No. of Printed Pages: 4

(21)

Sardar Patel University

B. Sc. Semester-III Examination

2011

11th November, 2011

Course Code: US 03CSTA01

(Descriptive Statistics)

Time: 10 - 30 to 13 - 30 M.Marks: 70

Note: (i) Simple/Scientific calculator is allowed.

(ii) Graph paper will be provided on request.

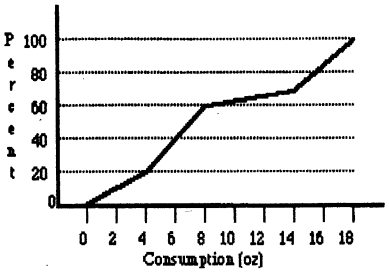
(iii) Figures to the right indicate marks.

Q.1 Multiple Choice Questions **(10×1)**

(1) The arithmetic mean of 1, 2, ...,n is

(a) $\frac{n(n+1)(2n+1)}{6}$ (b) $\left[\frac{n(n+1)}{2}\right]^2$ (c) $\frac{(n+1)}{2}$ (d) None of the above

(2) The following is an ogive on the number of ounces of alcohol (one ounce is about 30 mL) consumed per week in a sample of 150 students.



A study wished to classify the students as "light", "moderate", "heavy" and "problem" drinkers by the amount consumed per week. About what percentage of students are moderate drinkers, i.e., consuming between 4 and 8 ounces per week?

(a) 20% (b) 40% (c) 60% (d) 80%

(3) The limits for quartile coefficient of skewness (i.e. Bowley's coeff. Of skewness)

(a) ±3 (b) 0 and 3 (c) ±1 (d) ±∞

(4) If Laspeyre's price index is 324 and Paasche's price index is 144, then Fisher's index is

(a) 216 (b) 234 (c) 180 (d) None of the above

(5) If we want to know more about deaths occurring in a different section of the population, we have to calculate

(a) CDR (b) SDR (c) STDR (d) None of the above

(6) For a symmetrical distribution, all the odd order central moments are

(a) Equal to zero (b) Greater than zero (c) Less than zero (d) None of the above

(7) If each of a set of observations of a variable is multiplied by a positive constant (non-zero) value, the variance of the resultant variable is

(a) Unaltered (b) Increase (c) Decrease (d) None of the above

(8) According to Fertility, female child bearing age (in years) is

(a) 15 – 59 (b) 15 – 49 (c) 18 – 49 (d) 18 - 59

(9) The term test scores of 15 students enrolled in a Business Statistics class were recorded in ascending order as follows:

4, 7, 7, 9, 10, 11, 13, 15, 15, 15, 17, 17, 19, 19, 20

After calculating the mean, median, and mode, an error is discovered:

One of the 15's is really a 17. The measures of central tendency which will change are:

(a) the mean only (b) the mode only (c) the median only (d) the mean and mode

(10) In a five number summary, which of the following is not used for data summarization?

(a) the mean (b) the largest value (c) the median (d) the 25th percentile

Q.2 Short Type Questions (Attempt Any Six) **(6×2)**

(1) Explain the concept of (i) positive skewness (ii) negative skewness by sketching suitable diagrams locating measures of central tendency.

(2) Give two examples each of nominal and ordinal data.

(3) In usual notations, $\sum p_0 q_0 = 425$, $\sum p_1 q_0 = 500$, $\sum p_0 q_1 = 480$, $\sum p_1 q_1 = 540$, Calculate Fisher's index number.

(4) Give merits and demerits of median.

(5) Which of the following is Variable (Discrete/Continuous) or Attribute (Nominal/Ordinal)

(1) Severity of pain (2) Time spent on computer(in hours) (3) Consumption of electricity (unit)

(4) Smoking should be ban in public places?

(6) List out the various measures of central tendency. Define any one of them.

(7) Define Vital statistics.

(8) State the various measures of fertility. Define any one of them.

Q.3(a) In usual notation, prove that (4)

AM ≥ GM ≥HM. When will they become equal?

