

LECTURE WEEK 3
Spring 2005
January 25 and 28

TMA4275 LIFETIME ANALYSIS

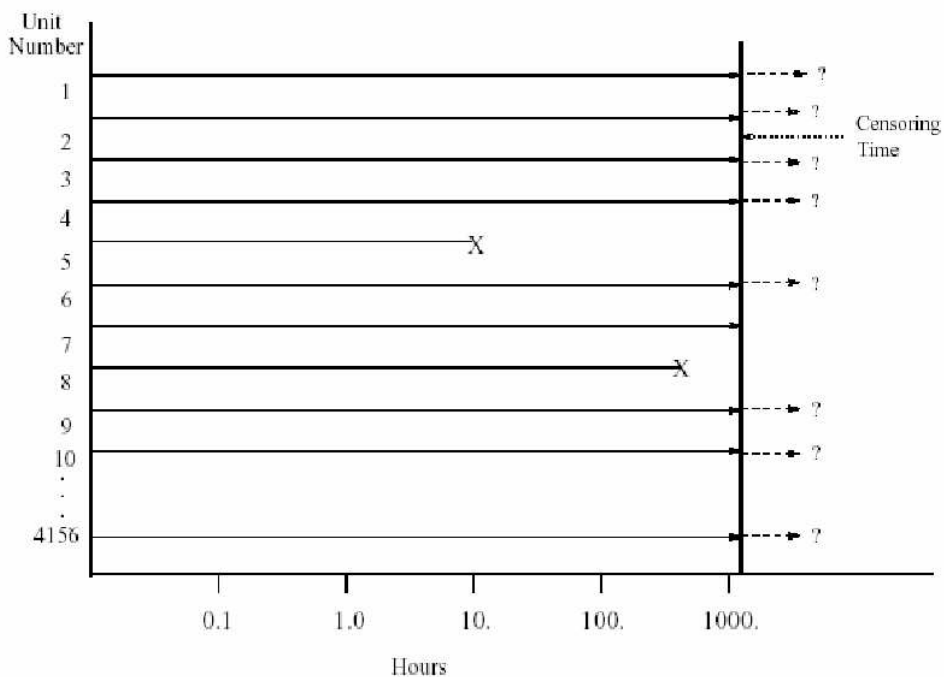
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1

EXAMPLE: CENSORING

IC Data Failure Pattern



2

Example of Censoring: Leukemia Data

Remission times for 42 children with acute leukemia (free of symptoms).

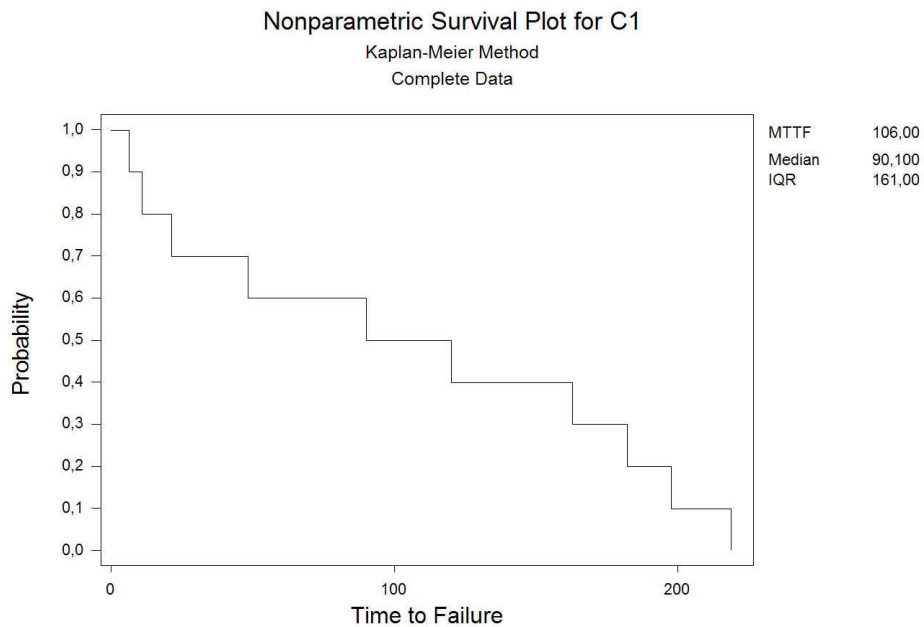
PL=Placebo, MP=6MP treatment, Y=time, C=censoring (0 means censored)

