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Outage Data and Consumer Statistics of the Ratmalana Feeder 9

Outage No	Date	Day	Time Duration		Fault Clearing Time (hrs)	No of Connected Customers	Consumers Hours Lost
			From	To			
1	2012.01.04	Wed	03.59	04.24	0.42	24,642	10,349.6
2	2012.02.29	Wed	14.51	15.15	0.40	24,642	9,856.8
3	2012.04.03	Tue	11.38	11.41	0.05	24,642	1,232.1
4	2012.04.04	Wed	13.20	13.23	0.05	24,642	1,232.1
5	2012.04.07	Sat	07.12	07.15	0.05	24,642	1,232.1
6	2012.04.14	Sat	06.10	06.13	0.05	24,642	1,232.1
7	2012.04.25	Wed	08.09	08.12	0.05	24,642	1,232.1
8	2012.05.20	Sun	09.20	09.45	0.42	24,642	10,349.6
9	2012.05.20	Sun	11.19	11.45	0.43	24,642	10,596.0
10	2012.05.22	Tue	13.48	13.51	0.05	24,642	1,232.1
11	2012.05.22	Tue	13.59	14.18	0.32	24,642	7,885.4
12	2012.06.07	Thu	09.50	09.53	0.05	24,642	1,232.1
13	2012.06.08	Fri	12.36	12.39	0.05	24,642	1,232.1
14	2012.06.15	Fri	09.11	11.14	2.05	24,642	50,516.1
15	2012.06.25	Mon	10.05	10.08	0.05	24,642	1,232.1
16	2012.06.26	Tue	20.07	20.56	0.82	24,642	20,206.4
17	2012.06.27	Wed	13.43	13.46	0.05	24,642	1,232.1
18	2012.07.08	Sun	06.21	06.24	0.05	24,642	1,232.1
19	2012.07.13	Fri	11.58	13.51	1.88	24,642	46,326.9
20	2012.07.14	Sat	09.35	09.38	0.05	24,642	1,232.1
21	2012.07.15	Sun	17.54	17.58	0.07	24,642	1,724.9
22	2012.07.18	Wed	09.18	09.21	0.05	24,642	1,232.1
23	2012.07.18	Wed	16.23	18.24	2.02	24,642	49,776.8
24	2012.07.24	Tue	15.35	17.40	2.08	24,642	51,255.4
25	2012.07.25	Wed	01.22	01.25	0.05	24,642	1,232.1
26	2012.07.25	Wed	09.39	09.42	0.05	24,642	1,232.1
27	2012.07.25	Wed	09.58	10.33	0.58	24,642	14,292.4
28	2012.07.25	Wed	15.31	15.46	0.25	24,642	6,160.5

Appendix - A(Contd.)

