Exam 2 At

Due Mar 31 at 11:59pm	Points 100	Questions 40
Available Mar 15 at 8am - Ma	ar 31 at 11:59pm	Time Limit 120 Minutes

Instructions

This test is 120 minutes. You're allowed two cheat sheets (4 sides total). You will find tables attached on the last page of this exam (scroll to the end). All questions are worth 2.5 points.

You're allowed the following items:

- Pencil / pen and scratch paper.
- A reasonable calculator.
- Two cheat sheets (4 sides total).
- Tables. (Available at the end of test questions too)

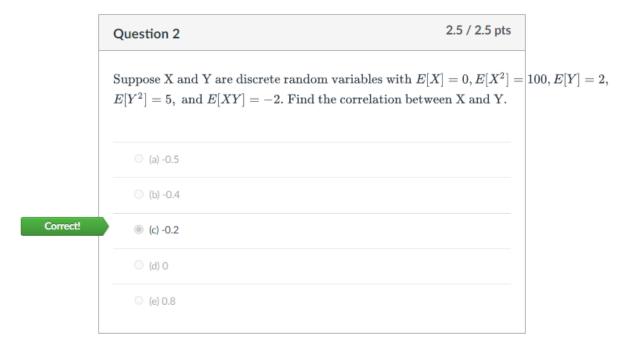
Note that you are *not* allowed to use Arena (or any other software), even though I'm asking questions about it.

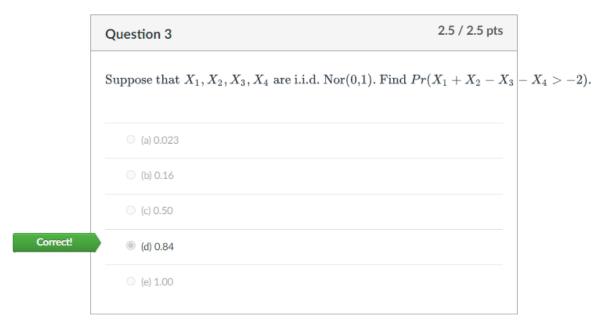
Good luck! I want you to make this test sorry that it ever tried to mess around with you!!!

Submission	Details

Time:	98 minutes
Current Score:	92.5 out of 100
Kept Score:	92.5 out of 100

	Question 1	2.5 / 2.5 pts
	Suppose X and Y are continuous random variables $0 \le x \le 1, 0 \le y \le 1$. Find $E[-4X+2]$.	with joint p.d.f. $f(x, \cdot)$
	○ (a) -11/3	
	○ (b) -7/3	
	○ (c) -2	
Correct!	⊚ (d) -2/3	
	(e) 7/3	





	Question 4	2.5 / 2.5 pts
	TRUE or FALSE? In Arena, you can use a single CHANCE module to route to the resource having the smallest queue.	customers
	○ True	
Correct!	False	
	Question 5	2.5 / 2.5 pts
	TRUE or FALSE? In Arena, the Schedule spreadsheet care establish either resource capacity schedules or arrival ra	
Correct!	True	

True

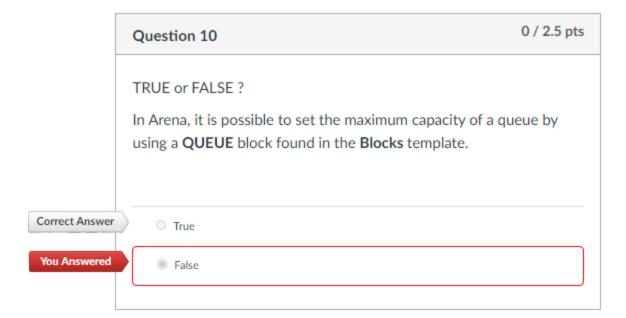
False

Question 6	2.5 / 2.5 pts
In an Arena program, how would you be able to	do a DELAY ?
(a) From within a PROCESS module in the Batemplate.	asic Process
 (b) Using a DELAY module in the Advanced F 	Process template.
(c) Using a DELAY block in the Blocks tem	plate.
(d) (a) and (b) only	
(e) (a) and (b) and (c)	

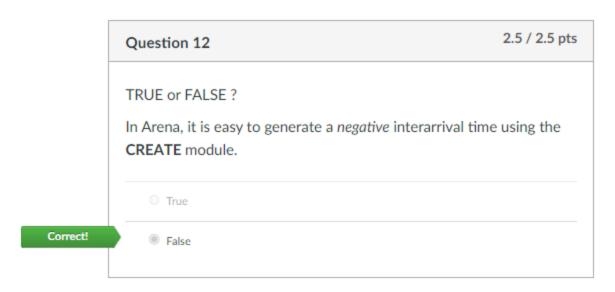
Question 7	2.5 / 2.5 pts
What random variable do you get from the Arena ex 2*NORM(3, 3) ?	pression
(a) Normal with mean 6 and variance 6.	
(b) Normal with mean 6 and variance 12.	
(c) Normal with mean 6 and variance 18.	
(d) Normal with mean 6 and variance 24.	
(e) Normal with mean 6 and variance 36.	
⊚	

