|<1)=\frac{3}{4}-\frac{1}{4}=\frac{1}{2}$
$=1$, $x\ge 2$ (iii) $P(2X+3>5)$ (iv) c.d.f. of X.
$=P(X>1)=1-P(X<1)=1-\frac{3}{4}=\frac{1}{4}$.

(b) If a random variable x takes the values 1, 2, 3, ----- with probability

(a) $\frac{1}{2}+\frac{1}{4}+\frac{1}{6}+\cdots$ $P(X=x)=(\frac{1}{2})^x$, $x=1,2,3,\ldots$ $\Sigma f(x)=$
$=0$, otherwise $=\frac{1}{2}+\frac{1}{2^2}+\frac{1}{2^3}+\cdots$
$=\frac{1}{2}(1+\frac{1}{2}+\frac{1}{2^2}+\cdots)$
$=\frac{1}{2}\cdot\frac{1}{1-\frac{1}{2}}=1$

(i) Is this a p.m.f. of X?
(ii) Compute (a) $P(X$ is even) (b) $P(X\ge 5)$ and (c) $P(X$ is multiple of 3)

Q:6 (a) State the relation between central moments and raw moments. Hence find an expression for first for central momen [12]

(b) Two fair dice are tossed and X denotes the sum of the numbers on two dice. Find $E(X)$, $V(X)$, $E(3X-2)^2$, $V(3X-2)$.

(P.T.O)→

(c) If a continuous random variable X has a p.d.f given by

$f(x) = 3x^2, \quad 0<x<1$
$= 0, \quad$ otherwise.

$E(X) = \frac{3}{4}$; $E(X^2) = 3\frac{1}{5}$; $V(X) = \frac{3}{5} - \left(\frac{3}{4}\right)^2 = 3/80$

Find (i) mean and variance of X
(ii) $E(5X-2) = 5(\frac{3}{4}) - 2 = \frac{15}{4} - 2 = \frac{7}{4}$ OR $V(5X-2) = 25(\frac{3}{80}) = \frac{75}{80}$

Q:6 [a] If $f(x) = \frac{x}{21}$, $x = 1, 2, 3, 4, 5, 6$. [12]
$= 0$, otherwise then find mean $E(X) = \frac{91}{21}$ and variance of X. Also find $E(1-2X) = 1 - 182/21 = -7.6667$
$E(X^2) = \frac{441}{21}$ and variance of $(1-2X) = 4V(X) = 8.8888$
$V(X) = 2.2222$

[b] If $f(x) = 504\frac{x^3}{(1+x)^{10}}$, $0<x<\infty$
$= 0$, otherwise, then obtain $E(X^2) = \frac{504}{630} = .8$, $E(3X+5) = 9 + 30(.8) + 25 = 58$, $V(X) = .16$, $E(\frac{1}{X}) = 2$ & $V(3X-5) = 1.44$

$E(X^r) = 504\int_0^\infty \frac{x^{r+3}}{(1+x)^{10}}dx$
$= 504\int_0^\infty \frac{x^{r+4-1}}{(1+x)^{(r+4)+(10-r-4)}}$
$= 504\frac{\lfloor r+4 \rfloor \lfloor 6-r \rfloor}{\lfloor 10} = \mu'_r$

[c] If $f(x) = \frac{1}{25}$, $x = 1, 2, 3, \ldots 25$
$= 0$, otherwise then prove that variance $= \frac{n^2-1}{12} = \frac{624}{12} = 52$, mean $= \frac{n+1}{2} = 13$, $52 = 4(13)$ [3]

Q:7(a) Define (i) m.g.f. (ii) p.g.f (iii) c.g.f

(b) Prove that (i) $M_{ax+b}(t) = e^{bt} M_x(at)$ [4]
(ii) $M_x(t) = \sum_{r=0}^{\infty} \mu'_r \cdot \frac{t^r}{r!}$

(c) If $f(x) = e^{-x}$, $0<x<\infty$ [5]
$= 0$, otherwise then find m.g.f. $(1-t)^{-1}$ of X and hence find mean and variance

OR

Q:7 (a) If $R_X(t) = e^{5(t-1)}$ denote the p.g.f. of X [12]
then find $P(X=0) = e^{-5}$, $P(X<1) = 1 - e^{-5}$. Also find $E(X) = 5$, $V(X) = 5$.

(b) If $M_{X_i}(t)$, $i=1,2$ is a m.g.f of X_i, $i=1,2$ and X_1 and X_2 are independent then prove that $M_{X_1+X_2}(t) = M_{X_1}(t) \cdot M_{X_2}(t)$.

(c) Prove that $\left.\frac{d^r M_X(t)}{dt^r}\right|_{t=0} = \mu'_r$

——x— Best of Luck —x——

M. B. PATEL SCIENCE COLLEGE, ANAND

S. Y.B .Sc. Third Semester

US03ESTA01 (OPERATION RESEARCH)

Time: - 2:00 to 5:00 Date:- 23/09/11 Marks:- 60

Q.1. Select the appropriate choice from the following :- 12

Attempt any Twelve:-

1 Linear programming is a

a)A linear objective function	b)Non-negative variables.	c)Linear constraints	d)all of the above.

2 A feasible solution to an LPP

a)must satisfy all of the problem's constraints simultaneously.	b) need not satisfy all of the constraints, only some of them.	c)must be a corner point of the feasible region.	d)must optimize the value of the objective functions.

