Week 8 Homework

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

Started: Jul 2 at 7:50am

Quiz Instructions

Question 1

1 pts

Lesson 5.28: TRUE or FALSE? The ROUTE module is found in the Advanced Transfer template and allows you to move entities from Station to Station.

- True why?
- False

Question 2

1 pts

Lesson 5.29: A Sequence must consist of unique visitation locations... no repeat visits!

- True
- False ?

Question 3

1 pts

Lesson 5.30: You could use the Advanced Set functionality to define a "Set of Sequences".

- True

False

Question 4

1 pts

Lesson 5.30: The name of the automatically supplied ARENA attribute that stores a particular entity's sequence is Entity.Sequence (what a surprise)!

True

False

Question 5

1 pts

Lesson 5.31: Cell 3 actually had TWO servers -- an "old"/slow guy and a "younger"/fast guy.

True

False

Question 6

1 pts

Lesson 5.32: TRUE or FALSE? You SEIZE-DELAY-RELEASE a conveyor.

True

False

Question 7

1 pts

Lesson 5.32: An ENTER module is usually paired with what other module?

- DEPART
- DISPOSE
- TERMINATE
- LEAVE

Question 8

1 pts

(Lesson 6.1: Introduction to Uniform Random Numbers.) TRUE or FALSE? It's actually a good thing for you to be able to reproduce a sequence of PRNs, should you so desire.

- True
- False

Question 9

1 pts

(Lesson 6.2: Some Lousy Generators.) Consider von Neumann's mid-square PRN method, and suppose that $X_0 = 6632$. What is $R_3 = X_3/10000$? [Note: For purposes of this problem, treat all X_i's as if they were 8 digits, e.g., treat 123456 as if it were 00123456.]

$X_0 = 6632 \longrightarrow 6632^2 = 43983424$

$X_1 = 9834 \rightarrow 9834^2 = 96707556$

$X_2 = 7075 \rightarrow 7075^2 = 50055625$

$X_3 = 0556 \rightarrow 556^2 = 309136$

$\frac{556}{10000} = 0.0556$ //

- a. 9834
- b. 0.9834
- c. 50055625
- d. 556
- e. 0.0556

Question 10

1 pts

CHECK

(Lesson 6.3: Linear Congruential Generators.) YES or NO? Does $X_i = (X_{i-1} + 12)\mathbf{mod}(13)$ have full period?

Theorem: $X_i = (aX_{i-1} + c) \bmod m$ (with $c>0$) has full cycle if (i) c and m are coprime; (ii) $a-1$ is a multiple of every prime which divides m; and (iii) $a-1$ is a multiple of 4 if 4 divides m.

- ✓ True
- False

(i) 12 and 13 are coprime

(ii) $a-1=0$ which is a multiple of all integers

(iii) does not hold. Trivial.

Question 11

1 pts

Corollary: $X_i = (aX_{i-1}+c) \bmod 2^n$ ($n>1$) has full cycle if c is odd and $a=4k+1$, $\exists k$.

(Lesson 6.3: Linear Congruential Generators. Problem 7.1 from Law 2015). Consider the generator

$$X_i = (\overset{a}{5}X_{i-1} + \overset{c}{3})\mathbf{mod}(\overset{m = 2^4}{16}).$$

Starting from $X_0 = 7$, find X_{500}.

$x_0 = 7$

$x_1 = 38 \bmod 16 = 6$

$X_2 = 33 \bmod 16 = 1$

$X_3 = 8 \bmod 16 = 8$

$X_4 = 43 \bmod 16 = 11.$

$X_5 = 58 \bmod 16 = 10$

X_{500} will have 31 full cycles which stop at

$X_{496} = X_0 = 7$

$X_{497} = X_1 = 6$

$X_{498} = X_2$

$X_{499} = X_3$

$X_{500} = X_4 = 11$

(i) 3 & 16 coprime

(ii) $5-1=4=a-1$

primes that divide m are 2 and only 2

3 is odd and $a = 4(1)+1$

Thus full cycle by corollary

- a. 0
- b. 6
- c. 7
- ✓ d. 11
- e. 38

Question 12

1 pts

(Lesson 6.3: Linear Congruential Generators.) Which uniform generator was recommended in class, at least as a desert island" generator?

- a. $X_i = 16807X_{i-1}\mathbf{mod}(2^{31})$

b. $X_i = 16807X_{i-1}\mathbf{mod}(2^{31}-1)$

c. $X_i = 16807(X_{i-1}-1)\mathbf{mod}(2^{31})$

d. $X_i = 16807(X_{i-1}-1)\mathbf{mod}(2^{31}-1)$

Question 13

1 pts

(Lesson 6.4: Tausworthe Generators.) Suppose that a Tausworthe generator gave you the series of bits 1010101. If you use all 7 bits, what Unif(0,1) random number would that translate to?