Row	YPL	CPL	YMP	CMP
1	1	1	6	1
2	1	1	6	1
3	2	1	6	1
4	2	1	6	0
5	3	1	7	1
6	4	1	9	0
7	4	1	10	1
8	5	1	10	0
9	5	1	11	0
10	8	1	13	1
11	8	1	16	1
12	8	1	17	0
13	8	1	19	0
14	11	1	20	0
15	11	1	22	1
16	12	1	23	1
17	12	1	25	0
18	15	1	32	0
19	17	1	32	0
20	22	1	34	0
21	23	1	35	0

3

KM-PLOT WITH COMPLETE DATA (Example 11.8/9.1)

Data: 6.3, 11.0, 21.5, 48.4, 90.1, 120.2, 163.0, 182.5, 198.0, 219.0



4

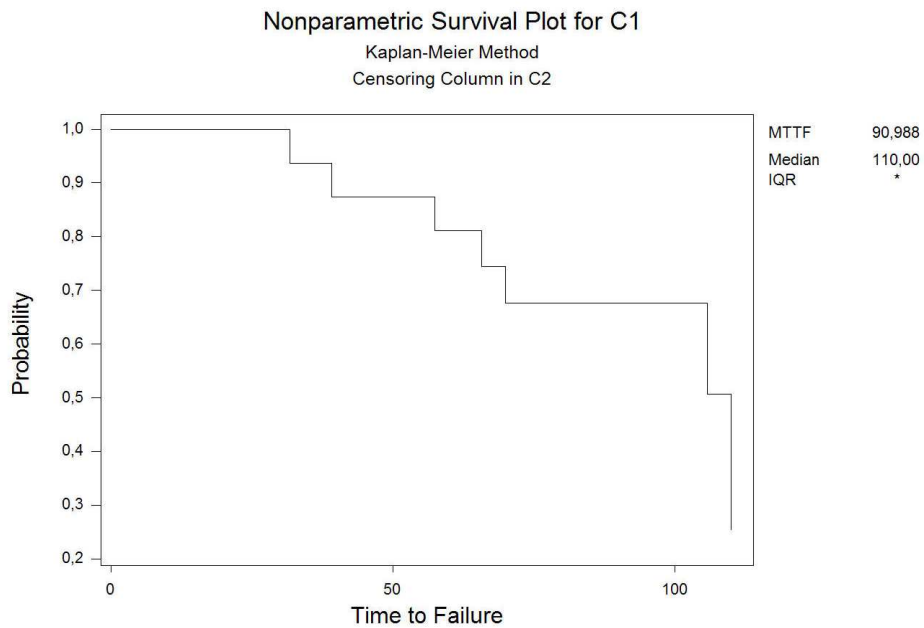
KM-ESTIMATOR WITH CENSORED DATA - Example 11.5/9.3

Row	C1	C2
1	31,7	1
2	39,2	1
3	57,5	1
4	65,0	0
5	65,8	1
6	70,0	1
7	75,0	0
8	75,2	0
9	87,5	0
10	88,3	0
11	94,2	0
12	101,7	0
13	105,8	1
14	109,2	0
15	110,0	1
16	130,0	0

Time	Number at Risk	Number Failed	Survival Probability	Standard Error	95,0% Normal CI Lower	95,0% Normal CI Upper
31,7000	16	1	0,9375	0,0605	0,8189	1,0000
39,2000	15	1	0,8750	0,0827	0,7130	1,0000
57,5000	14	1	0,8125	0,0976	0,6213	1,0000
65,8000	12	1	0,7448	0,1105	0,5283	0,9613
70,0000	11	1	0,6771	0,1194	0,4431	0,9111
105,8000	4	1	0,5078	0,1718	0,1711	0,8445
110,0000	2	1	0,2539	0,1990	0,0000	0,6440

