Chapter 5 SAS 입력 및 결과출력 정리

```
/*************************************************
        Chapter 5
*************************************************/
/*read data from the path of dataset*/
Data dat3;
infile "C:/Users/HSY/Desktop/CTCarcinoma.csv" delimiter="," firstobs=2;
input TRT$ Time Status Age;
RUN;
PROC PRINT data= dat3;
RUN;
```

OBS	TRT	Time	Status	Age
1	S+CT	48	1	26
2	S+CT	55	0	65
3	S+CT	58	1	48
4	S+CT	63	0	53
5	S+CT	102	0	55
6	S+CT	133	0	63
7	S+CT	144	0	62
8	S+CT	177	1	49
9	S+CT	182	1	50
10	S+CT	216	1	63
11	S+CT	217	0	58
12	S+IT	102	0	52
13	S+IT	105	0	72
14	S+IT	144	0	52
15	S+IT	151	0	54
16	S+IT	182	1	52
17	S+IT	191	1	62
18	S+IT	192	0	62
19	S+IT	196	1	50
20	S+IT	222	1	43
21	S+IT	251	1	31
22	S+CT+IT	36	0	60
23	S+CT+IT	73	0	72
24	S+CT+IT	139	1	48
25	S+CT+IT	158	0	60
26	S+CT+IT	185	1	47
27	S+CT+IT	198	1	51
28	S+CT+IT	239	1	55
29	S+CT+IT	239	1	56
30	S+CT+IT	240	1	61
31	S+CT+IT	242	1	35

```
PROC SORT data= dat3 out= dat3;
by descending TRT;
RUN;
```

```
/*******************************************************
        Section 5.5.1.1
*******************************************************/
/*fit Kaplan-Meier and
estimat suvival and cumulative harzard function and plot*/
PROC LIFETEST data= dat3;
time Time*Status(1);      /*0 is event, 1 is censored*/
strata TRT;
RUN;
```

The LIFETEST Procedure

Stratum 1: TRT = S+CT

Product-Limit Survival Estimates

Time	Survival	Failure	Survival Standard Error	Number Failed	Number Left
0.000	1.0000	0	0	0	11
48.000*	.	.	.	0	10
55.000	0.9000	0.1000	0.0949	1	9
58.000*	.	.	.	1	8
63.000	0.7875	0.2125	0.1340	2	7
102.000	0.6750	0.3250	0.1551	3	6
133.000	0.5625	0.4375	0.1651	4	5
144.000	0.4500	0.5500	0.1660	5	4
177.000*	.	.	.	5	3
182.000*	.	.	.	5	2
216.000*	.	.	.	5	1
217.000	0	1.0000	.	6	0

NOTE: The marked survival times are censored observations.

Summary Statistics for Time Variable Time

Quartile Estimates

Percent	Point Estimate	95% Confidence Interval Transform	[Lower	Upper)
75	217.000	LOGLOG	133.000	217.000
50	144.000	LOGLOG	55.000	217.000
25	102.000	LOGLOG	55.000	144.000

Mean	Standard Error
152.875	23.073

Stratum 2: TRT = S+CT+IT

Product-Limit Survival Estimates

Time	Survival	Failure	Survival Standard Error	Number Failed	Number Left
0.000	1.0000	0	0	0	10
36.000	0.9000	0.1000	0.0949	1	9
73.000	0.8000	0.2000	0.1265	2	8
139.000*	.	.	.	2	7
158.000	0.6857	0.3143	0.1515	3	6
185.000*	.	.	.	3	5
198.000*	.	.	.	3	4
239.000*	.	.	.	3	3
239.000*	.	.	.	3	2
240.000*	.	.	.	3	1
242.000*	0.6857	0.3143	.	3	0

NOTE: The marked survival times are censored observations.

Summary Statistics for Time Variable Time

Quartile Estimates

Percent	Point Estimate	95% Confidence Interval Transform	[Lower	Upper)
75	.	LOGLOG	.	.
50	.	LOGLOG	36.000	.
25	158.000	LOGLOG	36.000	.

Mean	Standard Error
137.300	16.351

NOTE: The mean survival time and its standard error were underestimated because the largest observation was censored and the estimation was restricted to the largest event time.

Stratum 3: TRT = S+IT

Product-Limit Survival Estimates

Time	Survival	Failure	Survival Standard Error	Number Failed	Number Left
0.000	1.0000	0	0	0	10
102.000	0.9000	0.1000	0.0949	1	9
105.000	0.8000	0.2000	0.1265	2	8
144.000	0.7000	0.3000	0.1449	3	7
151.000	0.6000	0.4000	0.1549	4	6
182.000*	.	.	.	4	5
191.000*	.	.	.	4	4
192.000	0.4500	0.5500	0.1743	5	3
196.000*	.	.	.	5	2
222.000*	.	.	.	5	1
251.000*	0.4500	0.5500	.	5	0

NOTE: The marked survival times are censored observations.

