Week 3 Homework - Summer 2020

This is a preview of the published version of the quiz

Started: May 9 at 4:18pm

Quiz Instructions

Question 1

1 pts

(Lesson 3.1: Solving a Differential Equation.) Suppose that $f(x) = e^{2x}$. We know that if h is small, then
$f'(x) \approx \frac{f(x+h)-f(x)}{h}$.
Using this expression with $h = 0.01$, find an approximate value for $f'(1)$.

- a. 1
- b. 2.72
- c. 7.38
- d. 14.93

Question 2

1 pts

(Lesson 3.1: Solving a Differential Equation.) Suppose that $f(x) = e^{2x}$. What is the actual value of $f'(1)$?

- a. 1
- b. $e \approx 2.72$
- c. $e^2 \approx 7.39$
- d. $2e^2 \approx 14.78$
- e. 14.93

Question 3

1 pts

(Lesson 3.1: Solving a Differential Equation.) Consider the differential equation $f'(x) = (x+1)f(x)$ with $f(0) = 1$. What is the exact formula for $f(x)$?

- a. $f(x) = e^x$
- b. $f(x) = e^{2x}$
- c. $f(x) = \exp\left\{\frac{x^2}{2} + x\right\}$
- d. $f(x) = \exp\{x^2 + 2x\}$

Question 4

1 pts

(Lesson 3.1: Solving Differential Equations.) Consider the differential equation $f'(x) = (x+1)f(x)$ with $f(0) = 1$. Solve for $f(0.20)$ using Euler's approximation method with increment $h = 0.01$ for $x \in [0, 0.20]$.

- a. $f(0.20) \approx 0.0$
- b. $f(0.20) \approx 1.0$
- c. $f(0.20) \approx 1.24$
- d. $f(0.20) \approx 2.49$

Question 5

1 pts

(Lesson 3.2: Monte Carlo Integration.) Suppose that we want to use Monte Carlo integration to approximate $I = \int_1^3 \frac{1}{1+x}\, dx$. If $U_1, U_2, \ldots, U_n$ are i.i.d. Unif(0,1)'s, what's a good approximation $\bar{I}_n$ for I?

- a. $\frac{1}{n}\sum_{i=1}^{n} \frac{1}{1+U_i}$
- b. $\frac{2}{n}\sum_{i=1}^{n} \frac{1}{1+U_i}$
- c. $\frac{1}{n}\sum_{i=1}^{n} \frac{1}{1+2U_i}$
- d. $\frac{2}{n}\sum_{i=1}^{n} \frac{1}{1+2U_i}$
- e. $\frac{1}{n}\sum_{i=1}^{n} \frac{1}{1+3U_i}$

Question 6

1 pts

(Lesson 3.2: Monte Carlo Integration.) Again suppose that we want to use Monte Carlo integration to approximate $I = \int_1^3 \frac{1}{1+x}\, dx$. You may have recently discovered that the MC estimator is of the form $\bar{I}_n = \frac{1}{n}\sum_{i=1}^{n} \frac{1}{1+U_i}$.

Estimate the integral I by calculating $\bar{I}_n$ with the following 4 uniforms:

$$U_1 = 0.3 \qquad U_2 = 0.9 \qquad U_3 = 0.2 \qquad U_4 = 0.7$$

- a. 0
- b. 0.2
- c. 0.321
- d. 0.679
- e. 0.8

Question 7

1 pts

(Lesson 3.2: Monte Carlo Integration.) Yet again suppose that we want to use Monte Carlo integration to approximate $I = \int_1^3 \frac{1}{1+x}\, dx$. What is the *exact* value of I?

- a. 0.197
- b. 0.693
- c. 1.386
- d. 2.773

Question 8

1 pts

(Lesson 3.3: Making Some π.) Inscribe a circle in a unit square and toss $n = 1000$ random darts at the square. Suppose that 760 of those darts land in the circle. Using the technology developed in class, what is the resulting estimate for π?