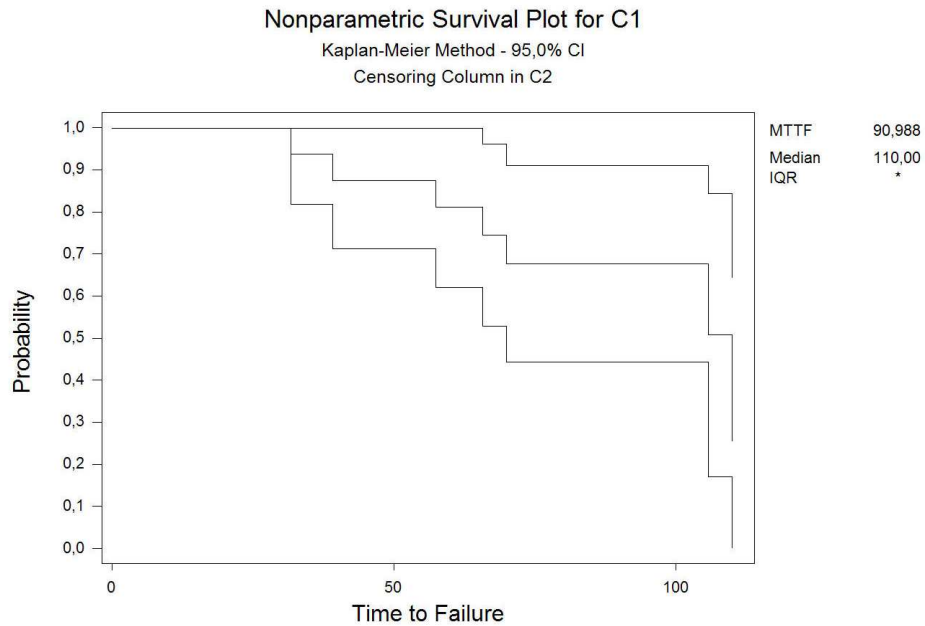
5

KM-plot (Example 11.5/9.3)



6

KM-plot with confidence limits (Example 11.5/9.3)



7

Leukemia Data

Remission times for 42 children with acute leukemia (free of symptoms).

PL=Placebo, MP=6MP treatment, Y=time, C=censoring (0 means censored)

Row	YPL	CPL	YMP	CMP
1	1	1	6	1
2	1	1	6	1
3	2	1	6	1
4	2	1	6	0
5	3	1	7	1
6	4	1	9	0
7	4	1	10	1
8	5	1	10	0
9	5	1	11	0
10	8	1	13	1
11	8	1	16	1
12	8	1	17	0
13	8	1	19	0
14	11	1	20	0
15	11	1	22	1
16	12	1	23	1
17	12	1	25	0
18	15	1	32	0
19	17	1	32	0
20	22	1	34	0
21	23	1	35	0

8

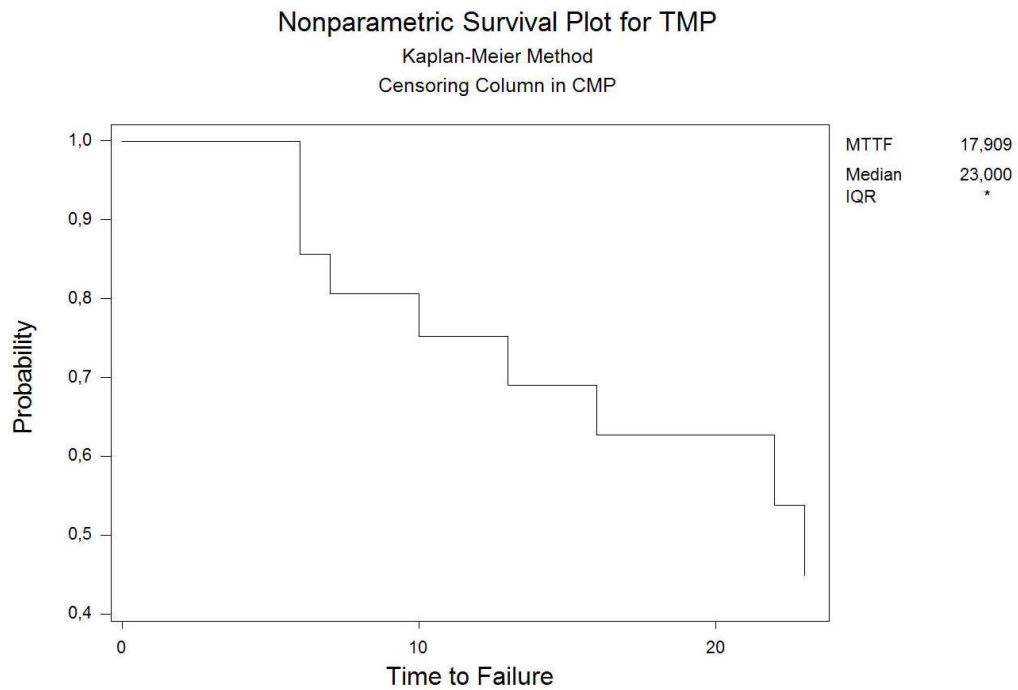
Kaplan-Meier Estimator – Leukemia Data

Treatment group (6MP)