Question 8 0 / 2.5 pts How do you generate a discrete random variable X in Arena such that Pr(X = 1) = 0.3, Pr(X = 2.5) = 0.5, and Pr(X = 8) = 0.2 ? You Answered (a) DISC(0.3, 1, 0.5, 2.5, 0.2, 8). (b) DISC(0.3, 1, 0.8, 2.5, 1.0, 8). (c) DISC(0.3, 0.5, 0.2; 1, 2.5, 8). (d) CONT(0.3, 0.8, 1.0; 1, 2.5, 8). (e) CONT(0.3, 0.8, 1.0; 1, 2.5, 8).

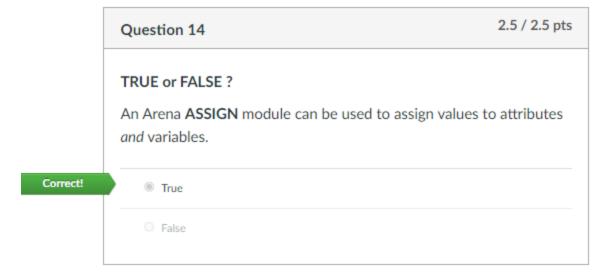
Question 9	2.5 / 2.5 pts
What is an equivalent alternative ARENA expression UNIF(0,1)) -2*LN(1-UNIF(0,1))?	on for - 2*LN(1 -
○ TRIA(0, 1, 2).	
EXPO(2)	
○ EXPO(4)	
O NORM(2, 4)	
	What is an equivalent alternative ARENA expression UNIF(0,1)) -2*LN(1-UNIF(0,1))? TRIA(0, 1, 2). EXPO(2) EXPO(4) ERLA(2,2)



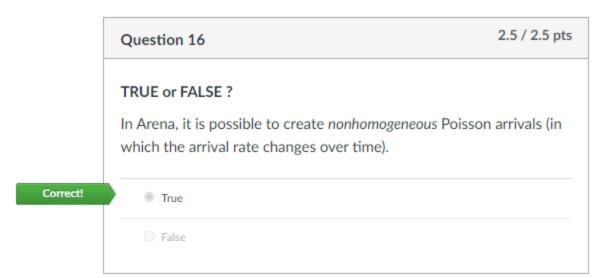
	Question 11 2.5 / 2.5 pts	
	TRUE or FALSE ? In Arena, it is possible to use more than one resource at a time in a PROCESS module.	
Correct!	True	
	○ False	



	Question 13	2.5 / 2.5 pts
	In Arena, what typically happens when you do not RELE. SEIZE'd resource?	ASE a
Correct!	(a) A long line forms in front of the resource.	
	(b) The resource automatically adds capacity (more so	ervers).
	(c) The resource turns off.	
	(d) The simulation immediately stops.	



Question 15 2.5 / 2.5 ;	pts
TRUE or FALSE? In Arena, it is possible to use the <i>same</i> resource (worker) at two different workstations.	
True	
○ False	
	TRUE or FALSE? In Arena, it is possible to use the <i>same</i> resource (worker) at two different workstations.



	Question 17	2.5 / 2.5 pts
	Suppose there are 5 people in the line called <i>joe.queue</i> a in the line called <i>tom.queue</i> . What is the value of the fol expression?	
	(NQ(joe.queue) + (NQ(tom.queue) <= 10)) * (TNC	OW > -1)
	© 3	
	O 4	
	○ 5	
Correct!	◎ 6	
	O 8	

	Question 18	2.5 / 2.5 pts
	TRUE or FALSE ? The Arena Call Center model discussed in class feature servers who would occasionally call back their customatics.	
Correct!	True	
	○ False	

	Question 19	2.5 / 2.5 pts
	TRUE or FALSE ? The Arena Inventory model discussed in class use to periodically make inventory ordering decisions	
Correct!	True	
	○ False	

Question 20 TRUE or FALSE? In Arena, it is possible to pre-assign customers a sequence of stations to visit, and it is even possible for the sequence to have repeat visits at certain stations, and it is even possible to have different service-time distributions at those repeat stations!

