Student Information

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Answer 1

The followings are the parameters for Poisson and Gamma distributions respectively:

$$\lambda_{car_{poisson}} = 50\ day^{-1}$$
$$\lambda_{car_{gamma}} = 0.15\ kilograms^{-1}$$
$$\alpha_{car_{gamma}} = 190$$
$$\lambda_{truck_{poisson}} = 10\ day^{-1}$$
$$\lambda_{truck_{gamma}} = 0.01\ kilograms^{-1}$$
$$\alpha_{truck_{gamma}} = 110$$

a)

Size of a Monte Carlo Study N can be calculated by the following inequality:

$$N \geq p^*(1-p^*)(\frac{z_{\alpha/2}}{\epsilon})^2$$

Since we do not have a preliminary estimation for p^* we can replace $p^*(1-p^*)$ to its maximum value 0.25.

$$N \geq 0.25(\frac{z_{\alpha/2}}{\epsilon})^2$$

We have a %1 level of significance and our error can be at most 0.02. Therefore;

$$\alpha = 0.01$$

$$\epsilon = 0.02$$

From z-table:

$$z_{\alpha/2} = z_{0.005} = 2.575$$

So:

$$N \geq 0.25(\frac{2.575}{0.02})^2 = 4144.14$$

Therefore the size of Monte Carlo Study should be at least 4145.

b)

For Gamma distribution:

$$E(X) = \frac{\alpha}{\lambda}$$

Then,

$$E(W_{car}) = \frac{\alpha_{car_{gamma}}}{\lambda_{car_{gamma}}} = \frac{190}{0.15} = 1266.67\ kilograms$$

$$E(W_{truck}) = \frac{\alpha_{truck_{gamma}}}{\lambda_{truck_{gamma}}} = \frac{110}{0.01} = 11000\ kilograms$$

The expected value for Poisson distrubition is λ:

$$E(X) = \lambda$$

$$E(W_{car_{total}}) = E(N_{car}W_{car}) = E(N_{car})E(W_{car}) = 50 * 1266.67 = 63335.5\ kilograms$$

$$E(W_{truck_{total}}) = E(N_{truck}W_{truck}) = E(N_{truck})E(W_{truck}) = 10 * 11000 = 110000\ kilograms$$

Finally the expected weight of the all vehicles that are passed the bridge in a day is:

$$E(W_{car_{total}} + W_{truck_{total}}) = E(W_{car_{total}}) + E(W_{truck_{total}}) = 63335.5 + 110000 = 173335.5\ kilograms$$

Answer 2

According to the result of the simulation that is simulated in MATLAB, the estimated probability p_{est} usually takes values between **0.21 to 0.23**.

The estimated total weight is close to **173000** kilograms.

The estimated standard deviation takes values around **36000** kilograms.

We can say that our estimation about X is quite accurate as it varies between 172000 to 174000 kilograms when the theoretial results in part 1.b gives a expected total weight of $63333.5+110000 = 17333.5\ kilograms$.