Student Information

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Answer 1

a)

Size of the Monte Carlo simulation with the significance level $\alpha = 0.01$, and amount of error $\varepsilon = 0.02$ is:

$$N \geq 0.25 \left(\frac{z_{\alpha/2}}{\varepsilon}\right)^2$$

From the z-table $z_{0.005} = 2.57$

$$N \geq 0.25 \left(\frac{2.57}{0.02}\right)^2 = 4128.0625$$

Then N must be at least 4129.

b)

Expected value of the random variable W_a, weight of an automobile is α/λ.

$$E(W_t) = \frac{190}{0.15} = 1266.67$$

Expected value of the random variable W_t, weight of a truck is α/λ.

$$E(W_t) = \frac{110}{0.01} = 11000$$

Random variable representing the total weight of all automobiles that pass over the bridge on a day is $N_a \cdot W_a$ where N_a is a Poisson random variable representing the number of automobiles that pass over the bridge on a day. Since N_a and W_a are independent, $E(N_aW_a) = E(N_a)E(W_a)$

$$E(N_a) = \lambda = 50$$
$$E(N_aW_a) = E(N_a)E(W_a) = 50 \cdot 1266.67 = 63333.5$$

Random variable representing the total weight of all trucks that pass over the bridge on a day is $N_t \cdot W_t$ where N_t is a Poisson random variable representing the number of trucks that pass over the bridge on a day. Since N_t and W_t are independent, $E(N_tW_t) = E(N_t)E(W_t)$

$$E(N_t) = \lambda = 10$$
$$E(N_tW_t) = E(N_t)E(W_t) = 10 \cdot 11000 = 110000$$

Answer 2

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Estimated probability = 0.232017
Expected weight = 173688.904268
Standard deviation = 36491.839092
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When error rate $\varepsilon = 0.02$ is considered, $\hat{X}$ should be in the interval $(X - X \cdot 0.02, X + X \cdot 0.02)$ which is approximately equal to (16986, 17679). Since all estimated values are in this interval, it can be said that estimator X is accurate.