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.

    b. Determine the amount that Rahn paid in 2019.

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

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

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.

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.

4. A random number generated from a uniform distribution on (0, 1) is 0.6. Using the inverse transformation method, calculate the simulated value of X assuming:

    i. X is distributed Pareto with $\alpha = 3$ and $\theta = 2000$

$$F(x) = \begin{cases} 0.5x & 0 \le x < 1.2 \\ 0.6 & 1.2 \le x < 2.4 \\ 0.5x - 0.6 & 2.4 \le x < 3.2 \end{cases}$$

    ii. $F(x) = \begin{cases} 0.1x - 1 & 10 \le x < 15 \\ 0.05x & 15 \le x < 20 \end{cases}$

5. * You are given that $f(x) = (1/9)x^2$ for $0 \le x \le 3$.

You are to simulate three observations from the distribution using the inversion method. The follow three random numbers were generated from the uniform distribution on [0,1]:

      0.008   0.729   0.125

Using the three simulated observations, estimate the mean of the distribution.

6. * You are to simulate four observations from a binomial distribution with two trials and probability of success of 0.30. The following random numbers are generated from the uniform distribution on [0,1]:

    0.91   0.21   0.72   0.48

Determine the number of simulated observations for which the number of successes equals zero.

7. Kyle has an automobile insurance policy. The policy has a deductible of 500 for each claim. Kyle is responsible for payment of the deductible.

The number of claims follows a Poison distribution with a mean of 2. Automobile claims are distributed exponentially with a mean of 1000.

Kyle uses simulation to estimate the claims. A random number is first used to calculate the number of claims. Then each claim is estimated using random numbers using the inverse transformation method.

The random numbers generated from a uniform distribution on (0, 1) are 0.7, 0.1, 0.5, 0.8, 0.3, 0.7, 0.2.

Calculate the simulated amount that Kyle would have to pay in the first year.

8. * Insurance for a city's snow removal costs covers four winter months.

You are given:

   i.   There is a deductible of 10,000 per month.
   ii. The insurer assumes that the city's monthly costs are independent and normally distributed with mean of 15,000 and standard deviation of 2000.
   iii. To simulate four months of claim costs, the insurer uses the inversion method (where small random numbers correspond to low costs).
   iv. The four numbers drawn from the uniform distribution on [0,1] are:

   0.5398   0.1151   0.0013   0.7881

Calculate the insurer's simulated claim cost.

9. * Annual dental claims are modeled as a compound Poisson process where the number of claims has mean of 2 and the loss amounts have a two-parameter Pareto distribution with θ = 500 and α = 2.

An insurance pays 80% of the first 750 and 100% of annual losses in excess of 750.

You simulate the number of claims and loss amounts using the inversion method.

The random number to simulate the number of claims is 0.80. The random numbers to simulate the amount of claims are 0.60, 0.25, 0.70, 0.10, and 0.80.

Calculate the simulated insurance claims for one year.

Answers

1.

       a. 405,000

       b. 50,000

       c. 6.42%

       d. 39.00%

2. 1,250,000

3. 132,500

4. 714.42, 2.4, 15
5. 1.6
6. 2
7. 1105.36
8. 14,400
9. 630.79