Summary Statistics for Time Variable Time

Quartile Estimates

Percent	Point Estimate	95% Confidence Interval Transform	[Lower	Upper)
75	.	LOGLOG	192.000	.
50	192.000	LOGLOG	102.000	.
25	144.000	LOGLOG	102.000	192.000

Mean	Standard Error
165.400	12.539

NOTE: The mean survival time and its standard error were underestimated because the largest observation was censored and the estimation was restricted to the largest event time.

Summary of the Number of Censored and Uncensored Values

Stratum	TRT	Total	Failed	Censored	Percent Censored
1	S+CT	11	6	5	45.45
2	S+CT+IT	10	3	7	70.00
3	S+IT	10	5	5	50.00
Total		31	14	17	54.84

Testing Homogeneity of Survival Curves for Time over Strata

Rank Statistics

TRT	Log-Rank	Wilcoxon
S+CT	2.3590	47.000
S+CT+IT	-2.1905	-32.000
S+IT	-0.1685	-15.000

Covariance Matrix for the Log-Rank Statistics

TRT	S+CT	S+CT+IT	S+IT
S+CT	2.61691	-1.28846	-1.32845
S+CT+IT	-1.28846	3.16017	-1.87172
S+IT	-1.32845	-1.87172	3.20017

Covariance Matrix for the Wilcoxon Statistics

TRT	S+CT	S+CT+IT	S+IT
S+CT	1408.61	-674.65	-733.96
S+CT+IT	-674.65	1559.09	-884.44
S+IT	-733.96	-884.44	1618.39

Test of Equality over Strata

Test	Chi-Square	DF	Pr > Chi-Square
Log-Rank	2.5458	2	0.2800
Wilcoxon	1.6411	2	0.4402
-2Log(LR)	1.8128	2	0.4040

```
/*test the treatment difference*/
/*check table "Stratified Test of Equality over Group"*/

/*********************************************************
        Section 5.5.1.2
*********************************************************/
/*fit exponential model*/
PROC LIFEREG data= dat3 order= data;
class TRT;
model Time*Status(1)= TRT / dist= exponential;
RUN;
```

The LIFEREG Procedure

Model Information

Data Set	WORK.DAT3
Dependent Variable	Log(Time)
Censoring Variable	Status
Censoring Value(s)	1
Number of Observations	31
Noncensored Values	14
Right Censored Values	17
Left Censored Values	0
Interval Censored Values	0
Number of Parameters	3
Name of Distribution	Exponential
Log Likelihood	-29.57181223

Number of Observations Read	31
Number of Observations Used	31

Class Level Information

Name	Levels	Values
TRT	3	S+IT S+CT+IT S+CT

Fit Statistics

-2 Log Likelihood	59.144
AIC (smaller is better)	65.144
AICC (smaller is better)	66.033
BIC (smaller is better)	69.446

Fit Statistics (Unlogged Response)

-2 Log Likelihood	190.095
Exponential AIC (smaller is better)	196.095
Exponential AICC (smaller is better)	196.984
Exponential BIC (smaller is better)	200.397

Algorithm converged.

Type III Analysis of Effects

Effect	DF	Wald Chi-Square	Pr > ChiSq
TRT	2	1.7190	0.4234

Analysis of Maximum Likelihood Parameter Estimates

Parameter		DF	Estimate	Standard Error	95% Confidence Limits		Chi-Square	Pr > ChiSq
Intercept		1	5.4489	0.4082	4.6487	6.2490	178.14	<.0001
TRT	S+IT	1	0.4010	0.6055	-0.7858	1.5878	0.44	0.5078
TRT	S+CT+IT	1	0.9193	0.7071	-0.4666	2.3052	1.69	0.1936
TRT	S+CT	0	0.0000	.	.	.	.	.
Scale		0	1.0000	0.0000	1.0000	1.0000		
Weibull Shape		0	1.0000	0.0000	1.0000	1.0000		

Lagrange Multiplier Statistics

Parameter	Chi-Square	Pr > ChiSq
Scale	287.4597	<.0001

```
/*fit Weibull model*/
PROC LIFEREG data= dat3 order= data;
class TRT;
model Time*Status(1)= TRT / dist=weibull;
RUN;
```

The LIFEREG Procedure

Model Information

Data Set	WORK.DAT3
Dependent Variable	Log(Time)
Censoring Variable	Status
Censoring Value(s)	1
Number of Observations	31
Noncensored Values	14
Right Censored Values	17
Left Censored Values	0
Interval Censored Values	0
Number of Parameters	4
Name of Distribution	Weibull
Log Likelihood	-26.7611207

Number of Observations Read	31
Number of Observations Used	31

Class Level Information

Name	Levels	Values
TRT	3	S+IT S+CT+IT S+CT

Fit Statistics

-2 Log Likelihood	53.522
AIC (smaller is better)	61.522
AICC (smaller is better)	63.061
BIC (smaller is better)	67.258

Fit Statistics (Unlogged Response)

-2 Log Likelihood	184.473
Weibull AIC (smaller is better)	192.473
Weibull AICC (smaller is better)	194.012
Weibull BIC (smaller is better)	198.209

Algorithm converged.

