There are ten (10) multiple choice questions here and you are to answer all questions asked. Each question is worth 10 points.

Please double check your work as no partial points will be granted.

Please write legibly.

The Illustrative Life Table (ILT) is attached in the last two pages of this paper.

Anyone caught writing after time has expired will be given a mark of zero.

Good luck.

Have a Happy and Healthy Christmas and New Year!

<table>
<thead>
<tr>
<th>Question</th>
<th>Worth</th>
<th>Score</th>
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</table>

Total 100
Question No. 1: (10 points)

For a fully continuous whole life insurance of $1 issued to (40), you are given:

- Mortality follows De Moivre’s (or Uniform distribution) law with $\omega = 100$.
- $\delta = 0.05$
- Premium, based on the Equivalence Principle, is paid continuously at the annual rate of $P$.

Calculate $P$.

(a) 0.015
(b) 0.021
(c) 0.023
(d) 0.025
(e) 0.031
Question No. 2: (10 points)

A fully discrete whole life insurance of $100 is issued to (46). You are given:

- Expenses consist of 10% of annual gross premium in the first year and 4% in subsequent years.
- $A_{45} = 0.15$
- $p_{45} = 0.99$
- $i = 0.04$

Calculate the annual gross premium for this policy.

(a) 0.67
(b) 0.70
(c) 0.73
(d) 0.77
(e) 0.80
Question No. 3: (10 points)

For a special fully discrete whole life insurance issued to (50), you are given:

- The death benefit is $1,000 plus the return of all premiums paid without interest.
- $i = 0.05$
- $(IA)_{50} = 9.268$
- Based on the Equivalence Principle, the level annual premium for this insurance is equal to $38.491$.

Calculate $\ddot{a}_{50}$.

(a) 6.6
(b) 8.6
(c) 11.2
(d) 13.8
(e) 15.8
Question No. 4: (10 points)

For a special type of whole life insurance issued to (30), you are given:

- Death benefits are 5,000 for the first 10 years and 1,000 thereafter.
- Death benefits are payable at the moment of death.
- Deaths are uniformly distributed over each year of age interval.
- \( i = 5\% \)
- The following table of actuarial present values:

<table>
<thead>
<tr>
<th>( x )</th>
<th>( 1000A_x )</th>
<th>( 1000\overline{E}_x )</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>112.31</td>
<td>779.79</td>
</tr>
<tr>
<td>35</td>
<td>138.72</td>
<td>779.20</td>
</tr>
<tr>
<td>40</td>
<td>171.93</td>
<td>777.14</td>
</tr>
</tbody>
</table>

Calculate the Actuarial Present Value (APV) of the benefits for this policy.

(a) 25.90

(b) 147.25

(c) 399.28

(d) 438.08

(e) 468.42
Question No. 5: (10 points)

You are given:

- $p_x = 0.99$
- $p_{x+1} = 0.98$
- $p_{x+2} = 0.96$
- $4p_x = 0.89$
- $3p_{x+1} = 0.92$

Calculate $2p_{x+1}$.

(a) 0.960
(b) 0.963
(c) 0.966
(d) 0.969
(e) 0.972
Question No. 6: (10 points)

You are given:

• $A_{x+20} = 0.40$
• $20E_x = 0.50$
• $A_{x:20} = 0.55$
• $i = 0.03$

Calculate $A_x$.

(a) 0.05
(b) 0.15
(c) 0.25
(d) 0.40
(e) 0.50
Question No. 7: (10 points)

Get-a-Life Insurance Company sells 10,000 fully discrete whole life insurance policies of $1, each with the same age 50. You are given:

- All policies have independent future lifetime.
- $A_{50} = 0.300$
- $2A_{50} = 0.125$
- $i = 0.05$
- Premium is determined according to the portfolio percentile principle, with the probability that the total future loss on the portfolio is negative is at least 95%.
- The 95th percentile of a standard Normal distribution is 1.645.

Calculate the annual premium for each policy.

(a) 0.0204
(b) 0.0207
(c) 0.0210
(d) 0.0213
(e) 0.0216
Question No. 8: (10 points)

Consider a life \((x)\) with curtate future lifetime denoted by \(K\). A fully discrete whole life insurance is issued to \((x)\) where:

- The death benefit is $100.
- Expenses, to be paid at the beginning of each year, consist of 4% of each premium.
- The annual premium is \(G\).
- Denote the discount rate by \(d = \frac{i}{1+i}\).

Which of the following is the loss-at-issue random variable?

(a) \(100 + \frac{1.04G}{d} v^{K+1} - \frac{1.04G}{d}\)

(b) \(100 - \frac{1.04G}{d} v^{K+1} + \frac{1.04G}{d}\)

(c) \(100 v^{K+1} - 1.04 G \bar{a}_{\overline{K+1}}\)

(d) \(100 - \frac{0.96G}{d} v^{K+1} + \frac{0.96G}{d}\)

(e) \(100 + \frac{0.96G}{d} v^{K+1} - \frac{0.96G}{d}\)
Question No. 9: (10 points)

You are given:

- $\ddot{a}_x = 3.65$
- $\ddot{a}_{x+1} = 3.55$
- $p_x = 0.80$

Calculate $i$.

(a) 2%
(b) 4%
(c) 7%
(d) 15%
(e) 20%
Question No. 10: (10 points)

A fully discrete whole life policy of $100 is issued to (50). Level annual premium is determined with the following expense assumptions:

<table>
<thead>
<tr>
<th></th>
<th>% of Premium</th>
<th>Per 100</th>
<th>Per Policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>First year</td>
<td>20%</td>
<td>0.12</td>
<td>2.0</td>
</tr>
<tr>
<td>Renewal years</td>
<td>5%</td>
<td>0.07</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Mortality follows the *Illustrative Life Table* with interest rate $i = 6\%$.

Calculate the gross annual premium for this policy.

(a) 2.0  
(b) 2.6  
(c) 3.2  
(d) 3.8  
(e) 4.4
EXTRA PAGE FOR ADDITIONAL OR SCRATCH WORK