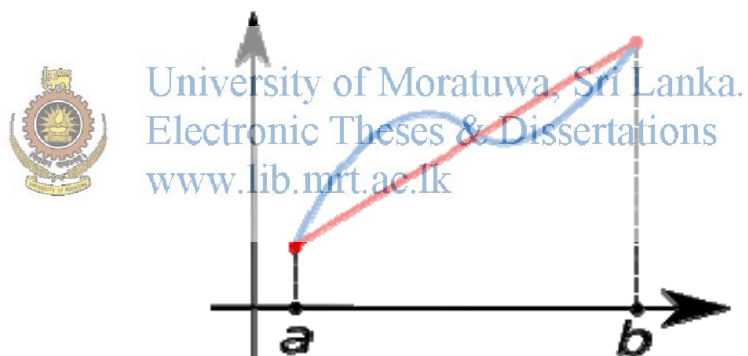
29	2012.07.25	Wed	21.15	21.40	0.42	24,642	10,349.6
30	2012.07.26	Thu	15.29	17.39	2.17	24,642	53,473.1
31	2012.08.08	Wed	06.35	06.39	0.07	24,642	1,724.9
32	2012.08.08	Wed	15.20	17.29	2.15	24,642	52,980.3
33	2012.08.12	Sun	15.19	17.40	2.35	24,642	57,908.7
34	2012.08.20	Mon	15.06	18.15	3.15	24,642	77,622.3
35	2012.08.21	Tue	14.56	17.41	2.75	24,642	67,765.5
36	2012.08.22	Wed	07.30	08.33	1.05	24,642	25,874.1
37	2012.08.22	Wed	15.05	17.11	2.10	24,642	51,748.2
38	2012.08.23	Thu	15.09	18.11	3.03	24,642	74,665.3
39	2012.08.27	Mon	12.50	12.53	0.05	24,642	1,232.1
40	2012.08.28	Tue	14.43	15.40	0.95	24,642	23,409.9
41	2012.08.29	Wed	15.09	17.03	1.90	24,642	46,819.8
42	2012.09.04	Tue	16.39	18.05	1.43	24,642	35,238.1
43	2012.09.05	Wed	14.57	16.39	1.70	24,642	41,891.4
44	2012.09.06	Thu	14.54	17.36	2.70	24,642	66,533.4
45	2012.09.07	Fri	11.44	11.47	0.05	24,642	1,232.1
46	2012.09.07	Fri	16.22	18.29	2.12	24,642	52,241.0
47	2012.09.14	Fri	05.13	06.16	1.05	24,642	25,874.1
48	2012.09.14	Fri	16.30	16.33	0.05	24,642	1,232.1
49	2012.09.17	Mon	11.20	11.23	0.05	24,642	1,232.1
50	2012.09.30	Sun	09.55	09.59	0.07	24,642	1,724.9
51	2012.10.13	Sat	06.13	8.31	2.30	24,642	56,676.6
52	2012.10.31	Wed	17.56	17.59	0.05	24,642	1,232.1
53	2012.10.31	Wed	18.08	18.24	0.27	24,642	6,653.3
54	2012.10.31	Wed	18.42	18.45	0.05	24,642	1,232.1
55	2012.10.31	Wed	18.48	18.51	0.05	24,642	1,232.1
56	2012.11.01	Thu	10.00	10.03	0.05	24,642	1,232.1
57	2012.11.09	Fri	06.56	06.59	0.05	24,642	1,232.1
58	2012.11.16	Fri	07.56	07.59	0.05	24,642	1,232.1
59	2012.12.24	Sat	18.12	18.15	0.05	24,642	1,232.1
Total					46.77	1,453,878	1,152,506.34

Trapezoidal Method

In numerical analysis, the trapezoidal rule (also known as the trapezoid rule or trapezium rule) is a technique for approximating the definite integral

$$\int_a^b f(x) dx.$$

The trapezoidal rule works by approximating the region under the graph of the function $f(x)$ as a trapezoid and calculating its area. It follows that



The Area under the Curve;

$$\int_a^b f(x) dx \approx (b - a) \left[\frac{f(a) + f(b)}{2} \right].$$

The recorded outage data of RF – 9 in 2012

Outage No	Date	Day	Time Duration		Fault Clearing Time (hrs)	Recorded Available Current before the Fault (A)	Remarks
			From	To			
01	2012.01.04	Wed	3.59	4.24	0.42	130	EF/OC
02	2012.02.29	Wed	14.51	15.15	0.40	300	EF/OC
03	2012.04.03	Tue	11.38	11.41	0.05	338	OC
04	2012.04.04	Wed	13.20	13.23	0.05	295	EF/OC
05	2012.04.07	Sat	7.12	7.15	0.05	150	EF/OC
06	2012.04.14	Sat	6.10	6.13	0.05	112	EF
07	2012.04.25	Wed	8.09	8.12	0.05	210	EF
08	2012.05.20	Sun	9.20	9.45	0.42	165	Request ES to cut the way leaves
09	2012.05.20	Sun	11.19	11.45	0.43	156	Request ES to cut the way leaves
10	2012.05.22	Tue	13.48	13.51	0.05	270	OC
11	2012.05.22	Tue	13.59	14.18	0.32	270	OC
12	2012.06.07	Thu	9.50	9.53	0.05	257	EF/OC
13	2012.06.08	Fri	12.36	12.39	0.05	288	EF
14	2012.06.15	Fri	9.11	11.14	2.05	240	EF/OC
15	2012.06.25	Mon	10.05	10.08	0.05	260	EF
16	2012.06.26	Tue	20.07	20.56	0.82	238	EF/OC
17	2012.06.27	Wed	13.43	13.46	0.05	258	OC
18	2012.07.08	Sun	6.21	6.24	0.05	120	EF
19	2012.07.13	Fri	11.58	13.51	1.88	262	EF/OC
20	2012.07.14	Sat	9.35	9.38	0.05	230	OC
21	2012.07.15	Sun	17.54	17.58	0.07	132	EF/OC
22	2012.07.18	Wed	9.18	9.21	0.05	240	OC
23	2012.07.18	Wed	16.23	18.24	2.02	290	EF/OC
24	2012.07.24	Tue	15.35	17.40	2.08	269	EF/OC
25	2012.07.25	Wed	1.22	1.25	0.05	110	EF/OC
26	2012.07.25	Wed	9.39	9.42	0.05	236	OC
27	2012.07.25	Wed	9.58	10.33	0.58	260	EF
28	2012.07.25	Wed	15.31	15.46	0.25	260	EF/OC
29	2012.07.25	Wed	21.15	21.40	0.42	228	EF
30	2012.07.26	Thu	15.29	17.39	2.17	240	EF
31	2012.08.08	Wed	6.35	6.39	0.07	120	EF

Appendix – C (Contd.)

