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Tugas 6 Antrian

No 2

Dik:

Waktu antar kedatangan min (p) = 0,5 menit → 30 detik
Waktu antar kedatangan max (q) = 0,8 menit → 48 detik

A. Tabel RV waktu antar kedatangan kendaraan (ui) MCG
a = 19 m = 43 Z0 = 10118181

i	Zi-1	Zi (Random integer number)	Ui (uniform R.N)
1	10118181	$Z_1 = (19 \times 10118181) \bmod 43 = 7$	$u_1 = 7/43 = 0,163$
2.	7	$Z_2 = (19 \times 7) \bmod 43 = 4$	$u_2 = 4/43 = 0,093$
3.	4	$Z_3 = (19 \times 4) \bmod 43 = 33$	$u_3 = 33/43 = 0,767$
4.	33	$Z_4 = (19 \times 33) \bmod 43 = 25$	$u_4 = 25/43 = 0,581$
5.	25	$Z_5 = (19 \times 25) \bmod 43 = 2$	$u_5 = 2/43 = 0,047$
6.	2	$Z_6 = (19 \times 2) \bmod 43 = 38$	$u_6 = 38/43 = 0,884$
7.	38	$Z_7 = (19 \times 38) \bmod 43 = 34$	$u_7 = 34/43 = 0,791$
8.	34	$Z_8 = (19 \times 34) \bmod 43 = 1$	$u_8 = 1/43 = 0,023$
9.	1	$Z_9 = (19 \times 1) \bmod 43 = 19$	$u_9 = 19/43 = 0,44$
10.	19	$Z_{10} = (19 \times 19) \bmod 43 = 17$	$u_{10} = 17/43 = 0,39$
11.	17	$Z_{11} = (19 \times 17) \bmod 43 = 22$	$u_{11} = 22/43 = 0,512$
12.	22	$Z_{12} = (19 \times 22) \bmod 43 = 31$	$u_{12} = 31/43 = 0,721$
13.	31	$Z_{13} = (19 \times 31) \bmod 43 = 30$	$u_{13} = 30/43 = 0,698$
14.	30	$Z_{14} = (19 \times 30) \bmod 43 = 11$	$u_{14} = 11/43 = 0,256$

15	11	$z_{15} = (19 \times 11) \bmod 43 = 37$	$u_{15} = 37/43 = 0,860$
16	37	$z_{16} = (19 \times 37) \bmod 43 = 17$	$u_{16} = 17/43 = 0,349$
17	15	$z_{17} = (19 + 15) \bmod 43 = 27$	$u_{17} = 27/43 = 0,628$
18	27	$z_{18} = (19 \times 27) \bmod 43 = 40$	$u_{18} = 40/43 = 0,930$
19	40	$z_{19} = (19 \times 40) \bmod 43 = 29$	$u_{19} = 29/43 = 0,674$
20	29	$z_{20} = (19 + 29) \bmod 43 = 35$	$u_{20} = 35/43 = 0,814$

B. Tabel RV.G waktu proses pembayaran (u_i) MC6

$a = 3 \quad m = 43 \quad z_0 = \text{Lolli81}$

i	z_{i-1}	z_i (Random integer number)	U_i (Uniform R-N)
1	Lolli81	$z_1 = (3 \times \text{Lolli81}) \bmod 43 = 26$	$u_1 = 26/43 = 0,605$
2.	26	$z_2 = (3 + 26) \bmod 43 = 35$	$u_2 = 35/43 = 0,814$
3	35	$z_3 = (3 + 35) \bmod 43 = 19$	$u_3 = 19/43 = 0,442$
4	19	$z_4 = (3 + 19) \bmod 43 = 14$	$u_4 = 14/43 = 0,326$
5	14	$z_5 = (3 \times 14) \bmod 43 = 42$	$u_5 = 42/43 = 0,977$
6.	42	$z_6 = (3 \times 42) \bmod 43 = 40$	$u_6 = 40/43 = 0,930$
7.	40	$z_7 = (3 \times 40) \bmod 43 = 34$	$u_7 = 34/43 = 0,791$
8.	34	$z_8 = (3 \times 34) \bmod 43 = 16$	$u_8 = 16/43 = 0,372$
9.	16	$z_9 = (3 \times 16) \bmod 43 = 5$	$u_9 = 5/43 = 0,116$
10.	5.	$z_{10} = (3 \times 5) \bmod 43 = 15$	$u_{10} = 15/43 = 0,349$