Type III Analysis of Effects

Effect	DF	Wald Chi-Square	Pr > ChiSq
TRT	2	2.5605	0.2780

Analysis of Maximum Likelihood Parameter Estimates

Parameter		DF	Estimate	Standard Error	95% Confidence Limits		Chi-Square	Pr > ChiSq
Intercept		1	5.2630	0.2207	4.8303	5.6956	568.44	<.0001
TRT	S+IT	1	0.2934	0.3258	-0.3451	0.9319	0.81	0.3678
TRT	S+CT+IT	1	0.6111	0.3883	-0.1500	1.3722	2.48	0.1156
TRT	S+CT	0	0.0000	.	.	.	.	.
Scale		1	0.5342	0.1250	0.3376	0.8451		
Weibull Shape		1	1.8721	0.4382	1.1833	2.9618		

```
/*fit exponential model+Age*/
PROC LIFEREG data= dat3 order= data;
class TRT;
model Time*Status(1)= TRT Age / dist= exponential;
RUN;
```

The LIFEREG Procedure

Model Information

Data Set	WORK.DAT3
Dependent Variable	Log(Time)
Censoring Variable	Status
Censoring Value(s)	1
Number of Observations	31
Noncensored Values	14
Right Censored Values	17
Left Censored Values	0
Interval Censored Values	0
Number of Parameters	4
Name of Distribution	Exponential
Log Likelihood	-25.5233666

Number of Observations Read	31
Number of Observations Used	31

Class Level Information

Name	Levels	Values
TRT	3	S+IT S+CT+IT S+CT

Fit Statistics

-2 Log Likelihood	51.047
AIC (smaller is better)	59.047
AICC (smaller is better)	60.585
BIC (smaller is better)	64.783

Fit Statistics (Unlogged Response)

-2 Log Likelihood	181.998
Exponential AIC (smaller is better)	189.998
Exponential AICC (smaller is better)	191.536
Exponential BIC (smaller is better)	195.734

Algorithm converged.

Type III Analysis of Effects

Effect	DF	Wald Chi-Square	Pr > ChiSq
TRT	2	1.0756	0.5840
Age	1	6.9507	0.0084

Analysis of Maximum Likelihood Parameter Estimates

Parameter		DF	Estimate	Standard Error	95% Confidence Limits		Chi-Square	Pr > ChiSq
Intercept		1	11.0560	2.2253	6.6944	15.4176	24.68	<.0001
TRT	S+IT	1	0.2329	0.6068	-0.9564	1.4222	0.15	0.7011
TRT	S+CT+IT	1	0.7334	0.7072	-0.6528	2.1195	1.08	0.2998
TRT	S+CT	0	0.0000	.	.	.	.	.
Age		1	-0.0966	0.0366	-0.1684	-0.0248	6.95	0.0084
Scale		0	1.0000	0.0000	1.0000	1.0000		
Weibull Shape		0	1.0000	0.0000	1.0000	1.0000		

Lagrange Multiplier Statistics

Parameter	Chi-Square	Pr > ChiSq
Scale	.	.

```
/*fit Weibull model+Age*/
PROC LIFEREG data= dat3 order= data;
class TRT;
model Time*Status(1)= TRT Age / dist= weibull;
RUN;
```

The LIFEREG Procedure

Model Information

Data Set	WORK.DAT3
Dependent Variable	Log(Time)
Censoring Variable	Status
Censoring Value(s)	1
Number of Observations	31
Noncensored Values	14
Right Censored Values	17
Left Censored Values	0
Interval Censored Values	0
Number of Parameters	5
Name of Distribution	Weibull
Log Likelihood	-21.7479149

Number of Observations Read	31
Number of Observations Used	31

Class Level Information

Name	Levels	Values
TRT	3	S+IT S+CT+IT S+CT

Fit Statistics

-2 Log Likelihood	43.496
AIC (smaller is better)	53.496
AICC (smaller is better)	55.896
BIC (smaller is better)	60.666

Fit Statistics (Unlogged Response)

-2 Log Likelihood	174.447
Weibull AIC (smaller is better)	184.447
Weibull AICC (smaller is better)	186.847
Weibull BIC (smaller is better)	191.617

Algorithm converged.