Time	Number at Risk	Number Failed	Survival Probability	Standard Error	95,0% Normal CI Lower	95,0% Normal CI Upper
6,0000	21	3	0,8571	0,0764	0,7075	1,0000
7,0000	17	1	0,8067	0,0869	0,6363	0,9771
10,0000	15	1	0,7529	0,0963	0,5641	0,9418
13,0000	12	1	0,6902	0,1068	0,4808	0,8995
16,0000	11	1	0,6275	0,1141	0,4039	0,8510
22,0000	7	1	0,5378	0,1282	0,2865	0,7891
23,0000	6	1	0,4482	0,1346	0,1844	0,7120

9

KM-plot: Leukemia Data (Treatment group)



10

NELSON ESTIMATOR Data from Example 11.5/9.3

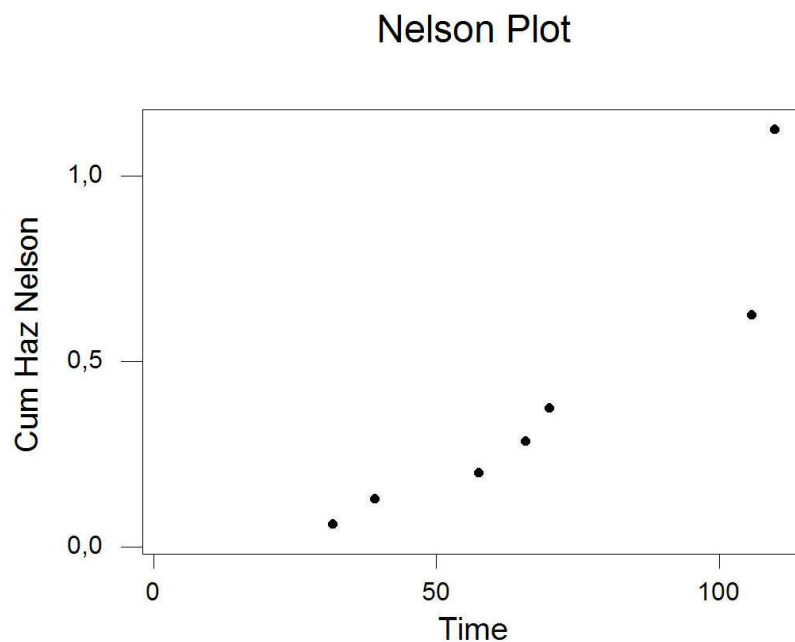
Row	Time	Numb at risk	1/Numb at risk	Cum Haz Nelson	Survival Nelson
1	31,7	16	0,062500	0,06250	0,939413
2	39,2	15	0,066667	0,12917	0,878827
3	57,5	14	0,071429	0,20060	0,818244
4	65,8	12	0,083333	0,28393	0,752820
5	70,0	11	0,090909	0,37484	0,687401
6	105,8	4	0,250000	0,62484	0,535348
7	110,0	2	0,500000	1,12484	0,324705

Survival KM

0,937500 0,875000 0,812500 0,744792 0,677083 0,507813
0,253906

11

Nelson-plot: Example 11.5/9.3.



12

TTT-plott

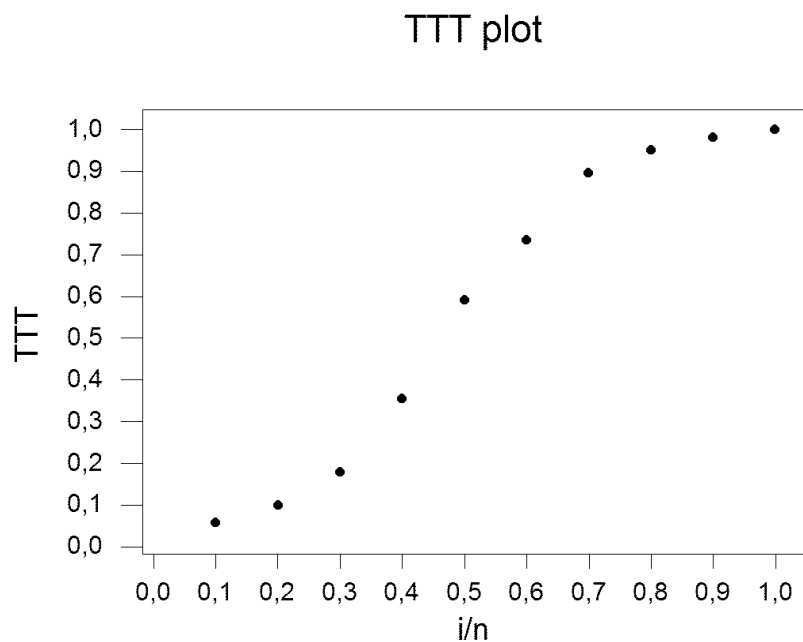
See Table 11.5/9.1.

