

Solutions

①

Selbo Stop Loss Insurance Company had the following five claims in 2019:

Claim Number	Loss
1	50,000
2	70,000
3	90,000
4	95,000
5	150,000

Selbo expects the claims will be subject to 10% trend for 2020. Selbo keeps 100,000 of risk and then reinsures the rest of risk over 100,000 to Rahn Reinsurance Company.

- a. Determine the amount that Selbo paid in 2019.

Solution:

$$50,000 + 70,000 + 90,000 + 95,000 + 100,000 = 405,000$$

- b. Determine the amount that Rahn paid in 2019.

Solution:

The only claim that Rahn pays on is claim 5 where Rahn pays 50,000.

- c. Calculate the percentage increase in claims expected to be paid by Selbo in 2020 based on the 10% trend.

Solution:

Claim Number	Loss Before Trend	Loss After Trend	Selbo Portion	Rah Portion
1	50,000	55,000	55,000	0
2	70,000	77,000	77,000	0
3	90,000	99,000	99,000	0
4	95,000	104,500	100,000	4,500
5	150,000	165,000	100,000	65,000
Total	455,000	500,500	431,000	69,500

$$\text{Selbo percentage increase} = 431,000/405,000 - 1 = 6.42\%$$

- d. Calculate the percentage increase in claims expected to be paid by Rahn in 2020 based on the 10% trend.

Solution:

$$\text{Rahn percentage increase} = 69,500/50,000 - 1 = 39.00\%$$

2

* A reinsurance treaty pays 80% of 1,000,000 excess of 2,000,000 and 90% of 1,000,000 excess of 3,000,000.

Calculate the amount paid on a loss of 3,500,000.

Solution:

This is really to a large extent a test of reinsurance language which I did not emphasize in the lecture. 80% of 1,000,000 excess of 2,000,000 means that it pays 80% of the losses between 2,000,000 and 3,000,000. 90% of 1,000,000 excess of 3,000,000 means that it pays 90% of the losses of between 3,000,000 and 4,000,000.

Therefore the amount paid is $(0.8)(3,000,000 - 2,000,000) + (0.9)(3,500,000 - 3,000,000) = 1,250,000$.

3

* A primary insurance company has a 100,000 retention limit. The company purchases a catastrophe reinsurance treaty that provides the following coverage:

1. Layer 1 is 85% of 100,000 excess 100,000
2. Layer 2 is 90% of 100,000 excess 200,000
3. Layer 3 is 95% of 300,000 excess 300,000

The primary company suffers a loss of 450,000.

Calculate the total amount retained by the primary insurance company.

Solution:

The primary company will pay the 100% of the first 100,000, 15% of the next 100,000, 10% of the amount between 200,000 and 300,000 and 5% of the amount above 300,000.

Amount paid = $(1)(100,000) + (0.15)(200,000 - 100,000) + (0.10)(300,000 - 200,000) + (0.05)(450,000 - 300,000) = 132,500$

4 a $u^{**} = .6$ Pareto $\Rightarrow F(x^{**}) = 1 - \left(\frac{\theta}{x^{**} + \theta}\right)^d$

$$.6 = 1 - \left(\frac{2000}{2000 + x^{**}}\right)^3 \Rightarrow \frac{2000}{2000 + x^{**}} = \sqrt[3]{.4}$$

$$\Rightarrow x^{**} = \frac{2000}{\sqrt[3]{.4}} - 2000 = 714.42$$

b Since $F(x^{**}) = .6$ for $1 \leq x < 2.4$
you use the greatest value = 2.4

c $F(15^-) = .5$ therefore for $u^{**} = .6$ $x^{**} = 15$
 $F(15) = .75$

5 $F(x) = \int_0^x f(x) dx = \int_0^x \frac{x^2}{9} dx = \frac{x^3}{27} \Big|_0^x = \frac{x^3}{27}$

$$u^{**} = \frac{x^{**3}}{27} \Rightarrow x^{**} = 3 \sqrt[3]{u^{**}}$$

$$u^{**} = .008 \Rightarrow x^{**} = 3(.2) = .6$$

$$u^{**} = .729 \Rightarrow x^{**} = 3(.9) = 2.7$$

$$u^{**} = .125 \Rightarrow x^{**} = 3(.5) = 1.5$$

$$\overline{x^{**}} = \frac{.6 + 2.7 + 1.5}{3} = 1.6$$

$$m = 2 \quad q = .3$$

$$p_0 = (1-q)^m = (.7)^2 = .49$$

Therefore all simulated values less than or equal to .49 are mapped to zero

so answer = 2 (.21 and .48)

$$p_0 = e^{-2} = .135335$$

$$p_1 = 2e^{-2} = .270671$$

$$p_2 = \frac{4e^{-2}}{2} = .270671$$

$$p_3 = \frac{8e^{-2}}{6} = .180447$$

$$\Sigma$$

$$.135335$$

$$.406005$$

$$.6766764$$

$$.857123$$

since the first random number = 0.7
we have 3 claims

For CLAIM Amounts

$$u^{**} = 1 - e^{-\frac{x^{**}}{1000}} \Rightarrow x^{**} = -1000 \ln(1 - u^{**})$$

$$u^{**} = 0.1 \Rightarrow x^{**} = 105.36$$

$$u^{**} = 0.5 \Rightarrow x^{**} = 693.15$$

$$u^{**} = 0.8 \Rightarrow x^{**} = 1609.43$$

$$\text{Kyle pays}$$

$$105.36$$

$$500.00$$

$$500.00$$

$$1105.36$$

TOTAL

Simulated cost = $15000 \pm z(2000)$

$$u^{**} = .5398 \Rightarrow x^{**} = 15000 + 2000(.1) = 15,200$$

$$u^{**} = .1151 \Rightarrow x^{**} = 15000 - 2000(1.2) = 12,600$$

$$u^{**} = .0013 \Rightarrow x^{**} = 15000 - 2000(3) = 9,000$$

$$u^{**} = .7881 \Rightarrow x^{**} = 15000 + 2000(.8) = 16,600$$

claims

$$15,200 - 10,000 = 5,200$$

$$12,600 - 10,000 = 2,600$$

$$9000 - 9000 = -0 -$$

$$16,600 - 10,000 = \frac{6,600}{14,400}$$

See #8/59

	<u>z</u>
$p_0 = 0.135335$.135
$p_1 = 0.270671$.406
$p_2 = 0.270671$.676
$p_3 = 0.180447$.857

$$u^{**} = .8 \Rightarrow 3 \text{ claims}$$

Amount of claims

$$u^{**} = 1 - \left(\frac{\theta}{x + \theta} \right)^{\alpha} = 1 - \left(\frac{300}{x + 300} \right)^2 \Rightarrow x^{**} = \frac{300}{\sqrt{1 - u^{**}}} - 300$$

$$u^{**} = .60 \Rightarrow x^{**} = 290.57$$

$$u^{**} = .25 \Rightarrow x^{**} = 77.35$$

$$u^{**} = .70 \Rightarrow x^{**} = 412.87$$

$$\text{TOTAL} = 290.57 + 77.35 + 412.87 = 780.79$$

$$\text{Amt Pd.} = (1.8)(780.79) + 30.79 = \underline{630.79}$$