Student Information

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Answer 1

a) The size of the Monte Carlo simulation with probability 0.99 ($\alpha = 0.01$) and the maximum error $\epsilon = 0.02$ can be calculated with Normal approximation:

$$N \geq 0.25 \cdot (\frac{Z_{a/2}}{\epsilon})^2$$

If we substitute the values into this formula with $Z_{0.005} \approx 2.576$:

$$N \geq 0.25 \cdot (\frac{2.576}{0.02})^2$$

$$N \geq 4147.36$$

Thus, the size of this simulation may be 4148.

b) 1- The expected value for the weight of an automobile can be found with $\frac{\alpha}{\lambda}$ with $\alpha = 190$ and $\lambda = 0.15$ since this is a random variable with Gamma distribution. Therefore, we have the expected value in kilograms:

$$E(x) = \frac{\alpha}{\lambda} = \frac{190}{0.15} = 1266.667$$

2- The expected value for the weight of an truck can be found with $\frac{\alpha}{\lambda}$ with $\alpha = 110$ and $\lambda = 0.01$ since this is a random variable with Gamma distribution. Therefore, we have the expected value in kilograms:

$$E(x) = \frac{\alpha}{\lambda} = \frac{110}{0.01} = 11000$$

3- The expected value for the total weights of all automobiles that pass over the bridge on a day can be found by multiplying the estimation of the number of automobiles in a day and average weight of a car as they are independent from each other. The average number of cars pass in a day can be found by the expected value of Poisson with $\lambda = 50$ is 50, so we have mean for total weights in kilograms:

$$E(x) = E(TotalNoOfCars) \cdot E(AverageWeight)$$

$$= 50 \cdot 1266.667$$

$$= 63333.333$$

4- The expected value for the total weights of all trucks that pass over the bridge on a day can be found by multiplying the estimation of the number of trucks in a day and average weight of a

truck as they are independent from each other. The average number of trucks pass in a day can be found by the expected value of Poisson with $\lambda = 10$ is 10, so we have mean for total weights in kilograms:

$$\begin{aligned} E(x) &= E(TotalNoOfTrucks) \cdot E(AverageWeight) \\ &= 10 \cdot 11000 \\ &= 110000 \end{aligned}$$

Answer 2

1- I choose the estimated probability of the total weight as an average of many Monte Carlo simulations of size 4148 as 0.268322, so the total weight of all cars and trucks that pass the bridge daily is more than 200 tones with the probability of 0.268322

2- Again as an average, total weight of both of them is 173565.848922 kilograms per day.

3- The standard deviation of the same simulation I picked is 44528.631241. With the given significance level and the error tolerance, so the error margin, it can be assumed that this Monte Carlo simulation with the size founded in Q1 part a gives accurate results. Furthermore, this accuracy may be enhanced by increasing the size of the simulation.