Question 21

2.5 / 2.5 pts

Consider the linear congruential generator $X_{i+1} = (5X_i + 3) mod(12)$. Using $X_0 = 0$, calculate the 48th integer X_{48} .

Correct!

- 0
- 0 2
- 3
- 0 6
- 9

Question 22

2.5 / 2.5 pts

Regarding Linear Congruential Generators (LCG's), select the statement that is **correct**.

(a) The midsquare generator is an example of a good LCG.

- (b) Some popular LCG's have cycle lengths that are over 2^{100} .
- (c) It is not possible to test LCGs for independence and uniformity.
- (d) Most LCG's in use produce numbers that are truly iid Unif(0,1).
- (e) The RANDU generator is an example of a good LCG.

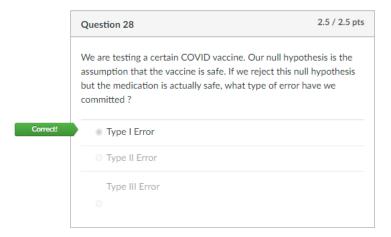
	Question 23	0 / 2.5 pts
	Consider our desert island generator $X_{i+1} = 16807X_i \mod M$ If $X_0 = 123456789$, find the value of the second PRN, U_2	
	0.184	
You Answered	◎ 0.218	
	0.528	
	0.622	
Correct Answer	0.956	

	Question 24	2.5 / 2.5 pts
	Suppose that a Tausworthe generator gave you the seri 110111. If you use all of these bits, what Unif(0,1) rand would that translate to ?	
	0.370	
	0.609	
	O.728	
Correct!	◎ 0.859	
	0.984	

	Question 25	2.5 / 2.5 pts
	Consider the following sequence of PRN's.	
	0.98 0.95 0.23 0.17 0.12 0.03 0.47 0.83 0.72 0.53 0.52	3 0.63
	How many runs above and below the mean (0.5) does this have?	sequence
	(a) 2	
Correct!	◎ (b) 3	
	O (c) 4	
	(d) 5	
	(e) 6	

	Question 26	2.5 / 2.5 pts
	Suppose U_1, U_2, U_3, U_4 are i.i.d. Unif(0,1). What is the probability that we will see exactly 1 run u	p and down ?
	(a) 1/24	
Correct!	◎ (b) 1/12	
	(c) 1/4	
	(d) 1/3	
	(e) 1/2	
	(f) None of the above	

Question 27 Suppose that we have a sequence of n=100 PRN's, and we observe 70 runs up and down. Using $\alpha=0.01$, do we ACCEPT (i.e., fail to reject) or REJECT the null hypothesis of independence? ACCEPT null hypothesis REJECT null hypothesis



Question 29 2.5 / 2.5 pts

Suppose we sample 1000 PRN's and we wish to conduct a χ^2 goodness-of-fit test at level $\alpha = 0.01$ of the hypothesis that the numbers are Unif(0,1). Here are the results, divided into equal-probability intervals under H_0 , as follows:

interval	O_i
[0.00, 0.20]	210
(0.20, 0.40]	225
(0.40, 0.60]	155
(0.60, 0.80]	???
(0.80, 1.00]	180

Use the tabled results to find the value of the g-o-f statistic, χ^2_0 .

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0 40.50

Question 30

2.5 / 2.5 pts

Suppose you are doing a χ^2 goodness-of-fit test with level of significance α = 0.05 and k =10 cells. Specifically, you are testing to see if your data is Unif(0,1); thus, there are no parameters to estimate, and so your g-o-f statistic χ^2_0 has k-1 degrees of freedom. If it happens that χ^2_0 = 120.0, do we ACCEPT (i.e., fail to reject) or REJECT the null hypothesis of uniformity?

ACCEPT

Correct!

REJECT

Question 31

2.5 / 2.5 pts

Suppose X is a continuous random variable with p.d.f.

 $f(x)=3x^2 \text{ for } 0 \leq x \leq 1$. Let U be a Unif(0,1) random variable. Which of the following functions of U will give you a realization of X?

