23. (1.5 points)

The following information is available for a retrospective rating plan:

Expected total loss	$100,000
Maximum loss	$200,000
Minimum loss	$50,000
Expense and profit provision (excluding taxes)	$20,000
Loss conversion factor	1.35

The following is a Table M, for policies of this size:

Entry Ratio	Charge
0.25	0.85
0.50	0.76
0.75	0.69
1.00	0.64
1.25	0.59
1.50	0.56
1.75	0.52
2.00	0.49
2.25	0.46
2.50	0.44
2.75	0.42
3.00	0.40

Calculate the basic premium for this policy.

Question 23:

Model Solution 1

E = 100,000; G = 200,000; H = 50,000; e = 20,000; c = 1.35
b = e – E(c – 1) + cI
= 20,000 – 100,000(0.35) + 1.35* [100,000 (Φ (r_G) – Ψ (r_H))]
r_G = $Loss_G$ /E = 200,000/100,000 = 2
r_H = $Loss_H$ /E = 50,000/100,000 = 0.5
Φ (2) = 0.49
Ψ (0.5) = Ψ (0.5) + 0.5 – 1 = 0.76 + 0.5 - 1 = 0.26
b = 20,000 – 35,000 + 135,000 (0.49 – 0.26) = 16,050

Model Solution 2

b = e – (c-1)E + c(X_g – S_h)E
E = 100,000
e = 20,000
$r_H$min loss = 50K/100K = 0.5 X_H = 0.76 S_h= X_h + r_H - 1 = 0.76 + 0.5 – 1 = 0.26
$r_G$max loss = 100K/100K = 2 X_G = 0.40
b = 20,000 – (1.35 – 1)100,000 + 1.35(.49 –.26)100,000
= $16,050

Model Solution 3

Insurance charge = E [Φ(r_G) – Ψ(r_H)]
= 100,000 [Φ(200,000/100,000) – Ψ(50,000/100,000)]
= 100,000 [Φ(2) – Ψ(0.5)]
= 100,000 [Φ(2) – (0.5 + Φ(0.5) – 1)]
= 100,000 [0.49 – 0.26] = 23,000
Converted Insurance Charge = c * Ins Charge = 1.35(23,000) = 31,050
Basic Premium = Expense & Profit Provision – (c-1)Expected Loss + Converted Ins Charge
= 20,000 – (1.35-1)(100,000) + 31,050
= 16,050

Model Solution 4

R = (E + e) T
R = (b + cL) T = (B + crE) T
E = 100,000
L_H = 50,000
L_G = 200,000
r_GE = L_G => r_G = L_G/E = 200,000/100,000 = 2 => X_G = 0.49

$r_H = 50{,}000/100{,}000 = 0.5 \Rightarrow X_H = 0.76$

$X_H - X_G = [(e + E) - H/T] / cE \Rightarrow (0.76 - 0.49) = [(20 + 100) - H/T]/(1.35*100) \Rightarrow H/T = 83.55$

$r_G - r_H = (G - H)/cET \Rightarrow (2 - 0.5) = [G/T - 83.55]/(1.35*100) \Rightarrow G/T = 286.05$ (this line included but not needed)

$H/T = 83.55 = (b + c*50) \Rightarrow b = 16.05$

$B = 16{,}050$

Examiner's Comments:

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Most candidates got full credit on this problem. Common mistakes included:

- Arithmetic errors
- Looking up the wrong value in the sample Table M, or copying a charge to where a savings belonged, or similar errors.
- Using the savings at the minimum for the insurance charge, instead of the charge-at-max minus the savings-at-min.
- Using only the charge-at-max for the insurance charge.
- Neglecting to multiply the insurance charge by the loss conversion factor.
- Adding, rather than subtracting, the (c-1)E term.
- Although "e", the expense and profit provision, was given in the statement of the problem as $20,000, some candidates assumed that e – (c-1)E was $20,000. Some may have been confused that (c-1)E was larger than $20,000, because it is unusual for the variable expense in the premium calculation to be greater than the total expense + profit provision, since the variable expense is often just the claims-related portion of the expense. However, this can happen either if there is enough expected investment income on the reserves (a negative expense included in the "profit provision") to offset the underwriting expenses, or if the policy-holder and the underwriter agree to load some of the fixed expenses into the loss conversion factor.
- Failing to see how to put the pieces together to solve the problem.

Some candidates commented on the lack of a tax load in this problem, but they either proceeded ignoring the taxes, or assumed a tax rate (usually no taxes, or a factor of 1.0) and no one lost credit based on this.

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