

IC-104

Fellowship

# EXAMINATION QUESTION PAPERS MAY 2009



भारतीय बीमा संस्थान  
INSURANCE INSTITUTE OF INDIA  
Universal Insurance Building,  
Sir P. M. Road, Fort,  
Mumbai - 400 001.

**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) An integer is chosen from the first 20,000 positive integers, if all are equally likely to be selected, what is the probability that the integer chosen is not divisible by 6 or 8 ?  | 10    |
|    | b) A Company has two screw producing machines . Past records show that Old machine produces 30% of the screws and New machine produces 70% of the screws in a day. Further, 5% of the screws produced by Old machine are defective, whereas only 1% of the screws produced by New machine are defective. If a defective screw is drawn at random, what is the probability that the defective screw was from Old machine? | 10    |
| 2. | Calculate price and quantity indices for the year 2005 with 2002 as base year from the following data by using :-<br>(i) Laspeyres (ii) Paasches and (iii) Fishers formula.  | 12    |

Year	Comodity I		Comodity II		Comodity III		Comodity IV	
	Price	quantity	Price	quantity	Price	quantity	Price	quantity
2002	5.00	5	7.75	6	9.63	4	12.50	9
2005	6.50	7	8.80	10	7.75	6	12.75	9

With reference to above, verify :-

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- i) Time Reversal Test is satisfied by Fishers formula.
- ii) Fishers Price Index  $\times$  Fishers quantity Index = Value Index (when expressed as ratios and not percentages)

3. A book of 1000 pages was scanned and the number of printing errors in each page was noted. The distribution of number of errors in a page was found to be 'Poisson'. If there were exactly 301 pages free from error and 26 pages with exactly 4 errors each, estimate the average errors per page. 4

Also estimate :

- a) i) the number of pages with exactly '1' error and 8  
 ii) the number of pages with exactly '2' errors
- b) If for the second edition of the same book (published after 3 years), the average errors per page was found to be '1' estimate. 8  
 i) the number of pages with '0' error and  
 ii) the number of pages with exactly '1' error.

Given that :  $e^{-1} = 0.36788$

4. a). The following table gives the distribution of relatively defective items of certain product; according to their size groups. 10

**Size Group**

X                    15.5    16.5    17.5    18.5    19.5    20.5

**Defective items**

Y                    75       60       50       50       45       50

Based on above data, check whether there is any possibility of correlation between size and defect in quality.

- b) Find the most appropriate missing value from the following data, if relationship between variables u & v is known to be linear. 10

u                    2        3        7        10       12       15

v                    18       16       10       ?        13       11

5. a) State the 'Commonly Used Estimators' for the following: 6  
 i) Population Mean,  $\mu$   
 ii) Population Variance,  $\sigma^2$  and  
 iii) The proportion  $\pi$  of units in the population, having a particular attribute.

- b) What are the short-comings of the above estimates? 3
- c) Using the following data of ages of 20 employees, of a firm, randomly selected from total 1000 employees, find the estimate for 11
- Population Mean,  $\mu$
  - Population Variance,  $\sigma^2$  and
  - the proportion of the employees aged more than 50 in the population,
- 21, 24, 26, 29, 31, 32, 33, 34, 35, 36, 43, 45, 46, 48, 49, 52, 53, 56, 56 & 59.

6. 550 students were examined for a competitive examination, in 'Mathematics'. The marks obtained by them ranged from 0 to 99, all being integers. The marks are grouped in 20 classes, each class of 5 marks interval. They are given below with respective frequencies.

Interval	Mid-value	Frequency	Interval	Mid-value	Frequency
0-4	2	11	50-54	52	49
5-9	7	12	55-59	57	51
10-14	12	12	60-64	62	60
15-19	17	13	65-69	67	40
20-24	22	22	70-74	72	31
25-29	27	22	75-79	77	26
30-34	32	28	80-84	82	22
35-39	37	33	85-89	87	16
40-44	42	43	90-94	92	12
45-49	47	43	95-99	97	4

- Calculate : Mean, Mode, Median 9
  - Calculate : Standard Deviation 3
  - Calculate measure of skewness  $\alpha_3$  8
7. a) The mean score of a random sample of 60 subjects was found to be 145 with a standard deviation of 40. Construct a 95% confidence interval for true mean. Assume the sample size to be large enough for normal approximation. What size of the sample is required to estimate the population mean (true mean) within the difference of 5 from true mean, with 95% confidence? 10

- b) The mean weekly sales of soap bars in departmental stores in certain city 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 campaign successful? 10

[ $t_{.05} = 1.72$  at 21 d.f. for single tailed test.]

8. a) The heights (to the nearest half-inch) of 15 men selected at random are as follows: 10

63.0, 64.0, 64.0, 64.5, 65.0, 65.0, 66.5, 66.5, 66.5, 67.0, 67.0,  
68.5, 69.0, 70.0, & 72.0

Can the sample be regarded as taken from the population having height 68 inches as mean?

[Given that  $t_{0.025} = 2.145$  for degrees of freedom 14]

- b) Two samples A and B of size 15 & 7 respectively gave following results: 10

	<u>Sample A</u>	<u>Sample B</u>
Mean	$\bar{x}_1 = 70$	$\bar{x}_2 = 68$
Standard deviation	$S_1 = 2.4$	$S_2 = 2.7$
number	$n_1 = 15$	$n_2 = 7$

Is the difference of the mean significant at 5% level?

The value of  $t_{0.025}$  for degrees of freedom 20 is 2.086

TABLE SHOWING AREAS OF THE STANDARD NORMAL CURVE FOR VALUE OF 'X' BETWEEN '0' AND 'X'

X	Area	X	Area
0.05	0.0199		
0.10	0.0398	1.1	0.3643
0.20	0.0793	1.2	0.3849
0.30	0.1179	1.3	0.4032
0.40	0.1554	1.4	0.4192
0.50	0.1915	1.5	0.4332
0.60	0.2257	1.6	0.4452
		1.645	0.4500
0.70	0.2580	1.7	0.4554
0.80	0.2881	1.8	0.4641
		1.9	0.4713
0.90	0.3159	1.96	0.4750
		2.00	0.4772
1.00	0.3413	2.58	0.4951
		3.0	0.4987

—END—