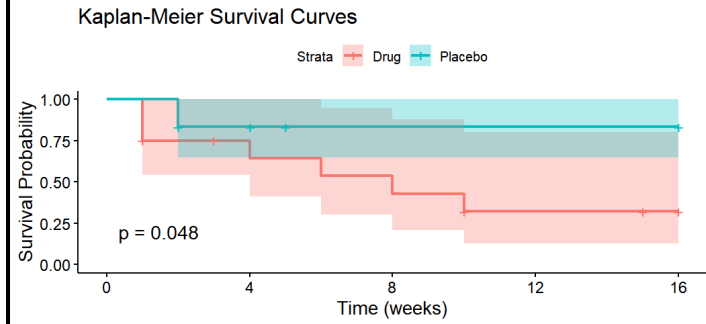


44. The data in Table 11.22, obtained by Gregory (1974) of the Stanford University, originally appeared in Brown and Hollander (1977). The data are from a clinical trial conducted to study the efficiency of a new drug thought to be helpful for treating patients with a particular type of serious liver disease. Is there evidence that the new drug does significantly better (or significantly worse) than the placebo in terms of survival times?

Table 11.22 Severe Viral Hepatitis Study

Patient	Treatment (D = drug, P = placebo)	Length of observation, weeks	Status (A = alive, D = dead)
1	D	6	D
2	P	16	A
3	P	2	D
4	D	1	D
5	D	1	D
6	P	4	A
7	D	16	A
8	D	3	A
9	P	16	A
10	D	8	D
11	P	16	A
12	P	2	D
13	D	4	D
14	P	16	A
15	P	5	A
16	D	1	D
17	D	10	A
18	P	2	A
19	P	2	A
20	D	10	D
21	P	16	A
22	D	1	A
23	P	16	A
24	D	15	A

Source: P. B. Gregory (1974).



```
#Q44
library(survival)

# Create survival data based on the table
length_obs <- c(6, 16, 2, 1, 1, 4, 16, 3, 16, 8, 16, 2, 4, 16, 5, 1, 10, 2, 2, 10, 16, 1, 16, 15)
status <- c(1, 0, 1, 1, 1, 0, 0, 0, 0, 1, 0, 1, 1, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0) # 1 = dead (D), 0 = alive (A)
treatment_44 <- factor(c("D", "P", "P", "D", "D", "P", "D", "D", "P", "D", "P", "D", "P", "P", "D", "P", "D", "P", "D", "P", "D", "P", "D", "P")) # Treatment groups

# Create a survival object
surv_obj_44 <- Surv(length_obs, status)

# Perform the log-rank test
log_rank_test_44 <- survdiff(surv_obj_44 ~ treatment_44)

# Print the results
print(log_rank_test_44)

...

Call:
survdiff(formula = surv_obj_44 ~ treatment_44)

      N Observed Expected (O-E)^2/E (O-E)^2/V
treatment_44=D 12      7    4.12    2.01    3.9
treatment_44=P 12      2    4.88    1.70    3.9

Chisq= 3.9 on 1 degrees of freedom, p= 0.05
```

Test results show $\hat{p} = 0.05$,
 From visualization result
 the drug did significant better than placebo

```

35
36 #Q46
37 {r}
38 gehan_test <- survdiff(surv_obj_44 ~ treatment_44, rho = 1)
39
40 print(gehan_test)
41

```

Call:

```
survdiff(formula = surv_obj_44 ~ treatment_44, rho = 1)
```

	N	Observed	Expected	(O-E)^2/E	(O-E)^2/V
treatment_44=D	12	5.81	3.49	1.55	3.54
treatment_44=P	12	1.75	4.07	1.32	3.54

Chisq= 3.5 on 1 degrees of freedom, p= 0.06

47. Apply the Tarone–Ware test with weights $b_i = \sqrt{n_i}$ (see Comment 43) to the hepatitis data of Table 11.22. Compare your results with those of Problems 44 and 46.

```
Exact Two-Sample Tarone-Ware Test

data: Surv(length_obs, status) by treatment_44 (D, P)
Z = -1.846, p-value = 0.064
alternative hypothesis: true theta is not equal to 1
```

We are still able to reject the null hypothesis.
but the significance level is lower than in Q44 and Q46