(b) The following table shows the marks obtained by three students A, B and C and the weights assigned to different subjects. Calculate the weighted mean of each of the students. If a scholarship awarded on the basis of weighted mean, who among the three, will get the scholarship? (4)

Subject	Weight	Marks scored		
		A	B	C
Physics	4	70	80	85
Chemistry	3	50	60	45
Mathematics	3	90	75	65
Computer Sc.	2	60	45	65

OR

Q.3(a) In case of grouped frequency distribution, derive the formula for determining median. (4)

(b) The mean salary of male and female employees in a firm is Rs. 5200 and Rs. 4200 respectively. The mean salary of all employees is Rs. 5000. Find the percentage of male and female employees. (4)

Q.4(a) What is Box-plot? Draw Box-plot for the data given below: (4)

18, 27, 34, 52, 54, 59, 61, 68, 78, 82, 85, 87, 91, 93, 100

(b) The following table shows the distribution of the life-time (in hours) of 200 bulbs. (4)

Life-time(in hours)	100-150	150-200	200-250	250-300	300-350	350-400	400-450
No. of bulbs	6	18	73	65	12	22	4

Determine (a) % of bulbs that have life-time (i) less than 300 hours (ii) between 300 and 375 hours (b) D_7, P_{45} and O_4. Comment on your findings.

OR

Q.4(a) The sum of squares of deviations is least (minimum) when measured from (4)
(a) Mean (b) Median (c) Mode (d) All of the above
Choose most suitable one and prove the same.

(b) A study was conducted comparing female adolescents who suffer from bulimia to healthy females with similar body compositions and levels of physical activity. Listed below are measures of daily caloric intake, recorded in kilocalories per kilogram of samples of adolescents from each group. (4)

Daily caloric intake (Kcal/kg)				
Bulimic			Healthy	
15.9	18.9	25.1	20.7	30.6
16.0	19.6	25.2	22.4	33.2
16.5	21.5	25.6	23.1	33.7
17.0	21.6	28.0	23.8	36.6
17.6	22.9	28.7	24.5	37.1
18.1	23.6	29.2	25.3	38.4
18.4	24.1	30.9	25.7	40.8
18.9	24.5		30.6	

(i) Find the median daily caloric intake for both the bulimic adolescents and the healthy ones.
(ii) Which group has greater amount of variability in the measurement?

Q.5(a) Define raw moments and central moments. Express raw moments in terms of central moments. (4)

(b) Calculate an appropriate measure of skewness from the following data. Comment on your findings. (4)

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

OR

Q.5(a) Explain the meaning of skewness. State the various methods to determine skewness and its coefficient. Explain any one of them. (4)

(b) The following data represent the scores of 40 students in a college test. (4)

174	178	171	135	160	115	95	190	119	144
133	162	98	138	154	158	178	162	131	106
176	167	166	161	145	144	126	145	162	194
157	184	147	115	152	182	136	165	137	143

Make a stem-and-leaf diagram. What kind of information do we get from it?

Q.6(a) What is an index number? State its uses. (4)

(b) Given the sum of the products of prices and quantities for the base year and current year for five items as, (4)

$$\sum p_0 q_0 = 782, \sum p_1 q_0 = 1084, \sum p_0 q_1 = 1008, \sum p_1 q_1 = 1329,$$

On the basis of the given information, show that Fisher's index number satisfies time reversal and factor reversal test.

OR

Q.6(a) Verify whether the following formulae satisfy time reversal test: (4)
(i) Laspeyre (ii) Paashe (iii) Fisher

(b) What is an index number? State its limitations. (4)

Q.7(a) Write a note on Specific Death Rate (SDR). (4)

(b) Calculate (i) CDR (ii) Age – Specific Death Rate (iii) STDR taking the population of Town-A as standard population using direct method. (4)

Age groups	Town - A		Town - B	
	Population	No. of deaths	Population	No. of deaths
< 5	6040	215	9300	391
5 – 15	12645	241	15410	248
15 – 35	13300	294	18620	331
35 – 50	4625	362	8190	789
> 50	6710	463	6480	587

OR

Q.7(a) Is crude death rate an accurate measure of mortality? If not, how will you modify it to give reliable results? (4)

(b) Find the STDR by direct and indirect methods for the data given below: (4)

Age (in years)	Standard population		Population A	
	Population('000)	Specific death rate	Population('000)	Specific death rate
0 – 5	8	50	12	48
5 – 15	10	15	13	14
15 - 50	27	10	15	9
> 50	5	60	10	59