- a. π
- b. 4.0 (UGA answer)
- c. 3.2
- d. 3.04
- e. 3.12

Question 9

1 pts

(Lesson 3.3: Making Some π.) Now suppose that we can somehow toss n random darts into a unit *cube*. Further, suppose that we've inscribed a *sphere* with radius 1/2 inside the cube. Let $\hat{p}_n$ be the proportion of the n darts that actually fall within the sphere. Give a Monte Carlo scheme to estimate π.

a. $\hat{\pi}_n = 2\hat{p}_n$

b. $\hat{\pi}_n = \frac{4}{3}\hat{p}_n$

c. $\hat{\pi}_n = 4\hat{p}_n$

d. $\hat{\pi}_n = 6\hat{p}_n$

Question 10

1 pts

(Lesson 3.4: Single-Server Queue.) Consider a single-server Q with *LIFO* (*last*-in-first-out) services. Suppose that three customers show up at times 5, 6, and 8, and that they all have service times of 4. When does customer 2 leave the system?

a. 3

b. 9

c. 13

d. 17

e. 19

Question 11

1 pts

(Lesson 3.5: (s, S) Inventory Model.) Consider our numerical example from the lesson. What would the third day's total revenues have been if we had used a (4,10) policy instead of a (3,10)?

a. -22

b. -13

c. 44

d. 45

e. 80

Question 12

1 pts

(Lesson 3.6: Simulating Random Variables.) If U is a Unif(0,1) random number, what is the distribution of $-0.5ln(U)$?

a. Who knows?

b. Exp(2)

c. Exp(1/2)

d. Exp(-2)

e. Exp$(-1/2)$

Question 13

1 pts

(Lesson 3.6: Simulating Random Variables.) If U_1 and U_2 are i.i.d. Unif(0,1) random variables, what is the distribution of $U_1 + U_2$? Hints: (i) I may have mentioned this in class at some point; (ii) You may be able to reason this out by looking at the distribution of the sum of two dice tosses; or (iii) You can use something like Excel to simulate $U_1 + U_2$ many times and make a histogram of the results.

a. Unif(0,2)

b. Normal

c. Exponential

d. Triangular

Question 14

1 pts

(Lesson 3.7: Spreadsheet Simulation.) I stole this problem from the Banks, Carson, Nelson and Nicol text (5th edition). Expenses for Joey's college attendance next year are as follows (in $):

Tuition = 8400
Dormitory = 5400
Meals $\sim$ Unif(900,1350)
Entertainment $\sim$ Unif(600,1200)
Transportation $\sim$ Unif(200,600)
Books $\sim$ Unif(400,800)

Here are the income streams the student has for next year:
Scholarship = 3000
Parents = 4000
Waiting Tables $\sim$ Unif(3000,5000)
Library Job $\sim$ Unif(2000,3000)

Use Monte Carlo simulation to estimate the expected value of the loan that will be needed to enable Joey to go to college next year.

- a. $2500
- b. $3250
- c. $3325
- d. $3450
- e. $4000

Question 15

1 pts

(Lesson 4.1: Steps in a Simulation Study.) Which steps are regarded as essential for a successful simulation study? (There may be more than one correct answer.)

- a. Problem formulation

- [ ] b. Model validation
- [ ] c. Model verification
- [ ] d. Experimental design
- [ ] e. Output analysis
- [ ] f. Attendance at a Justin Bieber concert

Question 16

1 pts

(Lesson 4.1: Steps in a Simulation Study.) Suppose that I have modelled the arriving calls to a call center as a Poisson process. What do I have to carry out in order to determine if that's indeed a reasonable model assumption?

- ○ a. Problem formulation
- ○ b. Model validation
- ○ c. Model verification
- ○ d. Attend a Justin Bieber concert

Question 17

1 pts

(Lesson 4.2: Some Useful Definitions.) Which of the following times could be regarded as events? (There may be more than one correct answer.)

- [ ] a. Customers arrive at Justin's concert venue
- [ ] b. Justin forgets a lyric
- [ ] c. Justin sings the wrong note
- [ ] d. Angry customers depart the venue
- [ ] e. A customer is 11 years old

Question 18

1 pts

(Lesson 4.2: Some Useful Definitions.) TRUE or FALSE? Customer waiting times are activities because these are typically explicitly specified in the simulation.

