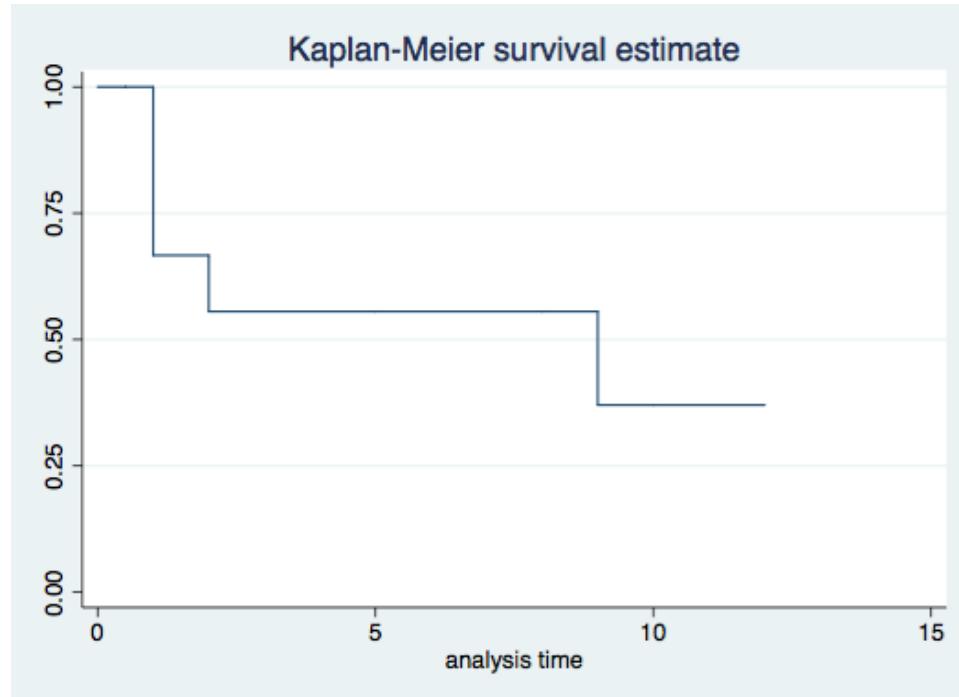


Exercise 10.1

The survival times (in months) for 10 AIDS patients are as follows (*=censored):

0.5*,1,1,1,2,5*,8*,9,10*,12*

- (a) A Kaplan-Meier curve was generated for these data using Stata. Use this to estimate the median survival time.



The estimated survival function was obtained in Stata.

. sts list						
failure _d: died analysis time _t: months						
Time	Beg. Total	Net Fail	Lost	Survivor Function	Std. Error	[95% Conf. Int.]
.5	10	0	1	1.0000	.	.
1	9	3	0	0.6667	0.1571	0.2817 0.8783
2	6	1	0	0.5556	0.1656	0.2042 0.8045
5	5	0	1	0.5556	0.1656	0.2042 0.8045
8	4	0	1	0.5556	0.1656	0.2042 0.8045
9	3	1	0	0.3704	0.1872	0.0677 0.6933
10	2	0	1	0.3704	0.1872	0.0677 0.6933
12	1	0	1	0.3704	0.1872	0.0677 0.6933

(b) What is the estimated survival probability at 1 month? At 5 months? At 6 months?

(c) Use the Stata output to confirm your answer to (a).

Exercise 10.2

An observational study of mortality (time to death) for breast cancer patients was conducted. Patients were classified into two groups based on their tumor's immunohistochemical response (0=negative; 1=positive). Time to death or censoring was recorded in months.

The survival function estimate was separately for each group and a Kaplan-Meier plot created. A logrank test was also conducted. Stata output is on the next few pages. Use that output to answer the following questions.

- (a) What is the estimated 25th percentile of survival for each group? Interpret these quantities.

(b) What is the estimated survival probability for each group at 2 years (24 months)? At 5 years (60 months)?

(c) What are the null and alternative hypotheses for the logrank test that was performed? Write down the hypotheses using symbols, and also explain in words what the null and alternative hypotheses mean.