11	15	$z_{11} = (3 \times 15) \bmod 43 = 2$	$u_1 = 2/43 = 0.047$
12	2	$z_{12} = (3 \times 2) \bmod 43 = 6$	$u_{12} = 6/43 = 0,140$
13	6	$z_{13} = (3 \times 6) \bmod 43 = 18$	$u_{13} = 18/43 = 0,419$
14	18	$z_{14} = (3 \times 18) \bmod 43 = 11$	$u_{14} = 11/43 = 0,256$
15	11	$z_{15} = (3 \times 11) \bmod 43 = 33$	$u_{15} = 33/43 = 0,767$
16	33	$z_{16} = (3 \times 33) \bmod 43 = 13$	$u_{16} = 13/43 = 0,302$
17	13	$z_{17} = (3 \times 13) \bmod 43 = 39$	$u_{17} = 39/43 = 0,907$
18	39	$z_{18} = (3 \times 39) \bmod 43 = 31$	$u_{18} = 31/43 = 0,721$
19	31	$z_{19} = (3 \times 31) \bmod 43 = 7$	$u_{19} = 7/43 = 0,163$
20	7	$z_{20} = (3 \times 7) \bmod 43 = 21$	$u_{20} = 21/43 = 0,488$

C. Mencari waktu antar kedatangan kendaraan (detik) → x_n

rumus = $x = p + ((q-p)u)$

$x_1 = 30 + ((48-30) \times 0,163 = 32,930$

$x_2 = 30 + ((48-30) \cdot 0,1093 = 31,6674$

$x_3 = 30 + ((48-30) \cdot 0,767 = 43,814$

$x_4 = 30 + ((48-30) \cdot 0,581 = 40,465$

$x_5 = 30 + ((48-30) \cdot 0,049 = 30,837$

$x_6 = 30 + ((48-30) \cdot 0,884 = 45,907$

$x_7 = 30 + ((48-30) \cdot 0,791 = 44,233$

$x_8 = 30 + ((48-30) \cdot 0,023 = 30,419$

$x_9 = 30 + ((48-30) \cdot 0,442 = 37,953$

$x_{10} = 30 + ((48-30) \cdot 0,395 = 37,11$

$x_{11} = 30 + ((48 - 307) \cdot 39.209\ 0,512 = 39,209$

$x_{12} = 30 + ((48 - 307) \cdot 42.977\ 0.721 = 42,972$

$x_{13} = 30 + ((48 - 307) \cdot 0.698 = 42,556$

$x_{14} = 30 + ((48 - 307) \cdot 0.256 = 34,605$

$x_{15} = 30 + ((48 - 307) \cdot 0.860 = 45,488$

$x_{16} = 30 + ((48 - 307) \cdot 0.349 = 36,279$

$x_{17} = 30 + ((48 - 307) \cdot 0.620 = 41,302$

$x_{18} = 30 + ((48 - 307) \cdot 0.930 = 46,244$

$x_{19} = 30 + ((48 - 307) \cdot 0.674 = 42,140$

$x_{20} = 30 + ((48 - 307) \cdot 0.814 = 44,651$

D. mencari kumulatif kedatangan (detik)

~~$Kk_i = \sum k_i + Kk_{i-1}$~~ $\quad Kk_i = \sum x_1 + Kk_{i-1}$

i	kk	i	kk
1	32,9	18	704,5
2	64,6	19	746,6
3	100,41		
4	148,8	20	791,3
5	179,72		
6	225,16		
7	269,8		
8	300,12		
9	338,2		
10	375,3		
11	414,55		
12	457,5		
13	500,0		
14	534,6		
15	580,1		
16	616,4		
17	657,7		

