UANL

UNIVERSIDAD AUTÓNOMA DE NUEVO LEÓN

Universidad Autonoma de Nuevo León

Facultad de Ingenieria Mecánica y Eléctrica

Modelado y simulación de sistemas

Generación de números rectangulares

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Grupo: 004 **Día:** LMV **Hora:** N5

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Semestre: 7mo

Periodo: Agosto-Diciembre 2025

Problemas Congruencial Mixto

1) $X_{n+1} = (8X_n + 16) \bmod 100$ y $X_0 = 15$

n	X_n	$(a X_n + C) \bmod m$	X_{n+1}	# Rectangular
1	15	$((8)(15)+16)/100 = 1 + 36/100$	(36)	$36/100$
2	36	$((8)(36)+16)/100 = 3 + 4/100$	4	$4/100$
3	4	$((8)(4)+16)/100 = 48/100$	48	$48/100$
4	48	$((8)(48)+16)/100 = 4$	0	$0/100$
5	0	$((8)(0)+16)/100 = 16/100$	16	$16/100$
6	16	$((8)(16)+16)/100 = 1 + 44/100$	44	$44/100$
7	44	$((8)(44)+16)/100 = 3 + 68/100$	68	$68/100$
8	68	$((8)(68)+16)/100 = 5 + 60/100$	60	$60/100$
9	60	$((8)(60)+16)/100 = 4 + 96/100$	96	$96/100$
10	96	$((8)(96)+16)/100 = 7 + 84/100$	84	$84/100$
11	84	$((8)(84)+16)/100 = 6 + 88/100$	88	$88/100$
12	88	$((8)(88)+16)/100 = 7 + 20/100$	20	$20/100$
13	20	$((8)(20)+16)/100 = 1 + 76/100$	76	$76/100$
14	76	$((8)(76)+16)/100 = 6 + 24/100$	24	$24/100$
15	24	$((8)(24)+16)/100 = 2 + 8/100$	8	$8/100$
16	8	$((8)(8)+16)/100 = 80/100$	80	$80/100$
17	80	$((8)(80)+16)/100 = 6 + 56/100$	56	$56/100$
18	56	$((8)(56)+16)/100 = 4 + 64/100$	64	$64/100$
19	64	$((8)(64)+16)/100 = 5 + 28/100$	28	$28/100$
20	28	$((8)(28)+16)/100 = 2 + 40/100$	40	$40/100$
21	40	$((8)(40)+16)/100 = 3 + 36/100$	(36)	$36/100$
22	36	$((8)(36)+16)/100 = 3 + 4/100$	4	$4/100$
23	4	$((8)(4)+16)/100 = 48/100$	48	$48/100$
24	48	$((8)(48)+16)/100 = 4$	0	$0/100$
25	0	$((8)(0)+16)/100 = 16/100$	16	$16/100$
26	16	$((8)(16)+16)/100 = 1 + 44/100$	44	$44/100$

27	44	$((8)(44)+16)/100 = 3 + 68/100$	68	$68/100$
28	68	$((8)(68)+16)/100 = 5 + 60/100$	60	$60/100$
29	60	$((8)(60)+16)/100 = 4 + 96/100$	96	$96/100$
30	96	$((8)(96)+16)/100 = 7 + 84/100$	84	$84/100$
31	84	$((8)(84)+16)/100 = 6 + 88/100$	88	$88/100$
32	88	$((8)(88)+16)/100 = 7 + 20/100$	20	$20/100$
33	20	$((8)(20)+16)/100 = 1 + 76/100$	76	$76/100$
34	76	$((8)(76)+16)/100 = 6 + 24/100$	24	$24/100$
35	24	$((8)(24)+16)/100 = 2 + 8/100$	8	$8/100$
36	8	$((8)(8)+16)/100 = 80/100$	80	$80/100$
37	80	$((8)(80)+16)/100 = 6 + 56/100$	56	$56/100$
38	56	$((8)(56)+16)/100 = 4 + 64/100$	64	$64/100$
39	64	$((8)(64)+16)/100 = 5 + 28/100$	28	$28/100$
40	28	$((8)(28)+16)/100 = 2 + 40/100$	40	$40/100$
41	40	$((8)(40)+16)/100 = 3 + 36/100$	36	$36/100$
42	36	$((8)(36)+16)/100 = 3 + 4/100$	4	$4/100$

Los números se entan ciclando por lo tanto, el período no está completo y los números rectangulares son rechazados.

2) $X_{n+1} = (50 X_n + 17) \bmod 64$ y $X_0 = 13$

n	X_n	$(aX_n + c) \bmod m$	X_{n+1}	# Rectangular
1	13	$((50)(13)+17)/64 = 10 + 27/64$	27	$27/64$
2	27	$((50)(27)+17)/64 = 21 + 23/64$	23	$23/64$
3	23	$((50)(23)+17)/64 = 18 + 15/64$	15	$15/64$
4	15	$((50)(15)+17)/64 = 11 + 63/64$	63	$63/64$
5	63	$((50)(63)+17)/64 = 49 + 31/64$	(31)	$31/64$
6	31	$((50)(31)+17)/64 = 24 + 31/64$	(31)	$31/64$
7	31	$((50)(31)+17)/64 = 24 + 31/64$	(31)	$31/64$

El número se quedó en 31 por lo tanto, el peñodo no está completo y los números rectangulares son rechazados.