Q.8(a) State the various measures of Fertility. Explain any one of them. (4)

(b) Calculate GFR, SFR and TFR from the data given below: (4)

Age groups	No. of females('000)	No. of live births
15 – 19	16	400
20 – 24	15	1710
25 – 29	14	2100
30 – 34	13	1430
35 - 39	12	960
40 – 44	11	330
45 - 49	9	36

OR

Q.8(a) What do you mean by fertility of the population? Define (i) CBR (ii) GFR (4)

(b) Calculate GFR and TFR from the following data: (4)

Age groups	No. of females	SFR
15 – 19	125	12
20 – 24	120	90
25 – 29	100	100
30 – 34	100	125
35 - 39	105	75
40 – 44	85	40
45 - 49	65	6

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SARDAR PATEL UNIVERSITY
B.Sc. EXAMINATION (Semester -III)
18th November, 2011
STATISTICS: (US03CSTA02)

Time: 10.30 am to 01.30 pm **Max Marks :** 70

N.B.: (i) Figures to the right indicate full marks.

Q.1 Answer the following questions selecting appropriate options. **(10)**

1. If $44C_{(r-2)} = 44C_{(r+2)}$ then r is
   a. 33 b. 11 c. 22 d. 44
2. In a get-to-gather function everybody handshakes with everybody else. The total number of handshakes is 105. The number of persons in the hall is
   a. 12 b. 11 c. 15 d. 14
3. If events A and B are equi-probable and independent with $P(A \cap B) = p$, then P(B) equals
   a. p b. p^2 c. p/2 d. $\sqrt{p}$
4. If $B \subset A$, then P (A / B) is equal to
   a. zero b. one
   c. P (A) / P(B) d. P (B) / P(A)
5. Given F (x), f(x) can be obtained as
   a. Successive difference b. Derivative with respect to x
   c. Integration with respect to x d. a or b
6. f(x) = x/21, x = 1, 2, 3, 4, 5,6 and f(x) = 0 otherwise then P(x = 2 or x = 3) is
   a. 5/21 b. 6/21
   c. 2/3 d. None of the above
7. If it is known that event A has occurred, the probability of an event E given A is called
   a. empirical probability b. a priori Probability
   c. posteriori probability d. conditional probability
8. f(x) is the probability density function of x for $a \le x \le b$ then geometric mean of x is
   a. $\int \ln(x) f(x) dx$ b. $\Sigma \ln(x) f(x)$
   c. $\exp(\int \ln(x) f(x) dx)$ d. none of the above
9. If X is a random variable with p.g.f. P(t),it can be used to obtain
   a. Probabilities of X b. Moment generating function of X
   c. Factorial moments of X d. all of the above
10. If f(x, y) is the joint probability density function of X and Y, the marginal p.d.f. of Y is given by
    a. $\int f(x, y) dy$ b. $\Sigma_x f(x, y)$
    c. (a) or (b) d. none of the above

Q.2 Answer any SIX of the following: **(12)**

(1) Explain union and intersection of events, complementary events and interpret them.
(2) State classical definition of probability. State its usefulness and limitations.
(3) Define conditional probability. State important results concerning it.
(4) Explain pair wise and mutual independence of events. State relations between them if there are any.
(5) Define median and mode of the distribution of a random variable X.
(6) Express r^{th} central moment in terms of raw moments. Use it to obtain variance.
(7) Define coefficients of skewness and kurtosis of the distribution of a random variable X and describe their interpretations.
(8) Define product moments. Explain how you can derive the moments for individual random variables.

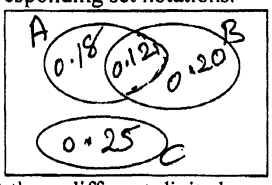
Q.3 (a) Explain mutually exclusive events, equi-probable events, exhaustive events. State mathematical conditions each one of them satisfies. **(4)**

(b) In a group of 100 employed and 100 unemployed persons, 40 are employed women. The group contains 50 more men than women. Find the probability that a person selected at random from the group is (i) unemployed man, (ii) a male or employed, (iii) employed when it is known that he is a man. **(4)**

OR

Q.3 (a) Using the figure given below, find the probability of occurrence of (i) exactly one, (ii) only A or C, **(4)**

(iii)none of A,B and C stating the corresponding set notations.