32	2012.08.08	Wed	15.20	17.29	2.15	244	EF/OC
33	2012.08.12	Sun	15.19	17.40	2.35	180	EF/OC
34	2012.08.20	Mon	15.06	18.15	3.15	250	Requested by System Control
35	2012.08.21	Tue	14.56	17.41	2.75	260	Requested by System Control
36	2012.08.22	Wed	7.30	8.33	1.05	139	EF/OC
37	2012.08.22	Wed	15.05	17.11	2.10	256	EF/OC
38	2012.08.23	Thu	15.09	18.11	3.03	240	Requested by System Control
39	2012.08.27	Mon	12.50	12.53	0.05	240	EF
40	2012.08.28	Tue	14.43	15.40	0.95	256	Requested by System Control
41	2012.08.29	Wed	15.09	17.03	1.90	230	EF
42	2012.09.04	Tue	16.39	18.05	1.43	260	Load Shedding
43	2012.09.05	Wed	14.57	16.39	1.7	232	EF/OC
44	2012.09.06	Thu	14.54	17.36	2.70	248	EF/OC
45	2012.09.07	Fri	11.44	11.47	0.05	270	EF
46	2012.09.07	Fri	16.22	18.29	2.12	270	EF/OC
47	2012.09.14	Fri	16.13	16.15	0.02	250	EF
48	2012.09.14	Fri	16.30	16.33	0.05	250	EF
49	2012.09.17	Mon	11.20	11.23	0.05	262	EF
50	2012.09.30	Sun	9.55	9.59	0.07	139	OC
51	2012.10.13	Sat	6.12	8.30	2.30	153	EF
52	2012.10.31	Wed	17.56	17.59	0.05	254	OC
53	2012.10.31	Wed	18.08	18.24	0.27	210	EF/OC
54	2012.10.31	Wed	18.42	18.45	0.05	197	OC
55	2012.10.31	Wed	18.48	18.51	0.05	200	OC
56	2012.11.01	Thu	10.00	10.03	0.05	220	OC
57	2012.11.09	Fri	6.56	6.59	0.05	155	EF
58	2012.11.16	Fri	7.56	7.59	0.05	195	EF
59	2012.12.24	Sat	18.12	18.15	0.05	150	EF/OC

Appendix - D

Load current in the RF – 9 at each time intervals

	5-Nov	6-Nov	7-Nov	1-Nov	2-Nov	3-Nov	4-Nov	Weekly Average Current (A)	Ave Cur. Week Days (A)
	Mon	Tues	Wed	Thu	Fri	Sat	Sun		
Time	Current (A)	Current (A)	Current (A)	Current (A)	Current (A)	Current (A)	Current (A)		
0:00	154	157	147	128	150	148	142	146.57	147.2
0:30	140	150	158	126	128	150	146	142.57	140.4
1:00	138	148	155	122	128	150	146	141.00	138.2
1:30	133	144	155	124	125	150	146	139.57	136.2
2:00	132	144	155	124	122	148	146	138.71	135.4
2:30	130	140	150	122	122	145	140	135.57	132.8
3:00	130	140	145	122	122	140	136	133.57	131.8
3:30	130	137	140	120	120	138	140	132.14	129.4
4:00	135	137	138	120	122	137	140	132.71	130.4
4:30	138	142	142	118	124	140	146	134.86	132.8
5:00	144	154	159	136	138	140	140	144.43	146.2
5:30	158	166	160	140	148	140	137	149.88	154.4
6:00	158	170	164	147	160	140	135	153.43	159.8
6:30	154	154	164	150	158	145	130	150.71	156.0
7:00	140	160	160	152	150	150	127	148.43	152.4
7:30	139	174	185	174	150	170	130	160.29	164.4
8:00	218	220	225	200	240	200	130	204.71	220.6
8:30	220	278	280	240	240	250	142	235.71	251.6
9:00	279	282	280	248	268	250	149	250.86	271.4
9:30	279	278	294	257	268	250	155	254.43	275.2
10:00	287	280	294	248	278	255	159	257.29	277.4
10:30	300	300	310	258	280	266	162	268.00	289.6
11:00	310	305	320	260	300	275	170	277.14	299.0
11:30	320	305	318	262	300	276	174	279.29	301
12:00	309	300	312	266	300	269	174	275.71	297.4
12:30	305	290	306	230	295	264	178	266.86	285.2
13:00	300	278	280	227	278	260	174	256.71	272.6
13:30	300	272	284	230	278	257	172	256.14	272.8
14:00	300	285	306	256	280	254	170	264.43	285.4
14:30	305	300	310	256	280	254	168	267.57	290.2
15:00	320	302	310	250	300	252	166	271.43	296.4
15:30	320	300	314	250	298	248	164	270.57	296.4