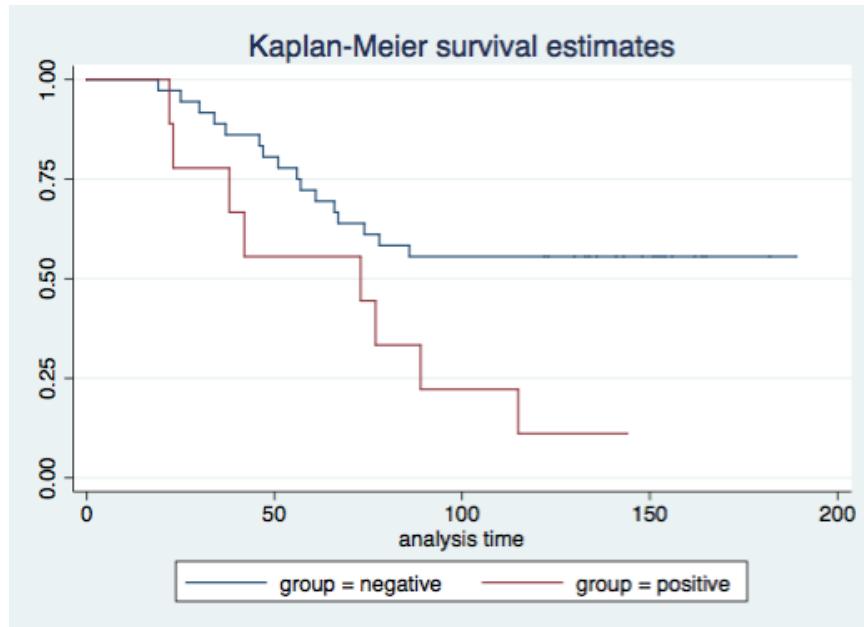
(d) Report the p-value for the logrank test and write a one-sentence conclusion (in context). (Assume $\alpha = 0.05$.)

```
. sts list, by(group)
```

Time	Beg. Total	Net Fail	Lost	Survivor Function	Std. Error	[95% Conf. Int.]
<hr/>						
negative						
19	36	1	0	0.9722	0.0274	0.8187 0.9960
25	35	1	0	0.9444	0.0382	0.7957 0.9858
30	34	1	0	0.9167	0.0461	0.7635 0.9723
34	33	1	0	0.8889	0.0524	0.7305 0.9568
37	32	1	0	0.8611	0.0576	0.6980 0.9397
46	31	1	0	0.8333	0.0621	0.6661 0.9214
47	30	1	0	0.8056	0.0660	0.6350 0.9022
51	29	1	0	0.7778	0.0693	0.6044 0.8821
56	28	1	0	0.7500	0.0722	0.5746 0.8613
57	27	1	0	0.7222	0.0747	0.5453 0.8398
61	26	1	0	0.6944	0.0768	0.5165 0.8177
66	25	1	0	0.6667	0.0786	0.4883 0.7950
67	24	1	0	0.6389	0.0801	0.4607 0.7718
74	23	1	0	0.6111	0.0812	0.4335 0.7482
78	22	1	0	0.5833	0.0822	0.4067 0.7240
86	21	1	0	0.5556	0.0828	0.3805 0.6994
122	20	0	1	0.5556	0.0828	0.3805 0.6994
123	19	0	1	0.5556	0.0828	0.3805 0.6994
130	18	0	2	0.5556	0.0828	0.3805 0.6994
133	16	0	1	0.5556	0.0828	0.3805 0.6994