Type III Analysis of Effects

Effect	DF	Wald Chi-Square	Pr > ChiSq
TRT	2	1.2472	0.5360
Age	1	6.8669	0.0088

Analysis of Maximum Likelihood Parameter Estimates

Parameter		DF	Estimate	Standard Error	95% Confidence Limits		Chi-Square	Pr > ChiSq
Intercept		1	8.5885	1.3214	5.9987	11.1783	42.25	<.0001
TRT	S+IT	1	0.1038	0.2947	-0.4739	0.6815	0.12	0.7248
TRT	S+CT+IT	1	0.3899	0.3505	-0.2971	1.0768	1.24	0.2660
TRT	S+CT	0	0.0000	.	.	.	.	.
Age		1	-0.0569	0.0217	-0.0994	-0.0143	6.87	0.0088
Scale		1	0.4822	0.1105	0.3078	0.7555		
Weibull Shape		1	2.0739	0.4751	1.3237	3.2494		

```
/*************************************************
         Section 5.5.1.3
*************************************************/
/*fit Cox regression model*/
PROC PHREG data= dat3;
class TRT(ref= "S+CT");
model Time*Status(1)= TRT/ ties=efron;
RUN;
```

The PHREG Procedure

Model Information

Data Set	WORK.DAT3
Dependent Variable	Time
Censoring Variable	Status
Censoring Value(s)	1
Ties Handling	EFRON

Number of Observations Read	31
Number of Observations Used	31

Class Level Information

Class	Value	Design Variables	
TRT	S+CT	0	0
	S+CT+IT	1	0
	S+IT	0	1

Summary of the Number of Event and Censored Values

Total	Event	Censored	Percent Censored
31	14	17	54.84

Convergence Status

Convergence criterion (GCONV=1E-8) satisfied.

Model Fit Statistics

Criterion	Without Covariates	With Covariates
-2 LOG L	83.972	81.487
AIC	83.972	85.487
SBC	83.972	86.765

Testing Global Null Hypothesis: BETA=0

Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	2.4857	2	0.2886
Score	2.5719	2	0.2764
Wald	2.4098	2	0.2997

Type 3 Tests

Effect	DF	Wald Chi-Square	Pr > ChiSq
TRT	2	2.4098	0.2997

Analysis of Maximum Likelihood Estimates

Parameter		DF	Parameter Estimate	Standard Error	Chi-Square	Pr > ChiSq	Hazard Ratio	Label
TRT	S+CT+IT	1	-1.08547	0.71558	2.3010	0.1293	0.338	TRT S+CT+IT
TRT	S+IT	1	-0.54823	0.60820	0.8125	0.3674	0.578	TRT S+IT

```
/*fit Cox regression model+Age*/
PROC PHREG data= dat3;
class TRT(ref= "S+CT");
model Time*Status(1)= TRT Age/ ties=efron;
RUN;
```

The PHREG Procedure

Model Information

Data Set	WORK.DAT3
Dependent Variable	Time
Censoring Variable	Status
Censoring Value(s)	1
Ties Handling	EFRON

Number of Observations Read	31
Number of Observations Used	31

Class Level Information

Class	Value	Design Variables	
TRT	S+CT	0	0
	S+CT+IT	1	0
	S+IT	0	1

Summary of the Number of Event and Censored Values

Total	Event	Censored	Percent Censored
31	14	17	54.84

Convergence Status

Convergence criterion (GCONV=1E-8) satisfied.

Model Fit Statistics

Criterion	Without Covariates	With Covariates
-2 LOG L	83.972	72.288
AIC	83.972	78.288
SBC	83.972	80.205

Testing Global Null Hypothesis: BETA=0

Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	11.6846	3	0.0085
Score	9.7200	3	0.0211
Wald	9.1348	3	0.0276

Type 3 Tests

Effect	DF	Wald Chi-Square	Pr > ChiSq
TRT	2	1.4424	0.4862
Age	1	7.4397	0.0064

Analysis of Maximum Likelihood Estimates

Parameter		DF	Parameter Estimate	Standard Error	Chi-Square	Pr > ChiSq	Hazard Ratio	Label
TRT	S+CT+IT	1	-0.86214	0.71845	1.4400	0.2301	0.422	TRT S+CT+IT
TRT	S+IT	1	-0.29422	0.61201	0.2311	0.6307	0.745	TRT S+IT
Age		1	0.11251	0.04125	7.4397	0.0064	1.119	

```
/*********************************************
        Section 5.5.2
*********************************************/
/*read data from the path of dataset*/
Data dat4;
infile "C:/Users/HSY/Desktop/BreastCancer.csv" delimiter="," firstobs=2;
input tL tU$ TRT Status;
if tU= "NA" then tU= .;
ntU= tU+0;      /* transform the type of variable "tU"
                   from char to int*/
if ntU= . then time= tL;
else time= (tL+ntU)/2;
if tL= 0 then ntL= .;
else ntL= tL;
RUN;
proc print data=dat4;
run;
```