X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}	X_{16}	X_{17}	X_{18}	X_{19}	X_{20}	X_{21}	X_{22}	X_{23}	X_{24}	X_{25}	X_{26}	X_{27}	X_{28}	X_{29}	X_{30}	X_{31}	X_{32}	X_{33}	X_{34}	X_{35}	X_{36}	X_{37}	X_{38}	X_{39}	X_{40}	X_{41}	X_{42}	X_{43}	X_{44}	X_{45}	X_{46}	X_{47}	X_{48}	X_{49}	X_{50}	X_{51}	X_{52}	X_{53}	X_{54}	X_{55}	X_{56}	X_{57}	X_{58}	X_{59}	X_{60}	X_{61}	X_{62}	X_{63}	X_{64}	X_{65}	X_{66}	X_{67}	X_{68}	X_{69}	X_{70}	X_{71}	X_{72}	X_{73}	X_{74}	X_{75}	X_{76}	X_{77}	X_{78}	X_{79}	X_{80}	X_{81}	X_{82}	X_{83}	X_{84}	X_{85}	X_{86}	X_{87}	X_{88}	X_{89}	X_{90}	X_{91}	X_{92}	X_{93}	X_{94}	X_{95}	X_{96}	X_{97}	X_{98}	X_{99}	X_{100}	X_{101}	X_{102}	X_{103}	X_{104}	X_{105}	X_{106}	X_{107}	X_{108}	X_{109}	X_{110}	X_{111}	X_{112}	X_{113}	X_{114}	X_{115}	X_{116}	X_{117}	X_{118}	X_{119}	X_{120}	X_{121}	X_{122}	X_{123}	X_{124}	X_{125}	X_{126}	X_{127}	X_{128}	X_{129}	X_{130}	X_{131}	X_{132}	X_{133}	X_{134}	X_{135}	X_{136}	X_{137}	X_{138}	X_{139}	X_{140}	X_{141}	X_{142}	X_{143}	X_{144}	X_{145}	X_{146}	X_{147}	X_{148}	X_{149}	X_{150}	X_{151}	X_{152}	X_{153}	X_{154}	X_{155}	X_{156}	X_{157}	X_{158}	X_{159}	X_{160}	X_{161}	X_{162}	X_{163}	X_{164}	X_{165}	X_{166}	X_{167}	X_{168}	X_{169}	X_{170}	X_{171}	X_{172}	X_{173}	X_{174}	X_{175}	X_{176}	X_{177}	X_{178}	X_{179}	X_{180}	X_{181}	X_{182}	X_{183}	X_{184}	X_{185}	X_{186}	X_{187}	X_{188}	X_{189}	X_{190}	X_{191}	X_{192}	X_{193}	X_{194}	X_{195}	X_{196}	X_{197}	X_{198}	X_{199}	X_{200}	X_{201}	X_{202}	X_{203}	X_{204}	X_{205}	X_{206}	X_{207}	X_{208}	X_{209}	X_{210}	X_{211}	X_{212}	X_{213}	X_{214}	X_{215}	X_{216}	X_{217}	X_{218}	X_{219}	X_{220}	X_{221}	X_{222}	X_{223}	X_{224}	X_{225}	X_{226}	X_{227}	X_{228}	X_{229}	X_{230}	X_{231}	X_{232}	X_{233}	X_{234}	X_{235}	X_{236}	X_{237}	X_{238}	X_{239}	X_{240}	X_{241}	X_{242}	X_{243}	X_{244}	X_{245}	X_{246}	X_{247}	X_{248}	X_{249}	X_{250}	X_{251}	X_{252}	X_{253}	X_{254}	X_{255}	X_{256}	X_{257}	X_{258}	X_{259}	X_{260}	X_{261}	X_{262}	X_{263}	X_{264}	X_{265}	X_{266}	X_{267}	X_{268}	X_{269}	X_{270}	X_{271}	X_{272}	X_{273}	X_{274}	X_{275}	X_{276}	X_{277}	X_{278}	X_{279}	X_{280}	X_{281}	X_{282}	X_{283}	X_{284}	X_{285}	X_{286}	X_{287}	X_{288}	X_{289}	X_{290}	X_{291}	X_{292}	X_{293}	X_{294}	X_{295}	X_{296}	X_{297}	X_{298}	X_{299}	X_{300}	X_{301}	X_{302}	X_{303}	X_{304}	X_{305}	X_{306}	X_{307}	X_{308}	X_{309}	X_{310}	X_{311}	X_{312}	X_{313}	X_{314}	X_{315}	X_{316}	X_{317}	X_{318}	X_{319}	X_{320}	X_{321}	X_{322}	X_{3
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48. The data in Table 11.23 are from Hollander (1996) and concern 444 manuscripts submitted for publication to “Theory and Methods” Section of the *Journal of the American Statistical Association* in the period January 1, 1995–December 15, 1995. Of interest is the distribution of the time (in days) to first review. When the data were studied on December 15, 1995, 173 papers were still awaiting the first review. Thus, there are 173 censored times and 271 uncensored times. In Table 11.23, the variable $X_i = \text{minimum}(T_i, C_i)$, where T_i is the time to first review and C_i is the time to censorship, and the indicator variable δ_i is 1 if the i th observation is uncensored and 0 if it is censored. Use the data in Table 11.18 and Table 11.23 to test if there is a significant difference between the 1994 times to first review and the 1995 times to first review.