(b) Using the digits 1, 2, 3, 4, 5, 8 and 9 three-different digited numbers are formed. Find the probability that a number selected at random is (i) odd, (ii) multiples of 5, (iii) even given that it is greater than 300. **(4)**

Q.4 (a) State and prove the law of addition of probabilities for two events. Write its particular cases and its generalized form. **(4)**

(b) In a factory, 2000, 2500, and 1000 items are produced during three shifts of which 5%, 8% and 12% are known to be defective respectively. An item selected at random from a day's production was found to be defective. Find the probability that it was produced during the second or the third shifts. State the result you have used. **(4)**

OR

Q.4 (a) If A& B' are independent events, prove that A & B are independent. State the other similar results. **(4)**

(b) A man and his wife appear in an interview for two vacancies in the same post. The probability of selection of the husband is 0.40 and that of his wife is 0.45. Find the probability that (i) both of them will be selected, (ii) none of them will be selected; (iii) the wife will be selected when exactly one of them is to be selected. **(4)**

Q.5 (a) Define probability mass function (p.m.f.), cumulative distribution function, median and quartile deviation (Q.D.) of a random variable. **(4)**

(b) The probability density function (p.d.f.) of a random variable X is **(4)**

$$f(x) = e^{-x/5}/5,\ x > 0$$
$$= 0 \qquad \text{o.w.}$$

Find (i) $P(2 < X < 5)$ (ii) cumulative distribution function and (iii) quartile deviation of X.

OR

Q.5 (a) Find the probability mass function and the cumulative distribution function of the number of teachers selected if a committee of 4 persons is to be formed from a group of 2 clerks, 3 teachers and 5 students. **(4)**

(b) The c.d.f. of a random variable X is as follows: **(4)**

X:	-2	-1	0	1	2	3	4	5
F(x):	0.05	0.15	0.30	0.60	0.80	0.92	0.99	1

Find (i) $P(|X-1|< 3)$, (ii) $P(X \text{ is even} / (|X-1|<3))$, (iii) the smallest value of 'a' for which $P(X \leq a) > 0.60$.

Q.6 (a) Define mathematical expectation , geometric mean, mean deviation and coefficient of variation of a random variable X. **(4)**

(b) The p.m.f. of a random variable X is as follows: **(4)**

X:	0	1	2	3
f(x):	a	0.15+b	3b	2b+0.05

Find a and b such that $E(X) = 1.6$. Also, find coefficient of variation of X.

OR

Q.6 (a) The p.d.f. of a random variable X is as follows: **(4)**

X:	1	2	3	4	5
f(x):	0.10	0.20	0.40	0.20	0.10

Find (i) geometric mean, (ii)standard deviation, and (iii) the mean deviation about mean of X.

(b) The p.d.f. of a random variable X is as follows: **(4)**

$$f(x) = k\,(1-x)^2 \text{ if } 1 < x < 3$$
$$= 0 \qquad \text{o.w.}$$

Find (i) k, (ii) the mean and variance of $Y = (2-3X)/5$.

Q.7 (a) Define various types of moments of a r. v X. State the relations which can be used to obtain variance of X using the factorial moments. **(4)**

(b) The p.g.f. of a random variable X is $(0.7 + 0.3\,t)^9$. Find (i) $P(X=2)$, (ii) second factorial moment, (iii) mean and (iv) standard deviation (s.d.)of X. **(4)**

OR **(4)**

Q.7 (a) Define various generating functions and describe relations between them if there are any. **(4)**

(b) The probability density function (p.d.f.) of a random variable X is **(4)**

$$f(x) = e^{-x},\ x > 0$$
$$= 0 \qquad \text{o.w.}$$

Find the r^{th} raw moment about origin. Hence or otherwise obtain coefficient of variation and coefficient of skewness of X.

Q.8 (a) Define joint, marginal and conditional p.f. of two random variables. Describe the relations between them if they exist. Also, state the conditions for independence of X and Y. **(4)**

(b) The joint p.m.f. of random variables X and Y is given below: **(4)**

Y \ X	0	1	2	3
-1	0.05	0.05	0.10	0.10
0	0.05	0.10	0.10	0.05
1	010	0.15	0.10	0.05

Find (i) Cov (X, Y), (ii) V(X \ Y = 0)

OR

Q.8 (a) The joint p.m.f. of random variables X and Y is **(4)**

$f(x, Y) = k(2X + 3Y)$, $x = 1,2,3$; $y = 0,1,2$

$= 0$ o.w.