OBS	tL	tU	TRT	Status	ntU	time	ntL
1	0	7	1	1	7	3.5	.
2	0	8	1	1	8	4.0	.
3	0	5	1	1	5	2.5	.
4	4	11	1	1	11	7.5	4
5	5	12	1	1	12	8.5	5
6	5	11	1	1	11	8.0	5
7	6	10	1	1	10	8.0	6
8	7	16	1	1	16	11.5	7
9	7	14	1	1	14	10.5	7
10	11	15	1	1	15	13.0	11
11	11	18	1	1	18	14.5	11
12	15	.	1	0	.	15.0	15
13	17	.	1	0	.	17.0	17
14	17	25	1	1	25	21.0	17
15	17	25	1	1	25	21.0	17
16	18	.	1	0	.	18.0	18
17	19	35	1	1	35	27.0	19
18	18	26	1	1	26	22.0	18
19	22	.	1	0	.	22.0	22
20	24	.	1	0	.	24.0	24
21	24	.	1	0	.	24.0	24
22	25	37	1	1	37	31.0	25
23	26	40	1	1	40	33.0	26
24	27	34	1	1	34	30.5	27
25	32	.	1	0	.	32.0	32
26	33	.	1	0	.	33.0	33
27	34	.	1	0	.	34.0	34
28	36	44	1	1	44	40.0	36
29	36	48	1	1	48	42.0	36
30	36	.	1	0	.	36.0	36
31	36	.	1	0	.	36.0	36
32	37	44	1	1	44	40.5	37
33	37	.	1	0	.	37.0	37
34	37	.	1	0	.	37.0	37
35	37	.	1	0	.	37.0	37
36	38	.	1	0	.	38.0	38
37	40	.	1	0	.	40.0	40
38	45	.	1	0	.	45.0	45
39	46	.	1	0	.	46.0	46
40	46	.	1	0	.	46.0	46
41	46	.	1	0	.	46.0	46
42	46	.	1	0	.	46.0	46
43	46	.	1	0	.	46.0	46
44	46	.	1	0	.	46.0	46
45	46	.	1	0	.	46.0	46
46	46	.	1	0	.	46.0	46
47	0	22	0	1	22	11.0	.
48	0	5	0	1	5	2.5	.
49	4	9	0	1	9	6.5	4
50	4	8	0	1	8	6.0	4
51	5	8	0	1	8	6.5	5
52	8	12	0	1	12	10.0	8
53	8	21	0	1	21	14.5	8
54	10	35	0	1	35	22.5	10
55	10	17	0	1	17	13.5	10
56	11	13	0	1	13	12.0	11
57	11	.	0	0	.	11.0	11
58	11	17	0	1	17	14.0	11
59	11	.	0	0	.	11.0	11
60	11	20	0	1	20	15.5	11
61	12	20	0	1	20	16.0	12
62	13	.	0	0	.	13.0	13
63	13	39	0	1	39	26.0	13
64	13	.	0	0	.	13.0	13

OBS	tL	tU	TRT	Status	ntU	time	ntL
65	13	.	0	0	.	13.0	13
66	14	17	0	1	17	15.5	14
67	14	19	0	1	19	16.5	14
68	15	22	0	1	22	18.5	15
69	16	24	0	1	24	20.0	16
70	16	20	0	1	20	18.0	16
71	16	24	0	1	24	20.0	16
72	16	60	0	1	60	38.0	16
73	17	27	0	1	27	22.0	17
74	17	23	0	1	23	20.0	17
75	17	26	0	1	26	21.5	17
76	18	25	0	1	25	21.5	18
77	18	24	0	1	24	21.0	18
78	19	32	0	1	32	25.5	19
79	21	.	0	0	.	21.0	21
80	22	32	0	1	32	27.0	22
81	23	.	0	0	.	23.0	23
82	24	31	0	1	31	27.5	24
83	24	30	0	1	30	27.0	24
84	30	34	0	1	34	32.0	30
85	30	36	0	1	36	33.0	30
86	31	.	0	0	.	31.0	31
87	32	.	0	0	.	32.0	32
88	32	40	0	1	40	36.0	32
89	34	.	0	0	.	34.0	34
90	34	.	0	0	.	34.0	34
91	35	.	0	0	.	35.0	35
92	35	39	0	1	39	37.0	35
93	44	48	0	1	48	46.0	44
94	48	.	0	0	.	48.0	48

```
PROC SORT data= dat4 out= dat4;
by descending TRT;
RUN;
```

```
/***********************************************
         Section 5.5.2.1
***********************************************/
/*fit Turnbull's estimator*/
PROC ICLIFETEST data= dat4 impute(seed= 123) method= turnbull;
strata TRT;
time (tL,ntU);
RUN;
```

The ICLIFETEST Procedure

Data and Methods Information

Data Set	WORK.DAT4
Left Boundary	tL
Right Boundary	ntU
Estimation Method	EM
Number of Observations Read	94
Number of Observations Used	94
Number of Imputations for Standard Errors	1000
Imputation Seed	123