Source: M. Hollander (1996).

Table 11.18 The Times to First Review of 1994 JASA Theory and Methods Papers

	X_i	δ_i	X_i	δ_i	X_i	δ_i	X_i	δ_i	X_i	δ_i	X_i	δ_i	X_i	δ_i	X_i	δ_i	X_i	δ_i			
214	1	201	1	28	1	252	0	118	1	187	0	28	1	28	1	76	1	56	0	28	0
184	1	274	1	287	0	96	1	33	1	152	1	21	1	118	0	18	1	21	1	27	0
150	1	265	1	195	1	175	1	69	1	46	1	1	1	40	1	88	0	55	0	27	0
70	1	120	1	86	1	54	1	133	1	103	1	0	1	6	1	85	0	55	0	25	0
16	1	141	1	137	1	167	1	126	1	37	1	144	0	91	1	85	0	54	0	25	0
141	1	48	1	74	1	150	1	84	1	170	1	144	0	34	1	85	0	18	1	22	0
210	1	204	1	71	1	219	1	197	1	64	1	140	0	21	1	20	1	54	0	22	0
132	1	312	0	140	1	86	1	85	1	182	0	14	1	1	1	83	0	53	0	21	0
30	1	220	1	22	1	1	1	15	1	180	0	0	1	111	0	82	0	50	0	21	0
204	1	188	1	120	1	111	1	206	1	176	0	27	1	111	0	81	0	50	0	15	0
84	1	84	1	176	1	128	1	125	1	175	0	23	1	1	1	81	0	1	1	15	0
36	1	84	1	181	1	178	1	57	1	64	1	126	1	48	1	11	1	15	1	15	0
38	1	215	1	155	1	40	1	181	1	42	1	139	0	110	0	77	0	50	0	1	1
69	1	33	1	74	1	131	1	215	0	175	0	55	1	47	1	77	0	47	0	1	1
33	1	55	1	29	1	20	1	3	1	149	1	137	0	68	1	70	1	47	0	14	0
49	1	140	1	100	1	220	1	13	1	158	1	114	1	74	1	74	0	46	0	12	0
203	1	147	1	195	1	84	1	175	1	169	0	56	1	98	1	71	0	16	1	12	0
203	1	41	1	127	1	32	1	37	1	169	0	124	1	105	0	23	1	43	0	12	0
218	1	94	1	34	1	95	1	182	1	22	0	121	1	104	0	28	1	43	0	8	0
267	1	292	1	177	1	188	1	210	0	168	0	1	1	104	0	70	0	18	1	8	0
99	1	131	1	150	1	115	1	92	1	157	1	27	1	103	0	44	1	43	0	8	0
21	1	221	1	265	0	238	0	208	0	89	1	130	0	90	1	69	0	42	0	8	0
78	1	39	1	174	1	1	1	30	1	165	1	130	0	98	0	68	0	42	0	7	0
150	1	3	1	104	1	187	1	28	1	14	1	130	0	98	0	67	0	40	0	7	0
237	1	16	1	203	1	125	1	168	1	161	0	127	0	98	0	64	1	0	1	7	0
91	1	129	1	109	1	110	1	202	0	161	0	100	1	97	0	30	1	12	1	7	0
21	1	210	1	217	1	32	1	114	1	159	0	126	0	96	1	41	1	39	0	6	0
224	1	240	1	238	1	32	1	105	1	91	1	126	0	97	0	62	0	35	0	5	0
126	1	141	1	210	1	228	1	196	0	146	1	28	1	18	1	61	0	35	0	5	0
167	1	231	1	22	1	80	1	195	0	159	0	125	0	96	0	20	1	35	0	4	0
105	1	119	1	148	1	64	1	114	1	134	1	125	0	92	0	57	0	30	1	1	0
146	1	291	0	142	1	231	0	75	1	13	1	125	0	91	0	57	0	35	0	1	0
50	1	199	1	126	1	64	1	194	0	159	0	95	1	91	0	57	0	34	0		
28	1	67	1	220	1	228	0	143	1	18	1	95	1	91	0	57	0	34	0		
288	1	263	1	145	1	18	1	106	1	155	0	123	0	31	1	57	0	34	0		
37	1	155	1	21	1	55	1	128	1	154	0	123	0	27	1	57	0	33	0		
18	1	189	1	256	0	154	1	200	0	124	1	123	0	83	1	42	1	33	0		
113	1	0	1	253	0	139	1	129	1	73	1	109	1	33	1	57	0	29	1		
22	1	209	1	22	1	91	1	138	1	51	1	119	0	11	1	57	0	28	0		
234	1	223	1	80	1	196	1	152	1	21	1	6	1	88	0	57	1	27	0		

Source: M. Hollander, I. W. McKeague, and J. Yang (1997).

We fail to reject the null hypothesis.
There is no significant difference