Complete (i.e. uncensored) data.

Row	Time	Cum Time	Tot Time	i/n	TTT
1	6,3	6,3	63,0	0,1	0,05943
2	11,0	17,3	105,3	0,2	0,09934
3	21,5	38,8	189,3	0,3	0,17858
4	48,4	87,2	377,6	0,4	0,35623
5	90,1	177,3	627,8	0,5	0,59226
6	120,2	297,5	778,3	0,6	0,73425
7	163,0	460,5	949,5	0,7	0,89575
8	182,5	643,0	1008,0	0,8	0,95094
9	198,0	841,0	1039,0	0,9	0,98019
10	219,0	1060,0	1060,0	1,0	1,00000

13

TTT-plot (Data from Table 11.5/9.1)



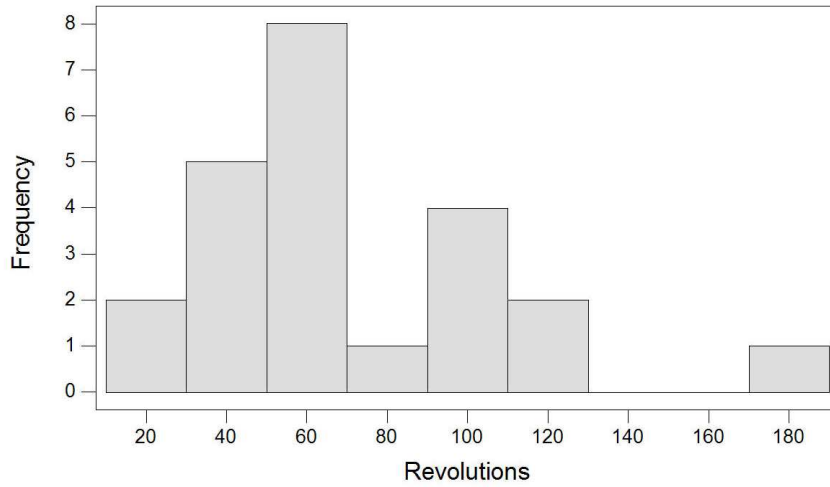
14

BALL BEARINGS FAILURE DATA

Data: Millions of revolutions to fatigue failure for 23 units

17,88	28,92	33,00	41,52	42,12	45,60	48,40	51,84
51,96	54,12	55,56	67,80	68,64	68,64	68,88	84,12
93,12	98,64	105,12	105,84	127,92	128,04	173,40	

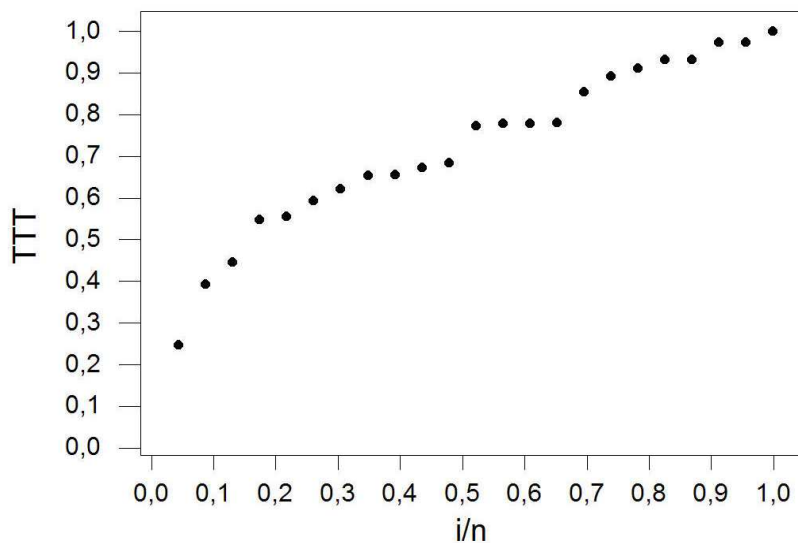
Histogram of Revolutions



15

BALL BEARINGS FAILURE DATA

TTT plot



16