Stratum 1: TRT = 0

Nonparametric Survival Estimates

Time	Interval	Probability Estimate Failure	Probability Estimate Survival	Imputation Standard Error	Lagrange Multiplier
0	4	0.0000	1.0000	0.0000	0.0000
5	5	0.0433	0.9567	0.0334	0.0000
8	8	0.0866	0.9134	0.0413	0.0000
9	11	0.0866	0.9134	0.0413	18.085
12	12	0.1558	0.8442	0.0568	0.0000
13	16	0.1558	0.8442	0.0568	11.964
17	18	0.3012	0.6988	0.0767	0.0000
19	19	0.4423	0.5577	0.0840	0.0000
20	21	0.5580	0.4420	0.0773	0.0000
22	22	0.5580	0.4420	0.0773	6.9520
23	23	0.5580	0.4420	0.0773	5.3735
24	24	0.5580	0.4420	0.0773	7.0045
25	30	0.6579	0.3421	0.0741	0.0000
31	31	0.7288	0.2712	0.0672	0.0000
32	32	0.7288	0.2712	0.0672	2.1699
34	34	0.7288	0.2712	0.0672	1.6126
35	35	0.7288	0.2712	0.0672	8.3473
36	44	0.8896	0.1104	0.0480	0.0000
48	48	0.9448	0.0552	0.0350	0.0000
60	Inf	1.0000	0.0000	0.0000	0.0000

NOTE: The estimation algorithm converged.
NOTE: Algorithm finds a maximum likelihood estimate.

Quartile Estimates

Percentile	Point Estimate	95% Confidence Interval Transform	[Lower	Upper)
75	36	LOGLOG	25	36
50	20	LOGLOG	19	25
25	17	LOGLOG	12	19

Stratum 2: TRT = 1

Nonparametric Survival Estimates

Time	Interval	Probability Estimate Failure	Probability Estimate Survival	Imputation Standard Error	Lagrange Multiplier
0	4	0.0000	1.0000	0.0000	0.0000
5	6	0.0463	0.9537	0.0358	0.0000
7	7	0.0797	0.9203	0.0459	0.0000
8	11	0.1684	0.8316	0.0581	0.0000
12	15	0.2391	0.7609	0.0629	0.0000
16	17	0.2391	0.7609	0.0629	24.279
18	24	0.2391	0.7609	0.0629	7.6502
25	25	0.3318	0.6682	0.0706	0.0000
26	33	0.3318	0.6682	0.0706	9.3605
34	34	0.4136	0.5864	0.0739	0.0000
35	36	0.4136	0.5864	0.0739	10.522
37	38	0.4136	0.5864	0.0739	2.8665
40	40	0.5344	0.4656	0.0759	0.0000
44	46	0.5344	0.4656	0.0759	2.7863
48	Inf	1.0000	0.0000	0.0000	0.0000

NOTE: The estimation algorithm converged.
NOTE: Algorithm finds a maximum likelihood estimate.

Quartile Estimates

Percentile	Point Estimate	95% Confidence Interval Transform	[Lower	Upper)
75	.	LOGLOG	.	.
50	40	LOGLOG	34	48
25	25	LOGLOG	8	34

Number of Censored and Uncensored Values

Stratum ID	TRT	Total	Type of Censoring Left	Interval	Right	Uncensored
1	0	48	2 (4.2%)	33 (68.8%)	13 (27.1%)	0 (0.0%)
2	1	46	3 (6.5%)	18 (39.1%)	25 (54.3%)	0 (0.0%)
Total		94	5 (5.3%)	51 (54.3%)	38 (40.4%)	0 (0.0%)

```
/*fit Kaplan-Meier estimator with midpoint or left point*/
PROC LIFETEST data= dat4;
time time*Status(0);        /*0 is censored, 1 is event*/
strata TRT;
RUN;
```