E. mencari proses pembayaran.

diketahui distribusi yang digunakan adalah distribusi normal dengan rumus:

$X = M + \sigma z$ dimana $z = (-2 \ln U_i)^{1/2} \sin(2\pi U_{i+2})$

Simpangan baku = 20 detik

rata-rata = 50 detik.

Jadi,

$X = M + \sigma z$

$= 50 + (20 \cdot (-2 \ln U_1)^{1/2} \sin(2\pi U_{i+1})$

Contoh pada iterasi 1

$X_1 = 50 + (20 \cdot ((-2 \ln 0{,}605) \cdot (\sin(2\pi \cdot 0{,}814))$

$= 31{,}516$

$= 31$

F. mencari waktu selesai pelayanan.

$WSD_i = KK_i + WPP_i$

$WSD_1 = 32{,}9 + 31{,}5$

$= 64$

G. waktu menunggu kedatangan

waktu menunggu untuk pelanggan pertama adalah 0

maka : $W MK_1 = 0$

untuk WMK_2 menggunakan rumus

$WMK_2 = WSD_1 - KK_2$

$= 64 - 64{,}6$

$= -0{,}2$ → karena $WMK < 0$ maka $WMK = 0$

* dilanjutkan untuk iterasi selanjutnya

H. ~~Collected~~ waktu mengganggu mesin sensor

wmms adalah kebalikan dari wmk
maka apabila wmk$_i$ = 0 maka

$wmms = wSD_{i-1} - kk_i$

untuk $wmms_1$ karena wmk = 0 maka

$wmms_1 = kk$

$= 32.930$

I. Tabel Hasil Simulasi

NO	Kilangan acak yg dibandingkan		Simulasi					
	Waktu Antar kedatangan kendaraan	waktu proses pembayaran	waktu antar kedatangan kendaraan (detik)	kumulatif kedatangan kendaraan (detik)	waktu proses pembayaran (detik)	waktu selesai dilayani (detik)	waktu menunggu kendaraan (detik)	waktu menganggur mesin kasir
1.	0.163	0.605	33	33	32	64	0	32.9
2.	0.093	0.824	32	65	51	119	0	0.2
3.	0.767	0.442	44	108	73	181	11	0
4.	0.582	0.326	40	149	46	194	32	6
5.	0.047	0.977	31	180	48	228	15	0
6.	0.884	0.930	46	226	43	268	2	0
7.	0.791	0.791	44	270	66	330	0	1.6
8.	0.023	0.372	30	300	69	369	29	0
9.	0.442	0.116	38	338	84	422	31	0
10.	0.395	0.349	37	375	58	434	47	0
11.	0.512	0.047	39	414	88	503	19	0
12.	0.721	0.140	43	458	69	527	45	0
13.	0.698	0.449	43	500	76	576	27	0

14	0.256	0.256	35	535	17	512	42	0
15	0.860	0.767	45	880	54	644	6	28.3
16	0.349	0.302	36	616	33	649	27	6
17	0.628	0.907	41	658	41	699	6	8.4
18	0.930	0.721	47	705	54	768	6	5.4
19	0.674	0.163	42	747	53	799	22	0
20	0.874	0.488	45	791	55	847	8	0

purata-rata waktu menunggu sebuah kenderaan untuk dapat melalui

pembayaran

$$= \frac{\sum \text{waktu menunggu kenderaan}}{\text{jumlah kenderaan}} = \frac{0+0+11+32+45+2+0+29+31+47+19+45+27+42+0+24+0+0+22+8}{20}$$

$$= 17.860$$

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