Find (i) k, (ii) P(Y is even), (iii) P(X + Y < 4) and (iv) if X and Y are independent.

(b) The joint p.d.f. of random variables X and Y is $f(x,y) = (6 - x - y)/8$, $0 \le x < 2$, $2 \le y < 4$ **(4)**

$= 0$ o.w.

Find the coefficients of variation for X and Y.

X = X = X

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SARDAR PATEL UNIVERSITY

S.Y.B.Sc. EXAMINATION (Semester -III)

17th November, 2011

OPERATIONS RESEARCH: (US03ESTA01)

Time: 10.30 am to 12.30 pm **Max Marks :** 70

N.B.: (i) Figures to the right indicate full marks.

(ii) Graph papers will be supplied on request.

Q.1 Answer the following questions selecting appropriate options. **(10)**

1. The best use of linear programming problem is to find an optimum use of
   a. money b. man-power
   c. machine d. all of the above
2. In standard form of linear programming problem, the constraints are
   a. ≥ type b. ≤ type
   c. = type d. all of the above
3. In graphical solutions of linear programming problem if the iso-cost lines coincide with a side of region of basic feasible solutions we get...
   a. unique optimum solution b. unbounded optimum solution
   c. no feasible solution d. infinite number of optimum solutions
4. If a negative value appears in the solution values column of the simplex table, then
   a. the solution is optimal b. the solution is infeasible
   c. the solution is unbounded d. all of the above
5. In the optimal simplex table z_j-c_j= 0 value for a non basic variable indicates
   a. unbounded solution b. cycling
   c. alternate solution d. infeasible solution
6. The solution to a transportation problem with m origins and n destinations is feasible if the number of positive allocations is
   a. m+n b. mxn
   c. m+n-1 d. m+n+1
7. An unoccupied cell in a transportation problem is similar to
   a. Z_j -C_j value in simplex method b. basic variable in simplex method
   c. non-basic variable in simplex method d. none of the above
8. For a maximization type transportation problem, we have to add
   a. an artificial slack variable b. surplus variables
   c. subtract each entry from the maximum entry d. all of the above
9. If total demand equals total supply in a transportation problem, the problem is said to be
   a. balanced b. unbalanced
   c. degenerate d. none of the above
   e. f.
   g. h.
10. The method of obtaining initial basic feasible solution that sometimes gives the optimum solution of the transportation problem is
    a. North-West corner method b. Row minima method unbalanced
    c. Matrix minima method d. Vogel's approximation method

Q. 2 Answer any TEN of the following: **(20)**

(1) Describe in brief, the method of plotting inequalities of a linear programming problem.

(2) Define linear programming problem. State its important characteristics.

(3) Explain the difference between basic variables and non-basic variables.

(4) What are the characteristics of simplex method of solving linear programming problem?

(5) How do you obtain $Z_j - C_j$? What is its significance?

(6) What is duality? State its importance.

(7) Describe the mathematical formulation of a transportation problem. Shaw that it is a particular case of linear programming problem.

(8) Describe the way of determining the cell to be assigned in Vogel's approximation method while solving a transportation problem.

(9) State methods of obtaining initial basic feasible solution of a transportation problem. Which one do you prefer? Why?

(10) What is unbalanced transportation problem? How do you deal with it?

(11) How do you determine the incoming and outgoing variables in uv method of solving transportation problem?

(12) Describe the situations in transportation problem where we have (i) alternate optimum solution, (ii) degenerate solution.

Q.3 (a) Define: basic feasible solution, degenerate basic feasible solution, optimum solution, region of basic feasible solution. **(4)**

(b) Solve the following linear programming problem graphically and interpret the solution. **(6)**

Maximize $Z = 5x_1 + 3x_2$ subject to the constraints

$x_1 + x_2 \leq 6,\ 2x_1 + 3x_2 \geq 6,\ 0 \leq x_1 \leq 4,\ 0 \leq x_2 \leq 3$

Examine if (i) $x_1 = 2, x_2 = 3$, (ii) $x_1 = 1, x_2 = 1$ is a feasible solution of the given problem.