3) $x_{n+1} = 5x_n \bmod 64$ y $x_0 = 7$

$PE = 64/4 = 16$

n	x_n	$ax_0 \bmod m$	x_{n+1}	# Rectangular
1	(7)	$(5)(7)/64 = 35/64$	35	$35/64$
2	35	$(5)(35)/64 = 2 + 47/64$	47	$47/64$
3	47	$(5)(47)/64 = 3 + 43/64$	43	$43/64$
4	43	$(5)(43)/64 = 3 + 23/64$	23	$23/64$
5	23	$(5)(23)/64 = 1 + 51/64$	51	$51/64$
6	51	$(5)(51)/64 = 3 + 63/64$	63	$63/64$
7	63	$(5)(63)/64 = 4 + 59/64$	59	$59/64$
8	59	$(5)(59)/64 = 4 + 39/64$	39	$39/64$
9	39	$(5)(39)/64 = 3 + 3/64$	3	$3/64$
10	3	$(5)(3)/64 = 15/64$	15	$15/64$
11	15	$(5)(15)/64 = 1 + 11/64$	11	$11/64$
12	11	$(5)(11)/64 = 55/64$	55	$55/64$
13	55	$(5)(55)/64 = 4 + 19/64$	19	$19/64$
14	19	$(5)(19)/64 = 1 + 31/64$	31	$31/64$
15	31	$(5)(31)/64 = 2 + 27/64$	27	$27/64$
16	27	$(5)(27)/64 = 2 + 7/64$	(7)	$7/64$

$n = PE$ y $x_n = x_{n+1}$

El periodo es completo y los números rectangulares son aceptados.

4) $X_{n+1} = 11\, X_n \bmod 128$ y $X_0 = 9$

$PE = \frac{128}{4} = 32$

n	X_n	a X_0 mod m	X_{n+1}	# Rectangular
1	(9)	$(11)(9)/128 = 99/128$	99	$99/128$
2	99	$(11)(99)/128 = 8 + 65/128$	65	$65/128$
3	65	$(11)(65)/128 = 5 + 75/128$	75	$75/128$
4	75	$(11)(75)/128 = 6 + 57/128$	57	$57/128$
5	57	$(11)(57)/128 = 4 + 115/128$	115	$115/128$
6	115	$(11)(115)/128 = 9 + 113/128$	113	$113/128$
7	113	$(11)(113)/128 = 9 + 91/128$	91	$91/128$
8	91	$(11)(91)/128 = 7 + 105/128$	105	$105/128$
9	105	$(11)(105)/128 = 9 + 3/128$	3	$3/128$
10	3	$(11)(3)/128 = 33/128$	33	$33/128$
11	33	$(11)(33)/128 = 2 + 107/128$	107	$107/128$
12	107	$(11)(107)/128 = 9 + 25/128$	25	$25/128$
13	25	$(11)(25)/128 = 2 + 19/128$	19	$19/128$
14	19	$(11)(19)/128 = 1 + 81/128$	81	$81/128$
15	81	$(11)(81)/128 = 6 + 123/128$	123	$123/128$
16	123	$(11)(123)/128 = 10 + 73/128$	73	$73/128$
17	73	$(11)(73)/128 = 6 + 35/128$	35	$35/128$
18	35	$(11)(35)/128 = 3 + 1/128$	1	$1/128$
19	1	$(11)(1)/128 = 11/128$	11	$11/128$
20	11	$(11)(11)/128 = 121/128$	121	$121/128$
21	121	$(11)(121)/128 = 10 + 51/128$	51	$51/128$
22	51	$(11)(51)/128 = 4 + 49/128$	49	$49/128$
23	49	$(11)(49)/128 = 4 + 27/128$	27	$27/128$
24	27	$(11)(27)/128 = 2 + 41/128$	41	$41/128$
25	41	$(11)(41)/128 = 3 + 67/128$	67	$67/128$

n	x_n	$a x_0 \bmod m$	x_{n+1}	# Rectangular
26	67	$(11)(67)/128 = 5 + 97/128$	97	$97/128$
27	97	$(11)(97)/128 = 8 + 43/128$	43	$43/128$
28	43	$(11)(43)/128 = 3 + 89/128$	89	$89/128$
29	89	$(11)(89)/128 = 7 + 83/128$	83	$83/128$
30	83	$(11)(83)/128 = 7 + 17/128$	17	$17/128$
31	17	$(11)(17)/128 = 1 + 59/128$	59	$59/128$
32	59	$(11)(59)/128 = 5 + 9/128$	(9)	$9/128$

$n = PE$ y $x_n = x_{n+1}$ El periodo esta completo y los números rectangulares son aceptados.