(a)
$$X = U^{1/3}$$

$$\bigcirc$$
 (b) $X = U^{1/2}$

$$\circ$$
 (c) $X = (1/3)U^{1/3}$

$$\bigcirc$$
 (d) $X = (1/3)U^{1/2}$

$$\circ$$
 (e) $X = 3U^2$

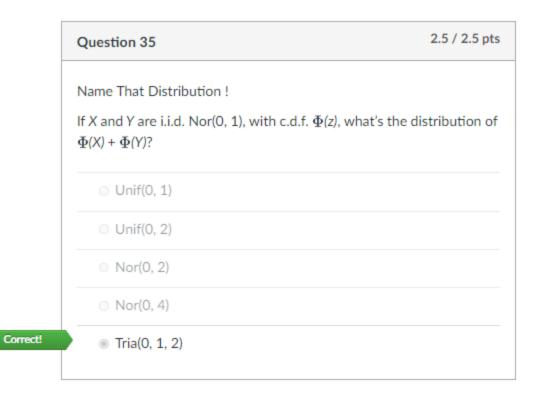
Question 32	2.5 / 2.5 pts
Let's toss a pair of dice and look at the sum. The number takes until I see a sum of 7 is obviously a $Geom(p)$ random Use the PRN $U = 0.5$ to generate X via inverse transform	m variable.
(a) 3	
⊚ (b) 4	
○ (c) 6	
O (d) 12	
(e) 24	
	Let's toss a pair of dice and look at the sum. The number takes until I see a sum of 7 is obviously a $Geom(p)$ randol Use the PRN $U = 0.5$ to generate X via inverse transform (a) 3 (b) 4 (c) 6 (d) 12

Correct!

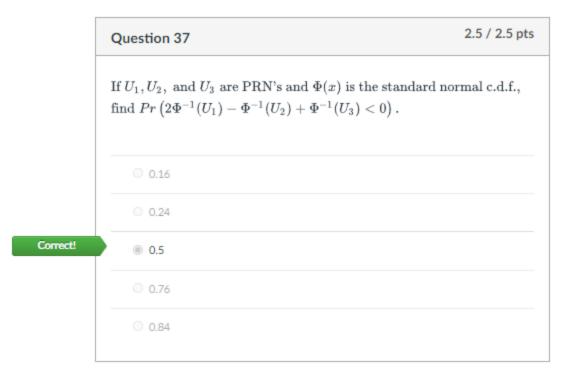
(e) 3.394

Ques	stion 33	2.5 / 2.5 pts	
$\bar{U} =$	sider 24 PRNs, U_1, U_2, \ldots, U_{24} , and suppose that the $\sum_{i=1}^{24} U_i/24 = 0.7$. These PRNs to generate a single approximately Nor		
	(a) -3.394		
	(b) -1.517		
	(c) 0.231		
	(d) 1.96		

	Question 34	2.5 / 2.5 pts
	Name That Distribution! If U_1 and U_2 are i.i.d. Unif(0,1), what's the distribution of	2(U ₁ - U ₂) ?
	(a) Unif(-2, 2)	
	(b) Unif(0, 4)	
	(c) Tria(-1, 0, 1)	
Correct!	⊚ (d) Tria(-2, 0, 2)	
	(e) Tria(0, 2, 4)	



Question 36	2.5 / 2.5 pts
From the list of convolutions below, select the statement incorrect.	nt that is
○ The sum of k i.i.d. Bern(p) RVs has a Bin(k, p) distr	ibution.
The sum of 5 i.i.d. Exp(3) RVs has an Erlang distribut mean 5/3.	tion with
The sum of 30 i.i.d. Uniform RVs is approximately	normal.
 The sum of 100 i.i.d. Exp(3) RVs is approximately 	normal.
The sum of 100 i.i.d. Cauchy RVs is approximately	y normal.



2.5 / 2.5 pts Question 38 Regarding the Acceptance-Rejection RV generation method, select the incorrect statement: (a) A-R attempts to gain efficiency by generating an easy "surrogate" random variable that is somewhat similar to the actual more-complicated random variable of interest. (b) A-R can often be used even when a continuous RV doesn't have a closed-form inverse.

- (c) The Box-Muller method is an A-R method.
- (d) The number of sampling cycles required by A-R is a geometric RV.
- (e) The closer an A-R method's majorizing function is to the p.d.f. of interest, the better.

Question 39

2.5 / 2.5 pts

Suppose $U_1 = 0.12, U_2 = 0.93, U_3 = 0.50, U_4 = 0.11$, and $U_5 = 0.49$.

Use these values and apply the Acceptance-Rejection technique to generate a realization of a $Pois(\lambda = 1.5)$ random variate. (You may not need to use all of the PRN's.)

Correct!

- (a) N = 0
- (b) N = 1
- (c) N = 2
- O(d) N = 3
- \circ (e) N = 4

Question 40

2.5 / 2.5 pts

If U₁ and U₂ are i.i.d. Unif(0,1), find the distribution of

 $X = 2 - \sqrt{-2ln(U_1)} \left[cos(2\pi U_2) + sin(2\pi U_2) \right]$

- (a) Nor(0, 2)
- (b) Nor(0, 4)
- (c) Nor(2, 1)

- (d) Nor(2, 2)
- (e) Nor(2, 4)