OR

Q.3 (a) Describe the situations in graphical method of solving linear programming problem where we have (i) unique optimum solution, (ii) alternate optimum solution, (iii) unbounded solution, (iv) no feasible solution. **(4)**

(b) A consumer durable manufacturer has potential market for two products P_1 and P_2 which uses machines M_1 and M_2 as per the following details. **(6)**

	Machine hours required per unit	
Product	M1	M2
P1	3	2
P2	4	1
Available Machine hours	36	16

The estimated costs are Rs. 30 per piece for P_1 and Rs. 50 per piece for P_2. The sales division has indicated that they can sell any amount of P_2 but only 10 units of P_1. Find out the best manufacturing strategy using Graphical Method.

Q.4 (a) What is Simplex method? What are its important characteristics? Represent the form of a simplex tableau. **(4)**

(b) Use simplex method to solve the following LP problem : **(6)**

Maximize $Z = 6x_1 + 4x_2$ subject to the constraints

$2x_1 + 3x_2 \geq 30,\ 3x_1 + 2x_2 \leq 24;\ x_1 + x_2 \leq 3$

$x_1 \geq 0, x_2 \geq 0$

Is the solution unique? If not, find one more solutions and comment.

OR

Q.4 (a) What is duality? Write procedure of writing dual of a linear programming problem. **(4)**

(b) Solve the following LP problem using duality. **(6)**

Minimize $Z = 160x_1 + 120x_2 + 80x_3$

subject to the constraint :

$x_1 + 3x_2 + 2x_3 \geq 4,\ 3x_1 + 4x_2 + x_3 \geq 8,$

$2x_1 + 2x_2 + 2x_3 \geq 6;\ x_1, x_2, x_3 \geq 0$

Q.5 (a) What is a transportation problem? State the methods of obtaining initial basic feasible solution to a transportation problem. Which one is the best? Why? **(4)**

(b) Find the initial basic feasible solutions for the following TP using North-West corner method and Vogel's approximation method and comment on your results: **(6)**

Source	Destination				Capacities
	1	2	3	4	
I	5	8	3	6	30
II	4	5	7	4	50
III	6	2	4	6	20
Requirements	30	40	20	10	100

OR

Q.5 (a) Explain basic variables, non-basic variables, rim requirements and penalty in connection with a transportation problem. **(4)**

(b) Find the initial basic feasible solution for the following TP using least cost method and Vogel's approximation method and comment on your results: **(6)**

Source	Destination				Capacities
	1	2	3	4	
I	2	4	6	11	50
II	10	8	7	5	70
III	13	3	9	12	30
iv	4	6	8	3	50
Requirements	25	35	105	20	

Q.6 (a) Describe in brief, the uv method of obtaining optimum solution of a transportation problem. **(4)**

(b) Using the solution given in the following table, answer the questions following the table. The values in the brackets indicate X_{ij}. **(6)**

Source	Destination				Capacities
	1	2	3	4	
I	5 -	10 -	4 **(10)**	5 -	10
II	6 **(20)**	8 -	7 -	2 **(5)**	25
III	4 **(5)**	2 **(10)**	5 **(5)**	7 -	20
Requirements	25	10	15	5	

(i) Is the solution (a) feasible? (b) degenerate?

(ii) Is the solution optimum? If so, is it unique? If not, find one more optimum solution .

OR **(4)**

Q.6 (a) Given the following profit matrix, find the optimum solution that maximizes the profit. Is it unique? If not, find one more optimum solution. **(6)**

Pit	Project location			
	A	B	C	a_i
X	4	8	8	76
Y	16	24	26	82
Z	8	16	24	77
b_j	72	102	41	

(b) $X_{11} = 90, X_{12} = 10, X_{22} = 150, X_{32} = 10, X_{33} = 50, X_{35} = 120, X_{44} = 210, X_{45} = 70, X_{ij} = 0$ o.w. is a solution of the following transportation problem. Examine if it is optimum. If not find one more solution and show that it is better than the given solution. **(4)**

Source	Destination				
	E	F	G	H	I
A	8	10	12	17	15
B	15	13	18	11	9
C	14	20	6	10	13
D	13	19	7	5	12

X=X=X