Fellowship

EXAMINATION QUESTION PAPERS MAY 2006

FL-82

FELLOWSHIP EXAMINATION
STATISTICS

Time: 3 Hours]   [Total Marks : 100

Answer any **FIVE** questions only.
All questions carry 20 marks each.

(An extract from the table of areas of the standard normal curve between o and x is given at the end)

Marks

1. a) The probability that at least 2 of 3 persons X, Y and Z will survive for 10 years is $\frac{247}{315}$. The probability that Y alone will survive for 10 years is $\frac{4}{63}$ and the probability that X alone will die within 10 years is $\frac{2}{9}$. Assuming that the events of survival of X, Y and Z can be regarded as independent, calculate the probability of each person surviving 10 years.   12

   b) Buses of 4 routes A, B, C, D call at a certain bus-stop, and out of every 14 buses it can be assumed that 5 are 'A', 4 are 'B', 3 are 'C' and 2 are 'D'. Two types of buses, old and new, are in service in equal numbers taking all 4 routes together, but the numbers of new buses on the different routes are such that if a person boards a new bus without noticing its route indication, it is equally likely to be on any of the 4 routes. A person boards an old bus without noticing its route indication. Calculate the probability from first principles that the bus is on route 'A'.   8

2. An agricultural experiment gave the following results for the cost of production of wheat per acre. Columns correspond to blocks and rows to treatments. Discuss the variation of the cost of production with each of the two factors.   20

TREATMENTS	BLOCKS					
	I	II	III	IV	V	VI
A	3.5	4.7	2.8	4.5	3.8	4.7
B	4.0	5.3	3.0	3.6	2.2	5.1
C	2.5	5.6	2.8	4.0	2.0	6.0
D	3.7	4.0	4.2	3.4	4.6	4.3
E	4.3	4.4	3.2	5.5	3.4	3.9

Given that $F_{0.05} = 2.87$ for degrees of freedom 4 and 20   and
$F_{0.05} = 2.71$ for degrees of freedom 5 and 20

3. a) Two unbiased dices are thrown. Find the probability of the product of   12
      numbers appearing on upper faces
      i)   6 or less
      ii)   18 or more

   b) Just before the polling day of election, a newspaper conducts a survey   3
      for estimating the proportion of voters likely to vote for the party X.
      What should be minimum size of the sample if the editor wants to be
      90% confident that error in estimate will not exceed 0.05?

   c) In what way the answer will differ, if it is known that the required   5
      proportion will be between
      i)   0.5 & 0.6
      ii)   0.3 & 0.4
      iii) 0.7 & 0.8

4. The table below gives a frequency distribution of the marks obtained in
   'English Subject' by 1000 successful candidates at a recruitment test
   conducted by an Insurance Company.

Marks in English X	50	51	52	53	54	55	56	57	58	59	60	61
No. of Candidates f	16	93	181	196	163	120	83	56	38	26	17	11

Using the above data, calculate inrespect of variable 'X' the following :

   i)   a) Mean b) Mode c) Median   10
        d) Lower Quartile e) Upper Quartile

   ii) a) Quartile Deviation   2
        b) Standard Deviation   3
        c) Mean Deviation   5

5. The Table below gives the observed values of Y corresponding to the
   given values of X.

Varible X →	21	24	27	29	30	32	35	38	40	43
Varible Y →	21	23	25	26	27	28	30	32	33	35

   i)   Find the co-efficient of co-rrelation between 'X' and 'Y'.   10
   ii) Find the equation of the regression line of 'Y' on 'X' and calculate the   5
        value of Y when X = 46.
   iii) Find the equation of the regression line of 'X' on 'Y' and calculate the   5
        value of X when Y = 37

6. a) What are the Type I Error and Type II Error ?   2

   b) A company manufacturing biscuits, packs its products in packets of   10
   100 gms. The packets will not usually weigh exactly 100 gms. but
   will either weigh slightly less than or greater than 100 gms. The
   standard deviation of the weights of packets is known to be 3 gms.
   from the past experience. The quality control section takes a sample
   of 36 packets every day and finds its average. If the probability of
   Type I error is fixed at 5%, what should be the minimum value for the
   sample mean, to adjust the machine, if the sample mean is found to be
   less than this minimum prescribed value.

   c) Calculate the probability of Type I error. When population mean is   8
   i)   99 gms.
   ii)   98.5 gms.

7. a) A random variable X is defined as the number of failures before the   15
   first success in a sequence of independent Bernoulli trials, where the
   probability of success is θ, at any trial and it remains the same
   throughout. Derive the probability distribution of X, state the formulae
   for expected value and variance of X.

   b) A box contains 100 balls, of which 20 are red and the remaining balls   5
   are white. After shaking the box well, one ball is drawn at random,
   its colour is noted and the ball is replaced in the box. The process is
   repeated a number of times.
   i)   Find the probability that the red ball will appear for the first
   time in the 4th draw.
   ii)   Find the probability that the red ball will appear for the 2nd time
   in the 4th draw.

8. The figures of consumption of cold drinks are tabulated below :-

   ### Consumption of Cold Drinks in '000 bottles

Year → ↓	Quarter I	Quarter II	Quarter III	Quarter IV	Total
2001	90	75	87	70	322
2002	75	80	78	75	308
2003	80	75	75	72	302
2004	85	82	80	81	328
Total :	330	312	320	298	1260

a) Obtain trend value for each quarter   10

b) Isolate random variations taking the following as quarterly Indices   6
   estimated from recent past experience.

QUARTER →	I	II	III	IV
INDEX →	104.66	101.63	100.73	92.98

c) Ignoring the random variations, forecast the quarterly consumption   4
   of cold drinks for the year 2005.

TABLE SHOWING AREAS OF THE STANDARD NORMAL CURVE FOR VALUE OF 'X' BETWEEN '0' AND 'x'			
X	AREA	X	AREA
0.1	0.0398	1.1	0.3643
0.2	0.0793	1.2	0.3849
0.3	0.1179	1.3	0.4032
0.4	0.1554	1.4	0.4192
0.5	0.1915	1.5	0.4332
0.6	0.2257	1.6	0.4452
		1.645	0.4500
0.7	0.2580	1.7	0.4554
0.8	0.2881	1.8	0.4641
		1.9	0.4713
0.9	0.3159	1.96	0.4750
		2.0	0.4772
1.0	0.3413	2.58	0.4951
		3.0	0.4987

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