IC - 104

Fellowship

EXAMINATION QUESTION PAPERS NOV 2009

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FL-81

FELLOWSHIP EXAMINATION

MATHEMATICAL BASIS OF LIFE ASSURANCE

Time: 3 Hours] [Total Marks : 100

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

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1. a) From the bag containing 8 red balls, 5 black balls and 3 white balls, a ball is drawn, its colour noted and replaced. Then a ball is again drawn. Find the following probabilities :- Marks 2 each

   i) the ball drawn is red in both the draws
   ii) at least one red ball is drawn in the two draws.
   iii) one of the ball drawn is red and the other is white.
   iv) a white ball is not drawn.

   b) Fill up the blanks in the following portion of a life table.

Age x	lx	dx	qx	P_x	
10	1000000	-	.00409	-	2
11	-	-	.00370	-	3
12	-	-	.00347	.99653	2
13	-	-	-	.99658	3
14	-	3370	-	.99658	2

2. a) Find the rate of interest if : $a_x = 12.36$ and $A_x = 0.738$ 5

   b) Calculate using the given commutation functions at 4% pa the values of : 9

   i) $A^1_{30:\overline{10}|}$ ii) $\ddot{a}^{(2)}_{40:\overline{5}|}$ iii) ${}_5|A_{55}$

   Given that :-

$M_{30} = 490.33$	$N_{40} = 41070.31$	$D_{30} = 3060.13$
$M_{40} = 473.33$	$N_{45} = 31583.93$	$D_{40} = 2052.96$
$M_{55} = 430.55$	$N_{47} = 28294.89$	$D_{45} = 1677.97$
$M_{60} = 402.93$	$D_{50} = 1366.61$	$D_{55} = 1105.41$

   c) Show that $\sum_{t=1}^{\infty} {}_{t|}q_x \; a_{\overline{t}|} = a_x$ 6

3. a) The following particulars from the revenue account of a life insurer are available. 8

	Rs.
Fund at the beginning of the year	2,85,00,000
Premium income during the year	7,40,000
Other receipts	50,000
Claims	4,45,000
Surrender and other payments	30,000
Expenses of Management	90,000
Net interest received	12,60,000
Tax paid	2,70,000

Find the gross and net rates of interest earned in the year.

b) A loan of Rs. 3,000 is to be paid with interest at 6% p.a. by means of an immediate annuity for 10 years. Find the level payment. What will be the interest and principal contained in the 5th instalment ? What will be the principal outstanding immediately after the 8th payment is made ? 6

V^6 @ 6% = .70496 $a_{\overline{2}|}$ @ 6% = 1.8334 $a_{\overline{10}|}$ @ 6% = 7.3601

c) Find the rate of discount corresponding to a rate of interest of 8%. What will be the present value of Rs. 10,000 due 4 years at the calculated interest ? 6

4. a) Show that using usual notations 5

$$\left[{}_t|A_x \right]^2 = v \times \left[\overline{A}_x - \overline{A}_{\overline{x:t}|} \right]^2$$

b) Prove that under a regular premium whole life policy effected 't' years ago for a life then aged 'x', the retrospective policy value is equal to the prospective policy value if both are calculated on the premium basis. You may ignore expenses. 10

c) If $l_x = 1000\sqrt{100 - x}$, Find :- 5

i) the probability of a life surviving from birth to age 19

ii) the probability of a life aged 36 dying before age 51.