The LIFETEST Procedure

Stratum 1: TRT = 0

Product-Limit Survival Estimates

time	Survival	Failure	Survival Standard Error	Number Failed	Number Left
0.0000	1.0000	0	0	0	48
2.5000	0.9792	0.0208	0.0206	1	47
6.0000	0.9583	0.0417	0.0288	2	46
6.5000	.	.	.	3	45
6.5000	0.9167	0.0833	0.0399	4	44
10.0000	0.8958	0.1042	0.0441	5	43
11.0000	0.8750	0.1250	0.0477	6	42
11.0000*	.	.	.	6	41
11.0000*	.	.	.	6	40
12.0000	0.8531	0.1469	0.0513	7	39
13.0000*	.	.	.	7	38
13.0000*	.	.	.	7	37
13.0000*	.	.	.	7	36
13.5000	0.8294	0.1706	0.0551	8	35
14.0000	0.8057	0.1943	0.0584	9	34
14.5000	0.7820	0.2180	0.0613	10	33
15.5000	.	.	.	11	32
15.5000	0.7346	0.2654	0.0661	12	31
16.0000	0.7109	0.2891	0.0681	13	30
16.5000	0.6872	0.3128	0.0698	14	29
18.0000	0.6635	0.3365	0.0713	15	28
18.5000	0.6398	0.3602	0.0726	16	27
20.0000	.	.	.	17	26
20.0000	.	.	.	18	25
20.0000	0.5688	0.4313	0.0753	19	24
21.0000	0.5451	0.4549	0.0758	20	23
21.0000*	.	.	.	20	22
21.5000	.	.	.	21	21
21.5000	0.4955	0.5045	0.0765	22	20
22.0000	0.4707	0.5293	0.0766	23	19
22.5000	0.4460	0.5540	0.0765	24	18
23.0000*	.	.	.	24	17
25.5000	0.4197	0.5803	0.0764	25	16
26.0000	0.3935	0.6065	0.0760	26	15
27.0000	.	.	.	27	14
27.0000	0.3410	0.6590	0.0743	28	13
27.5000	0.3148	0.6852	0.0731	29	12
31.0000*	.	.	.	29	11
32.0000	0.2862	0.7138	0.0718	30	10
32.0000*	.	.	.	30	9
33.0000	0.2544	0.7456	0.0705	31	8
34.0000*	.	.	.	31	7
34.0000*	.	.	.	31	6
35.0000*	.	.	.	31	5
36.0000	0.2035	0.7965	0.0725	32	4
37.0000	0.1526	0.8474	0.0700	33	3
38.0000	0.1018	0.8982	0.0625	34	2
46.0000	0.0509	0.9491	0.0476	35	1
48.0000*	0.0509	0.9491	.	35	0

NOTE: The marked survival times are censored observations.

Summary Statistics for Time Variable time

Quartile Estimates

Percent	Point Estimate	95% Confidence Interval Transform	[Lower	Upper)
75	36.0000	LOGLOG	26.0000	46.0000
50	21.5000	LOGLOG	18.5000	27.0000
25	15.5000	LOGLOG	11.0000	20.0000

Mean	Standard Error
24.3820	1.8497

NOTE: The mean survival time and its standard error were underestimated because the largest observation was censored and the estimation was restricted to the largest event time.

Stratum 2: TRT = 1

Product-Limit Survival Estimates

time	Survival	Failure	Survival Standard Error	Number Failed	Number Left
0.0000	1.0000	0	0	0	46
2.5000	0.9783	0.0217	0.0215	1	45
3.5000	0.9565	0.0435	0.0301	2	44
4.0000	0.9348	0.0652	0.0364	3	43
7.5000	0.9130	0.0870	0.0415	4	42
8.0000	.	.	.	5	41
8.0000	0.8696	0.1304	0.0497	6	40
8.5000	0.8478	0.1522	0.0530	7	39
10.5000	0.8261	0.1739	0.0559	8	38
11.5000	0.8043	0.1957	0.0585	9	37
13.0000	0.7826	0.2174	0.0608	10	36
14.5000	0.7609	0.2391	0.0629	11	35
15.0000*	.	.	.	11	34
17.0000*	.	.	.	11	33
18.0000*	.	.	.	11	32
21.0000	.	.	.	12	31
21.0000	0.7133	0.2867	0.0674	13	30
22.0000	0.6895	0.3105	0.0692	14	29
22.0000*	.	.	.	14	28
24.0000*	.	.	.	14	27
24.0000*	.	.	.	14	26
27.0000	0.6630	0.3370	0.0714	15	25
30.5000	0.6365	0.3635	0.0733	16	24
31.0000	0.6100	0.3900	0.0749	17	23
32.0000*	.	.	.	17	22
33.0000	0.5822	0.4178	0.0765	18	21
33.0000*	.	.	.	18	20
34.0000*	.	.	.	18	19
36.0000*	.	.	.	18	18
36.0000*	.	.	.	18	17
37.0000*	.	.	.	18	16
37.0000*	.	.	.	18	15
37.0000*	.	.	.	18	14
38.0000*	.	.	.	18	13
40.0000	0.5375	0.4625	0.0827	19	12
40.0000*	.	.	.	19	11
40.5000	0.4886	0.5114	0.0884	20	10
42.0000	0.4397	0.5603	0.0921	21	9
45.0000*	.	.	.	21	8
46.0000*	.	.	.	21	7
46.0000*	.	.	.	21	6
46.0000*	.	.	.	21	5
46.0000*	.	.	.	21	4
46.0000*	.	.	.	21	3
46.0000*	.	.	.	21	2
46.0000*	.	.	.	21	1
46.0000*	0.4397	0.5603	.	21	0

NOTE: The marked survival times are censored observations.

Summary Statistics for Time Variable time

Quartile Estimates

Percent	Point Estimate	95% Confidence Interval Transform	[Lower	Upper)
75	.	LOGLOG	.	.
50	40.5000	LOGLOG	30.5000	.
25	21.0000	LOGLOG	8.0000	31.0000

Mean	Standard Error
31.0645	2.1677

NOTE: The mean survival time and its standard error were underestimated because the largest observation was censored and the estimation was restricted to the largest event time.

