Week 12 Homework

ⓘ This is a preview of the published version of the quiz

Started: Jul 2 at 7:51am

Quiz Instructions

Question 1

1 pts

(Lesson 9.1: Introduction to Output Analysis.) Which of the following problems might best be characterized by a finite-horizon simulation? → takes place at a specific time or is caused by the occurence of a specific event

- a. Simulating long-term hurricane patterns X
- b. Simulating a manufacturing cell 24/7/365 X
- c. Simulating the operations of a bank from 9:00 a.m. until 5:00 p.m. ✓
- d. Simulating the steady-state distribution of a Markov chain X

Question 2

1 pts

(Lesson 9.1: Introduction to Output Analysis.) Let's run a simulation whose output is a sequence of daily inventory levels for a particular product. Which of the following statements is true? Lecture: Simulations almost never produce raw output that is iid normal data.

The sequence of daily inventory levels could be serially correlated.

- a. The consecutive daily inventory levels are independent. X
- b. The consecutive daily inventory levels are uncorrelated. X
- c. The consecutive daily inventory levels are normally distributed. X
- d. The consecutive daily inventory levels may not be identically distributed.

Question 3

1 pts

(Lesson 9.3: Finite-Horizon Analysis.) Suppose we want to estimate the expected average waiting time for the first $m = 100$ customers at a bank. We make $r = 4$ independent replications of the system, each initialized empty and idle and consisting of 100 waiting times. The resulting replicate means are:

$r=4$ $\bar{Z}_4 = 4.2$

i	1	2	3	4
Z_i	5.2	4.3	3.1	4.2

$S_Z^2 = \frac{1}{r-1}\sum_{i=1}^{r}(Z_i - \bar{Z}_r)^2$

$= \frac{1}{3}[1^2 + 0.1^2 + 1.1^2 + 0^2]$

$= 0.74$

$\alpha = 10\% = 0.1$

Find a 90% confidence interval for the mean average waiting time for the first 100 customers.

$t_{\alpha/2, r-1} = t_{0.05,3} = 2.353$ (use two-tailed) $\rightarrow$ this is the critical t-value for 90% CI and $n=4$ (ie 3 DOF)

- a. [4.2,4.3]
- ✓ b. [3.188,5.212]
- c. 4.2
- d. 3.5 ± 2
- e. 4.2 ± 2

$\bar{Z}_r \pm t_{\alpha/2, r-1}\sqrt{S_Z^2 / r}$

$= 4.2 \pm 2.353 \times \sqrt{0.74/4}$

$= 4.2 \pm 1.012$

$[3.188, \quad 5.212]$

Question 4

1 pts

A common recommendation is to take $b = 30$ (minimum) and increasing the batch-size m as much as possible.

b refers to number of nonoverlapping batches with m observations.

(Lesson 9.6: Steady-State Analysis.) Consider a particular data set of 100,000 stationary waiting times obtained from a large queueing system. Suppose your goal is to get a confidence interval for the unknown mean. Would you rather use (a) 50 batches of 2000 observations or (b) 10000 batches of 10 observations each?

- ✓ (a) 50 batches (b) of 2000 (m) observations
- (b) 10000 batches (b) of 10 (m) observations

Question 5

1 pts

range = 4

(Lesson 9.6: Steady-State Analysis.) Suppose $[0, 4]$ is a 95% nonoverlapping batch means confidence interval for the mean μ based on 20 batches of size 500. Now the boss has decided that she wants a 90% CI based on those same 20 batches of size 500. What is it? The 90% CI will be narrower than the 95% CI

- a. [0,4]
- b. [-1,5]
- c. [0.348, 3.652]
- d. [0.948, 3.052]

$\bar{x} \pm \underbrace{t_{0.025,19}\sqrt{\frac{S^2}{20}}}_{2} \Rightarrow 2 = 2.093 \times SE$

$SE = 0.9556$

New CI

$\bar{x} \pm t_{0.05,19}\, 0.9556 = 2 \pm 1.729(0.9556)$

$= 2 \pm 1.65223$

$[0.3477, 3.6522]$

Question 6

1 pts

(Lesson 9.8: Other Steady-State Methods.) Consider the following observations:

54 70 75 62

If we choose a batch size of 3, calculate all of the overlapping batch means for me.

- a. 65.25
- b. 62.0, 68.5
- c. 66.3, 69.0
- d. 65.25 $\pm$ 3
- e. None of the above

Batch 1: 54, 70, 75

Batch 2: 70, 75, 62

Batch Mean 1: $\frac{54+70+75}{3} = 66.33$

Batch Mean 2: $\frac{70+75+62}{3} = 69.00$

Not saved

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