There are two copies of the quiz.
1. A whole life insurance policy is issued to (70) and pays a death benefit of 78,000 at the end of the year of death. The policy has level annual premiums for as long as the insured is alive.

You are given:
   i. Mortality follows the Illustrative Life Table
   ii. $i = 0.06$
   iii. The policy pays commissions of 50% for the first year and 5% thereafter.
   iv. The per policy issue expense is 200.
   v. The maintenance expense for the policy is 40 at the beginning of every year including the first year.

a. (5 points) Calculate the net benefit reserve at the end of 10 years.

Solution:

$$P = \frac{78,000A_{70}}{\ddot{a}_{70}} = \frac{(78,000)(0.51495)}{8.5693} = 4687.21$$

$$10V^n = PVFB - PVFP = (78,000)A_{80} - (4687.21)\ddot{a}_{80} =$$

$$(78,000)(0.66575) - (4687.21)(5.9050) = 24,250.52$$

b. (9 points) The gross premium for this policy is 5600. Calculate the gross premium reserve at the end of 10 years.

Solution:

$$10V^g = PVFB + PVFE - PVFP =$$

$$78,000(A_{80}) + (0.05)(5600)(\ddot{a}_{80}) + 40(\ddot{a}_{80}) - 5600(\ddot{a}_{80})$$

$$(78,000)(0.66575) + (280 + 40 - 5600)(5.9050) = 20,750.10$$
c. (2 points) Calculate the expense premium and the expense reserve at the end of 10 years.

Solution:

\[ P^e = P^g - P^n = 5600.00 - 4687.21 = 912.79 \]

\[ \ddot{V}^e = \ddot{V}^g - \ddot{V}^n = 20,751.10 - 24,250.52 = -3500.42 \]

d. (4 points) Explain why the expense reserve is negative.

Solution:

The expenses in the first year are much higher than later years. The premium on the other hand level the expenses over the life of the policy. Therefore, after the first year, the present value of future expenses exceeds the present value of future expense premiums. This results in negative reserves.
1. A 30 year endowment policy of 30,000 on (70) has a death benefit payable at the end of the year. The policy has level annual premiums for the life of the insured.

You are given that mortality follows the Illustrative Life Table with interest at 6%.

a. (3 points) Calculate the first year net premium under Full Preliminary Term.

Solution:

First year net premium = \((S)(v)(q_x) = (30,000)(1.06^{-1})(0.03318) = 939.06\)

b. (6 points) Calculate the net premium under Full Preliminary Term for renewal years (years 2 and later).

Solution:

Renew Net Premium =

\[
\frac{(30,000)A_{\bar{x};29}}{\bar{a}_{\bar{x};29}} = \frac{30,000(A_{\bar{x};29} E_{\bar{x}} \cdot A_{\bar{x};00} + E_{\bar{x}})}{\bar{a}_{\bar{x};29} E_{\bar{x}} \cdot \bar{a}_{\bar{x};00}} =
\]

\[
30,000 \left[ 0.53026 - (1.06^{-29}) \frac{40,049}{6,396,609} (0.87970) + (1.06^{-29}) \frac{40,049}{6,396,609} \right] =
\]

\[
8.2988 - (1.06^{-29}) \frac{40,049}{6,396,609} 2.1252
\]

\[
\frac{30,000(0.530399)}{8.2964} = 1917.95
\]
c. (1 point) Calculate the Full Preliminary Term Reserve at the end of 1 year.

**Solution:**

Under FPT, the reserve at the end of year 1 is always zero.

d. (6 points) Calculate the Full Preliminary Term Reserve at the end of 15 years.

**Solution:**

\[ V^{\text{FPT}}_{15} = PVFB - PVFP = 30,000 A_{85/13} - 1917.95 \bar{a}_{85/13} = \]

\[ = 30,000( A_{85} - 15 E_{85} \cdot A_{100} + 15 E_{85}) - 1917.95(\bar{a}_{85} - 15 E_{85} \cdot \bar{a}_{100}) = \]

\[ = 30,000(0.73407 - (0.07056)(0.10043)(0.87970) + (0.07056)(0.10043)) - 1917.95(4.6980 - (0.07056)(0.10043)(2.1252)) \]

\[ = 13,066.02 \]

e. (4 Points) Explain the purpose of modified reserve methods such as Full Preliminary Term.

**Solution:**

Gross premium reserves are a truer reflection of the true economic reserve for a policy. The gross premium reserves are generally less than the net premium reserves. Modified reserve methods allow the insurance company to reflect reserves that are closer to the true economic reserves without the complications of calculating the gross premium reserve.