Summary of the Number of Censored and Uncensored Values

Stratum	TRT	Total	Failed	Censored	Percent Censored
1	0	48	35	13	27.08
2	1	46	21	25	54.35
Total		94	56	38	40.43

Testing Homogeneity of Survival Curves for time over Strata

Rank Statistics

TRT	Log-Rank	Wilcoxon
0	11.666	480.00
1	-11.666	-480.00

Covariance Matrix for the Log-Rank Statistics

TRT	0	1
0	12.7536	-12.7536
1	-12.7536	12.7536

Covariance Matrix for the Wilcoxon Statistics

TRT	0	1
0	53895.4	-53895.4
1	-53895.4	53895.4

Test of Equality over Strata

Test	Chi-Square	DF	Pr > Chi-Square
Log-Rank	10.6717	1	0.0011
Wilcoxon	4.2749	1	0.0387
-2Log(LR)	7.2598	1	0.0071

```
/*****************************************************
        Section 5.5.2.2
*****************************************************/
/*fit exponential model*/
PROC LIFEREG data= dat4 order= data;
class TRT;
model (ntL, ntU)= TRT / dist= exponential;
RUN;
```

The LIFEREG Procedure

Model Information

Data Set	WORK.DAT4
Dependent Variable	Log(ntL)
Dependent Variable	Log(ntU)
Number of Observations	94
Noncensored Values	0
Right Censored Values	38
Left Censored Values	5
Interval Censored Values	51
Number of Parameters	2
Name of Distribution	Exponential
Log Likelihood	-149.5731835

Number of Observations Read	94
Number of Observations Used	94

Class Level Information

Name	Levels	Values
TRT	2	1 0

Fit Statistics

-2 Log Likelihood	299.146
AIC (smaller is better)	303.146
AICC (smaller is better)	303.278
BIC (smaller is better)	308.233

Fit Statistics (Unlogged Response)

-2 Log Likelihood	299.146
Exponential AIC (smaller is better)	303.146
Exponential AICC (smaller is better)	303.278
Exponential BIC (smaller is better)	308.233

Algorithm converged.

Type III Analysis of Effects

Effect	DF	Wald Chi-Square	Pr > ChiSq
TRT	1	7.1754	0.0074

Analysis of Maximum Likelihood Parameter Estimates

Parameter		DF	Estimate	Standard Error	95% Confidence Limits		Chi-Square	Pr > ChiSq
Intercept		1	3.3764	0.1702	3.0428	3.7101	393.49	<.0001
TRT	1	1	0.7417	0.2769	0.1990	1.2844	7.18	0.0074
TRT	0	0	0.0000	.	.	.	.	.
Scale		0	1.0000	0.0000	1.0000	1.0000		
Weibull Shape		0	1.0000	0.0000	1.0000	1.0000		

Lagrange Multiplier Statistics

Parameter	Chi-Square	Pr > ChiSq
Scale	51.2540	<.0001

```
/*fit Weibull model*/
PROC LIFEREG data= dat4 order= data;
class TRT;
model (ntL, ntU)= TRT / dist= weibull;
RUN;
```

The LIFEREG Procedure

Model Information

Data Set	WORK.DAT4
Dependent Variable	Log(ntL)
Dependent Variable	Log(ntU)
Number of Observations	94
Noncensored Values	0
Right Censored Values	38
Left Censored Values	5
Interval Censored Values	51
Number of Parameters	3
Name of Distribution	Weibull
Log Likelihood	-143.0330578

Number of Observations Read	94
Number of Observations Used	94

Class Level Information

Name	Levels	Values
TRT	2	1 0

Fit Statistics

-2 Log Likelihood	286.066
AIC (smaller is better)	292.066
AICC (smaller is better)	292.333
BIC (smaller is better)	299.696

Fit Statistics (Unlogged Response)

-2 Log Likelihood	286.066
Weibull AIC (smaller is better)	292.066
Weibull AICC (smaller is better)	292.333
Weibull BIC (smaller is better)	299.696

Algorithm converged.

Type III Analysis of Effects

Effect	DF	Wald Chi-Square	Pr > ChiSq
TRT	1	10.4447	0.0012

Analysis of Maximum Likelihood Parameter Estimates

Parameter		DF	Estimate	Standard Error	95% Confidence Limits		Chi-Square	Pr > ChiSq
Intercept		1	3.3311	0.1064	3.1224	3.5397	979.28	<.0001
TRT	1	1	0.5680	0.1757	0.2235	0.9125	10.44	0.0012
TRT	0	0	0.0000	.	.	.	.	.
Scale		1	0.6194	0.0743	0.4897	0.7835		
Weibull Shape		1	1.6144	0.1936	1.2763	2.0421		