Appendix – D (Contd.)

16:00	310	294	312	250	295	250	162	267.57	292.2
16:30	300	284	312	246	270	246	160	259.71	282.4
17:00	280	272	290	235	268	234	156	247.86	269.0
17:30	267	268	288	230	260	220	150	240.43	262.6
18:00	280	278	280	230	250	220	164	243.14	263.6
18:30	267	278	260	230	240	230	200	243.57	255.0
19:00	250	260	254	230	239	227	202	237.43	246.6
19:30	254	250	250	222	235	216	202	232.71	242.2
20:00	248	240	238	222	230	218	199	227.86	235.6
20:30	240	232	230	224	220	216	190	221.71	229.2
21:00	230	225	220	220	220	208	184	215.29	223.0
21:30	202	219	210	200	201	200	182	202.00	206.4
22:00	190	215	186	168	175	184	180	185.43	186.8
22:30	180	186	180	168	164	178	170	175.14	175.6
23:00	170	170	164	160	158	167	160	164.14	164.4
23:30	164	160	155	133	155	156	152	153.57	153.4
24:00	154	157	147	128	150	148	142	146.57	147.2



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Calculated unserved energy due to outage in 2012 of RF – 9

Date	Day	Time Duration		Fault Clearing Time (hrs)	Recorded current before fault (A)	Area of the average Load Curve (Ah)	Unserved Energy (kWh)
		From	To				
2012.01.04	Wed	03.59	04.24	0.42	130	54.77	2817.37
2012.02.29	Wed	14.51	15.15	0.40	300	116.08	5971.38
2012.04.03	Tue	11.38	11.41	0.05	338	15.05	774.20
2012.04.04	Wed	13.20	13.23	0.05	295	13.63	701.15
2012.04.07	Sat	07.12	07.15	0.05	150	7.50	385.81
2012.04.14	Sat	06.10	06.13	0.05	112	5.60	288.07
2012.04.25	Wed	08.09	08.12	0.05	210	11.02	566.63
2012.05.20	Sun	09.20	09.45	0.42	215	62.58	3219.23
2012.05.20	Sun	11.19	11.45	0.43	260	73.10	3760.40
2012.05.22	Tue	13.48	13.51	0.05	270	13.64	701.67
2012.05.22	Tue	13.59	14.18	0.32	270	91.33	4,698.09
2012.06.07	Thu	09.50	09.53	0.05	257	14.26	733.56
2012.06.08	Fri	12.36	12.38	0.05	288	14.26	733.56
2012.06.15	Fri	09.11	11.14	2.05	240	581.85	29,931.47
2012.06.25	Mon	10.05	10.08	0.05	260	13.87	713.50
2012.06.26	Tue	20.07	20.56	0.82	238	186.23	9,580.03
2012.06.27	Wed	13.43	13.46	0.05	258	13.64	701.67
2012.07.08	Sun	06.21	06.24	0.05	120	6.75	347.23
2012.07.13	Fri	11.58	13.51	1.88	262	435.63	22,409.64
2012.07.14	Sat	09.35	09.38	0.05	230	11.50	591.58
2012.07.15	Sun	17.54	17.58	0.07	132	10.50	540.14
2012.07.18	Wed	09.18	09.21	0.05	240	13.57	698.07
2012.07.18	Wed	16.23	18.24	2.02	290	537.54	27,652.08
2012.07.24	Tue	15.35	17.40	2.08	269	576.96	29,679.92
2012.07.25	Wed	01.22	01.25	0.05	110	6.81	350.32
2012.07.25	Wed	09.39	09.42	0.05	236	13.77	708.36
2012.07.25	Wed	09.58	10.33	0.58	260	164.72	8,473.51
2012.07.25	Wed	15.31	15.46	0.25	260	74.10	3,811.85
2012.07.25	Wed	21.15	21.40	0.42	228	93.66	4,818.05
2012.07.26	Thu	15.29	17.39	2.17	240	643.19	33,086.82
2012.08.08	Wed	06.35	06.39	0.07	120	10.92	561.75
2012.08.08	Wed	15.20	17.29	2.15	244	637.26	32,781.87
2012.08.12	Sun	15.19	17.40	2.35	200	656.94	33,794.25
2012.08.22	Wed	07.30	08.33	1.05	139	226.93	11,673.71
2012.08.22	Wed	15.05	17.11	2.10	256	612.43	31,504.57