134	15	0	1	0.5556	0.0828	0.3805	0.6994
136	14	0	1	0.5556	0.0828	0.3805	0.6994
141	13	0	1	0.5556	0.0828	0.3805	0.6994
143	12	0	1	0.5556	0.0828	0.3805	0.6994
148	11	0	1	0.5556	0.0828	0.3805	0.6994
151	10	0	1	0.5556	0.0828	0.3805	0.6994
152	9	0	1	0.5556	0.0828	0.3805	0.6994
153	8	0	1	0.5556	0.0828	0.3805	0.6994
154	7	0	1	0.5556	0.0828	0.3805	0.6994
156	6	0	1	0.5556	0.0828	0.3805	0.6994
162	5	0	1	0.5556	0.0828	0.3805	0.6994
164	4	0	1	0.5556	0.0828	0.3805	0.6994
165	3	0	1	0.5556	0.0828	0.3805	0.6994
182	2	0	1	0.5556	0.0828	0.3805	0.6994
189	1	0	1	0.5556	0.0828	0.3805	0.6994
positive							
22	9	1	0	0.8889	0.1048	0.4330	0.9836
23	8	1	0	0.7778	0.1386	0.3648	0.9393
38	7	1	0	0.6667	0.1571	0.2817	0.8783
42	6	1	0	0.5556	0.1656	0.2042	0.8045
73	5	1	0	0.4444	0.1656	0.1359	0.7193
77	4	1	0	0.3333	0.1571	0.0783	0.6226
89	3	1	0	0.2222	0.1386	0.0337	0.5131
115	2	1	0	0.1111	0.1048	0.0061	0.3877
144	1	0	1	0.1111	0.1048	0.0061	0.3877

(plot and more output for this problem on next page)



```
. sts test group, logrank

Log-rank test for equality of survivor functions

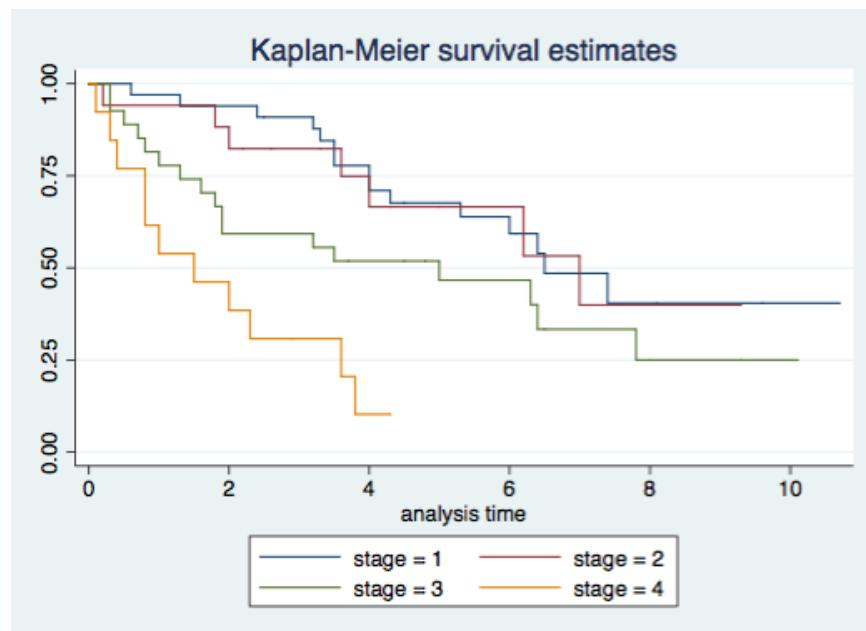
          |   Events      Events
group    |   observed     expected
-----+-----
negative |       16        20.19
positive |        8         3.81
-----+-----
Total    |       24        24.00

chi2(1) =      5.49
Pr>chi2 =    0.0191
```

Exercise 10.3

An observational study of survival of patients with cancer of the larynx was conducted. There were a total of 90 patients in the study, and for each patient we have information on the stage of cancer he/she has (stage = 1, 2, 3, 4). We also have the time in months until the patient died, was lost to follow-up, or was censored.

- (a) Below is a Kaplan-Meier plot of these data. Describe what you see in terms of how survival might differ by cancer stage. (Which one has the “best” survival? Which one the “worst”?) Remember that you’re not doing a test – just describing what you see.



(b) Using the plot, roughly approximate the median survival for each group.

(c) A logrank test was conducted; output is below. Write a one-sentence summary of the test result (in context), including reference to a p-value. (Assume $\alpha = 0.05$.)

```
. sts test stage, logrank

Log-rank test for equality of survivor functions

      |   Events          Events
stage |   observed        expected
-----+
1    |       15           22.57
2    |       7            10.01
3    |       17           14.08
4    |       11            3.34
-----+
Total |      50           50.00

chi2(3) =      22.76
Pr>chi2 =     0.0000
```