5. a) What is expection of life (e^x). Explain its relationship with complete expectation of life e^o_x 8

b) What is reserve for elimination of Negative values 6

c) What is surplus ? What are its main sources ? 6

6. a) A yearly annuity to a life aged 40 commences at Rs. 20,000 and decreases each year by Rs. 800 till Rs. 4,000 at which it remains level until it ceases at age of 80. Find the present value of annuity at 4% interest, if the first payment starts immediately. 10

Given :- $N_{40} = 41070.31$ $S_{41} = 602038.53$ $D_{40} = 2052.96$

$N_{80} = 1557.89$ $S_{61} = 119995.80$

b) A 10 year term assurance provides a benefit of Rs. 1 lakh at the end of year of death, together with the return (without interest) of the premiums paid . Allowing for expenses of 10% of the premium. Find the annual premium for a life aged 50 at 4% interest. 10

Given :- $M_{50} = 449.71$ $R_{50} = 11697.22$ $N_{50} = 23839.41$

$M_{60} = 402.93$ $R_{60} = 7382.67$ $N_{60} = 12477.80$

a) Corresponding to the rate of interest of 21% per half year, find the nominal rate of interest p.a. convertible quarterly. 4

b) 'X' has taken loan of Rs. 5,000 from 'Y' at rate of interest 10% p.a. convertible half yearly. 'X' pays Rs. 1,000 at the end of first year and pays Rs. 2,000 at the end of second year. 'X' pays the final amount at the end of 5 years. What is the final amount paid by 'X' ? 8

Given at 10% :- $v^2 = .82645$ $v^4 = .68301$ $v^5 = .62092$

$v^8 = .46651$ $v^{10} = .38554$

Given at 5% :- $v^2 = .90703$ $v^4 = .82270$ $v^5 = .78353$

$v^8 = .67684$ $v^{10} = .61391$

c) i) Find the effective rate of interest p.a. corresponding to nominal rate of 6% p.a. convertible quarterly. 3

ii) The compound interest on Rs. 7,000 at the end of 3 years is Rs. 1337. The amount at the end of 4 years is Rs. 8,837.50 Find rate of interest. Also find the amount at the end of 7 years. 5

8. A special Endowment policy for a life aged 40, for 20 year payable by way of half yearly premiums has the following benefits. 20

- Rs. 75,000 payable on death (at the end of year of death during the term of the policy.)
- Rs. 1,00,000 payable on survivance of the term
- Premiums paid along with interest of 4% p.a. effective compounding as the same frequency of premium payment on survivance of 10 years.

Calculate the half yearly premium on the following basis

Interest - 4%

Expenses - Initial Rs. 1,500
- Renewal Rs. 250 p.a.

You may assume that expenses are incurred, when premiums are received.

Given :-

$M_{40} = 473.33$ $D_{40} = 2052.96$

$M_{60} = 402.93$ $D_{50} = 1366.61$

$N_{40} = 41070.31$ $D_{60} = 882.85$

$N_{60} = 12477.80$

——— END ———

NOVEMBER, 2009

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) i) In a certain harbor there are 2 battleships, 3 cruisers, 5 destroyers and a submarine. Six of the commanding officers are invited to attend a cocktail party ashore. If all those invited and no others, attend, what is the probability that the guests represent 1 battleship, 2 cruisers, 2 destroyers and the submarine? 5

Assume that the eleven commanding officers are all equally likely to be invited.

ii) What is the probability that all 5 destroyer commanding officers attend the party? 5

b) 4 bags each contain 4 white and 7 black balls while one other bag contains 7 white and 4 black balls. A bag is chosen at random from the 5 bags and 2 balls are drawn out of it together and both are found to be black. What is the probability that it came from a bag containing 7 white and 4 black balls? 10

2. a) 10 students are selected from a class at random and given two tests, one in the 'Mathematics' and one in 'Statistics'. Marks obtained by the students in two tests are given below: 10

% Marks in Mathematics	85	77	41	71	56	76	48	91	53	62
% Marks in Statistics	80	66	41	51	57	69	46	86	51	53

Find the co-efficient of correlation between the % marks obtained in the two subjects.

b) Find the mean $\overline{x}$ & $\overline{y}$ of the two variables x & y. Given that: 10

a) The line of regression of y on x passes through the points (4,0) & (-14,3)

b) The line of regression of x on y passes through the points (1,-1)

c) Co-efficient of correlation between x & y is $-\frac{1}{2}$