$(l\text{- bits in base } 2)/2^l$

$[(1\times2^0)+(1\times2^2)+(1\times2^4)+(1\times2^6)]\div2^7$

$=(1+4+16+64)/2^7$

$=\frac{85}{126}=0.66406$

a. 0.3825

b. 0.5

c. 0.6641

d. 0.9826

Question 14

1 pts

(Lesson 6.5: Generalizations of LCGs.) TRUE or FALSE? There are some great PRN generators out there with incredible cycle lengths $\approx 2^{191}$ and even 2^{19937}!

lesson 5

True

False

Question 15

1 pts

(Lesson 6.6: Choosing a Generator --- Theory.) Which of the following statements about the RANDU generator is true?

a. Something just ain't right about that boy. ✓

b. The generator is given by $X_i = 65539 X_{i-1} \mathbf{mod}(2^{31})$ ✓

c. The PRNs appear at first glance to be uniform, but funny things happen when you look at the plots of the PRNs in multiple dimensions. ✓

d. The PRNs are distributed on just 15 hyperplanes. ✓

✓ e. All of the above.

Question 16

1 pts

(Lesson 6.7: Statistical Considerations - Intro.) Suppose the guy on trial is actually guilty but you incorrectly acquit him. So you've incorrectly accepted the null hypothesis of innocence. What type of error have you just made - Type I or Type II?

Type I — Reject true null hypothesis. False tve

a. Type I

Accusing an innocent person of a crime they didn't commit.

✓ b. Type II

Type II — Failing to reject a false null hypothesis. False -ve.

letting a guilty person go free.

Question 17

1 pts

(Lesson 6.8: Goodness-of-Fit Tests.) Suppose we observe 1000 PRNs to obtain the following data.

k = 1, 2, 3, 4

interval i	$[0.00, 0.25)$	$[0.25, 0.50)$	$[0.50, 0.75)$	$[0.75, 1.0]$
number observed	240	255	243	262

Conduct a χ^2 goodness-of-fit test to see if these numbers are approximately Unif(0,1). Use level of significance $\alpha = 0.05$. Here are some table entries that you may need: $\chi^2_{0.05,3} = 7.81$, $\chi^2_{0.05,4} = 9.49$, and $\chi^2_{0.05,5} = 11.1$. ACCEPT or REJECT?

$E_i = 250$ (mean)

$$\chi_0^2 \equiv \sum_{i=1}^{4} \frac{(O_i - E_i)^2}{E_i} = \frac{(240-250)^2}{250} + \dots + \frac{(262-250)^2}{250}$$

✓ a. Accept

$$= \frac{159}{125} = 1.272$$

b. Reject

$$\chi_0^2 = 1.272 < \chi^2_{0.05,3} = 7.81$$

fail to reject Ho.

Question 18

1 pts

CHECK

(Lesson 6.9: Runs Tests for Independence.) Consider the following $n = 30$ PRNs. (Read from left to right, and then down.)

$$\begin{array}{cccccccccc} 0.79 & 0.68 & 0.46 & 0.69 & 0.90 & 0.93 & 0.99 & 0.86 & 0.33 & 0.22 \\ 0.60 & 0.18 & 0.59 & 0.38 & 0.69 & 0.76 & 0.91 & 0.62 & 0.22 & 0.19 \\ 0.11 & 0.45 & 0.72 & 0.88 & 0.65 & 0.55 & 0.31 & 0.27 & 0.46 & 0.89 \end{array}$$

B = associated runs = 12

Let's conduct a runs *up and down* test to test H_0: the U_i's are independent with level α = 0.05. ACCEPT or REJECT?

$Z_{\alpha/2} = Z_{0.025} = 1.96$ $\quad n = 30, \quad n_1 = 17$ (# of observations ≥ 0.5)

$n_2 = n - n_1 = 13$

- a. Accept
- b. Reject

$B \approx Nor\left(\frac{2n_1n_2}{n} + \frac{1}{2}, \frac{2n_1n_2(2n_1n_2 - n)}{n^2(n-1)}\right)$

$= Nor\left(\frac{457}{30}, 6.9772\right)$

$Z_0 = (B - E[B]) / \sqrt{Var(B)} = \frac{12 - \frac{457}{30}}{\sqrt{6.9772}} = -1.224$

$|Z_0| = 1.224 < Z_{0.025} = 1.96$

Question 19

1 pts

(Lesson 6.9: Runs Tests for Independence.) Suppose that U_1, U_2, U_3 are i.i.d. Unif(0,1). Let's denote the number of runs up-and-down by X. Find the EXACT distribution of X.

CHECK

- a. X ~ Unif(0,1)
- b. X~ Norm(0,1)
- c. $\Pr(X = 0) = 0.2, \Pr(X = 1) = 0.3, \Pr(X = 2) = 0.3, \Pr(X = 3) = 0.2$
- d. $\Pr(X = 1) = 0.5, \Pr(X = 2) = 0.5$
- e. $\Pr(X = 1) = 1/3, \ \Pr(X = 2) = 2/3$

Answer is E

Not saved Submit Quiz