Appendix - E (Contd.)

2012.08.27	Mon	12.50	12.53	0.05	240	14.26	733.56
2012.08.29	Wed	15.09	17.03	1.90	230	545.82	28,078.02
2012.09.05	Wed	14.57	16.39	1.70	232	495.86	25,507.98
2012.09.06	Thu	14.54	17.36	2.70	248	765.60	39,383.93
2012.09.07	Fri	11.44	11.47	0.05	270	15.05	774.20
2012.09.07	Fri	16.22	18.29	2.12	270	563.71	28,998.32
2012.09.14	Fri	05.13	06.16	1.05	102	162.86	8,377.83
2012.09.14	Fri	16.30	16.33	0.05	250	14.12	726.36
2012.09.17	Mon	11.20	11.23	0.05	262	14.95	769.06
2012.09.30	Sun	09.55	09.59	0.07	139	10.85	558.14
2012.10.13	Sat	06.12	08.30	2.30	153	399.00	20,525.32
2012.10.31	Wed	17.56	17.59	0.05	254	13.13	675.43
2012.10.31	Wed	18.08	18.24	0.27	210	71.17	3661.22
2012.10.31	Wed	18.42	18.45	0.05	197	12.75	655.88
2012.10.31	Wed	18.48	18.51	0.05	200	12.75	655.88
2012.11.01	Thu	10.00	10.03	0.05	220	13.87	713.50
2012.11.09	Fri	06.56	06.59	0.05	155	7.80	401.25
2012.11.16	Fri	07.56	07.59	0.05	195	11.03	567.40
2012.12.24	Sat	18.12	18.15	0.05	210	10.50	540.14
							472,064.96



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Definitions for Economic Evaluation

Interest Rate and Discount Rate

Interest Rate

The percentage increase in the value of money over a period of one year. In addition to the time value of money, interest rate includes the effect of inflation and escalation.

Discount Rate

The time value of money, as perceived by an investor. Usually expressed in percentage per year.

Present Value
Discount Rate = r %

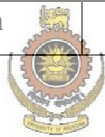


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Year	Value	PV Factor	Present Value
0	V_0	$\frac{1}{(1+r)^0}$	$\frac{V_0}{(1+r)^0}$
1	V_1	$\frac{1}{(1+r)^1}$	$\frac{V_1}{(1+r)^1}$
2	V_2	$\frac{1}{(1+r)^2}$	$\frac{V_2}{(1+r)^2}$
3	V_3	$\frac{1}{(1+r)^3}$	$\frac{V_3}{(1+r)^3}$
....
9	V_9	$\frac{1}{(1+r)^9}$	$\frac{V_9}{(1+r)^9}$
10	V_{10}	$\frac{1}{(1+r)^{10}}$	$\frac{V_{10}}{(1+r)^{10}}$

Cost - Benefit Analysis.

Year	Cost	Benefit	Present Value	
			Cost	Benefit
0	C_0	B_0	\bar{C}_0	\bar{B}_0
1	C_1	B_1	\bar{C}_1	\bar{B}_1
2	C_2	B_2	\bar{C}_2	\bar{B}_2
3	C_3	B_3	\bar{C}_3	\bar{B}_3
.....
n-1	C_{n-1}	B_{n-1}	\bar{C}_{n-1}	\bar{B}_{n-1}
n	C_n	B_n	\bar{C}_n	\bar{B}_n



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$$B = \sum_{t=1}^n B_t = \sum_{t=1}^n \frac{B_t}{(1+r)^t}$$

$$\text{Net Present Value (NPV)} = B - C$$

Project Accepted If NPV > 0