- True
- False

Question 19

1 pts

(Lesson 4.3: Time-Advance Mechanisms.) TRUE or FALSE? The simulation clock time is a variable.

- True
- False

Question 20

1 pts

(Lesson 4.3: Time-Advance Mechanisms.) TRUE or FALSE? The simulation clock time always equals real time.

- True
- False

Question 21

1 pts

(Lesson 4.3: Time-Advance Mechanisms.) TRUE or FALSE? In this class, time always moves forward.

- True
- False

Question 22

1 pts

(Lesson 4.3: Time-Advance Mechanisms.) TRUE or FALSE? A fixed-increment time-advance mechanism is used primarily in continuous-time models such as those involving differential equations.

- True
- False

Question 23

1 pts

(Lesson 4.3: Time-Advance Mechanisms.) TRUE or FALSE? A next-event time-advance mechanism is typically used in queueing models involving customer arrivals, services, and departures.

- True
- False

Question 24

1 pts

(Lesson 4.3: Time-Advance Mechanisms.) TRUE or FALSE? The future events list contains all known upcoming events, including arrival times, departure times, and machine breakdown times.

- True
- False

Question 25

1 pts

(Lesson 4.3: Time-Advance Mechanisms.) TRUE or FALSE? The FEL can be updated any time an event occurs.

- True
- False

Question 26

1 pts

(Lesson 4.3: Time-Advance Mechanisms.) TRUE or FALSE? It is possible for the system state to change between consecutive event times.

- True
- False

Question 27

1 pts

(Lesson 4.3: Time-Advance Mechanisms.) TRUE or FALSE? In a simulation using the “next-event” time-advance mechanism, the simulation clock moves to the most-imminent event.

- True
- False

Question 28 — 1 pts

(Lesson 4.3: Time-Advance Mechanisms.) TRUE or FALSE? When a new event occurs, the simulation may update the chronological order of the FEL's events by inserting new events, deleting events, moving them around, or even doing nothing.

- True
- False

Question 29 — 1 pts

(Lesson 4.3: Time-Advance Mechanisms.) TRUE or FALSE? Almost every discrete-event computer simulation language maintains a FEL somewhere.

- True
- False

Question 30 — 1 pts

(Lesson 4.3: Time-Advance Mechanisms.) TRUE or FALSE? In Arena, *you* are responsible for maintaining the language's FEL.

- True
- False

Question 31 — 1 pts

(Lesson 4.4: Two Modeling Approaches.) Which is generally the easier simulation modeling approach — Event-Scheduling or Process-Interaction?

- a. Event-Scheduling
- b. Process-Interaction

Question 32

1 pts

(Lesson 4.4: Two Modeling Approaches.) Which is the modeling approach adopted by Arena — Event-Scheduling or Process-Interaction?

- a. Event-Scheduling
- b. Process-Interaction

Question 33

1 pts

(Lesson 4.4: Two Modeling Approaches.) TRUE or FALSE? A simulation language incorporating the P-I approach considers the events that a generic customer undergoes as it passes through the system, and then automatically does the bookkeeping to keep track of how all such customers interact with each other.

- True
- False

Question 34

1 pts

(Lesson 4.5: Simulation Languages.) How many simulation languages are there?

- a. Just a few.
- b. 5-10.
- c. 10-50.
- d. >>50.

Question 35

1 pts

(Lesson 4.5: Simulation Languages.) Where can you learn about simulation languages? (There may be more than one correct answer.)

- a. Right here, right now!
- b. Simulation language textbooks
- c. The Winter Simulation Conference
- d. Vendor short courses
- e. The Justin Bieber School of Hard Knox. (Nice spelling, Justin.)

Question 36

1 pts

(Lesson 4.5: Simulation Languages.) When selecting a simulation language, what characteristics do you have to take into consideration?

- a. Cost
- b. Ease of use
- c. Modeling “world view” (e.g., event-scheduling or process-interaction)
- d. Random variate generation capabilities
- e. Output analysis capabilities
- f. All of the above

Not saved Submit Quiz