3 An iso-profit line represents

a)an infinite number of solutions all of which yield the same profit.	b)an infinite number of solutions all of which yield the same cost.	c)an infinite number of optimal solutions	d)a boundary of the feasible region.

4 While solving a LPP graphically, the area bounded by the constraints is called

a)feasible region	b)infeasible region	c)unbounded solution	d)none of the above.

5 For a maximization problem, the objective function coefficient for an artificial variable is

a) + M	b) -M	c) Zero	d)Noneofthese

6 For maximization LPP, the simplex method is terminated when all values

a) $z_j - c_j \leq 0$	b) $z_j - c_j \geq 0$	c) $z_j - c_j = 0$	d) $z_j \leq 0$

7 If any value in x_b - column of final simplex table is negative, then the solution is

a)unbounded	b) infeasible	c) optimal	d)Noneofthese

8 To convert $\geq$ inequality constraints into equality constraints, we must

a)add a surplus	b)subtract an	c) subtract a	d)add a surplus

variable	artificial variable	surplus variable and an artificial variable	variable and subtract an artificial variable.

9 The initial solution of a TP can be obtained by applying any known method. However, the only condition is that

a)the solution be optimal	b)the rim condition are satisfied	c) the solution is not be degenerate	d)all of the above.

10 One disadvantage of using NW Corner method to find IBFS to the TP problem is that

a) it is complicated to use	b)it does not take into account cost of transportation	c) it leads to a degenerate initial solution	d)all of the above.

11 The solution to a TP with m-rows and n-columns is feasible if number of positive allocations are

a) m + n	b) m x n	c) m + n - 1	d) m + n + 1

12 When the total supply is equal to the total demand in a TP, the problem is said to be

a) balanced	b)unbalanced	c)degenerate	d)all of the above.

13 The degeneracy in the TP indicates that

a) dummy allocation need to be added.	b)the problem has no feasible solution	c) the multiple optimal solution exist	d)(a) and (b) but not (c).

14 The dummy source or destination in a TP is added to

a) satisfy rim condition	b)prevent solution from becoming degenerate	c) ensure that total cost does not exceed a limit	d)all of the above.

15 Which of the following is used for OBFS

a) North west corner method	b) Vogel's approximation method	c) Modified distribution method.	d)all of the above.

16 The opportunity cost value is used for an unused cell to test optimality, it should be

a) equal to zero	b) most negative number	c) most positive number	d)all of the above.

Q.2. Attempt any Six for the given questions:- 12

1 What is Linear programming problem? Why it is called linear?

2 Write the steps for solving LPP by graphical method.

3 In context of LPP, define basic solution and optimal solution.

4 Define the slack variable and surplus variable giving illustration.

5 What is Duality in LPP? State its importance.

6 Write procedure of writing dual of a LPP.

7 What is Transportation problem?

8 What is the rim condition in the transportation problem? When the initial basic feasible solution exists.

9 In context of Transportation problem what is unbalanced TP.

10 What is degenerate TP?

11 What is NER and Replacement ratio while solving LPP by Simplex method.

12 What is artificial variable?

Attempt any three question out of four questions.

Q.3.(a) A firm manufactures Headache pills in two sizes A and B. Size A contains 2 grains of aspirin , 5 grains of bicarbonate and 1 grains of codein. Size B contains 1 grain of aspirin, 8 grains of bicarbonate and 6 grains of codeine for providing immediate effect. It is required to determine the least number of pills a patient should take to get immediate relief. Formulate the problem. 6

(b) The manager of an oil refinery must decide on the optimum mix of two possible blending processes of which the input and output production run are as follows: 6

Process	Input		Output	
	Crude A	Crude B	Gasoline X	Gasoline Y
1	6	4	6	9
2	5	6	5	5

The maximum amounts available of cruds A and B are 250 units and 200 units respectively. Market demand shows that at least 150 units of gasoline X and 130 units of gasoline Y must be produced. The profits per production run from process 1 and Process 2 are Rs. 4 and Rs. 5 respectively. Formulate the problem for maximizing the profit.

Q.4. Solve the given LPP by Simplex method

1) Max $z = 50 x_1 + 100 x_2$

s.t. $10 x_1 + 5 x_2 \leq 250$

$4 x_1 + 10 x_2 \leq 200$

$x_1 + 15 x_2 \leq 450$

$x_1 , x_2 \geq 0$

2) Max $z = 18 x_1 + 24 x_2$

s.t. $4 x_1 + 2 x_2 \leq 80$

$2 x_1 + 5 x_2 \leq 120$

$x_1 , x_2 \geq 0$

Q.5. Determine an IBFS by 1) NW corner method. 2) Least cost method.

Destination

Source	D1	D2	D3	D4	Supply
S1	1	2	1	4	30
S2	3	3	2	1	50
S3	4	2	5	9	20
Demand	20	40	30	10	

Q.6. 1) Solve the given LPP by graphical method.

Min $z = 3 x_1 + 2 x_2$

s.t. $5 x_1 + x_2 \geq 10$

$x_1 + x_2 \geq 6$

$x_1 + 4 x_2 \geq 12$

$x_1 , x_2 \geq 0$

2) Determine an IBFS by 1) Row minima 2) column minima

Destination

Source	D1	D2	D3	D4	Supply
S1	19	30	50	10	7
S2	70	30	40	60	9
S3	40	8	70	20	18
Demand	5	8	7	14	

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