STAT3032 SURVIVAL MODELS

SOLUTIONS TO TUTORIAL WEEK FIVE

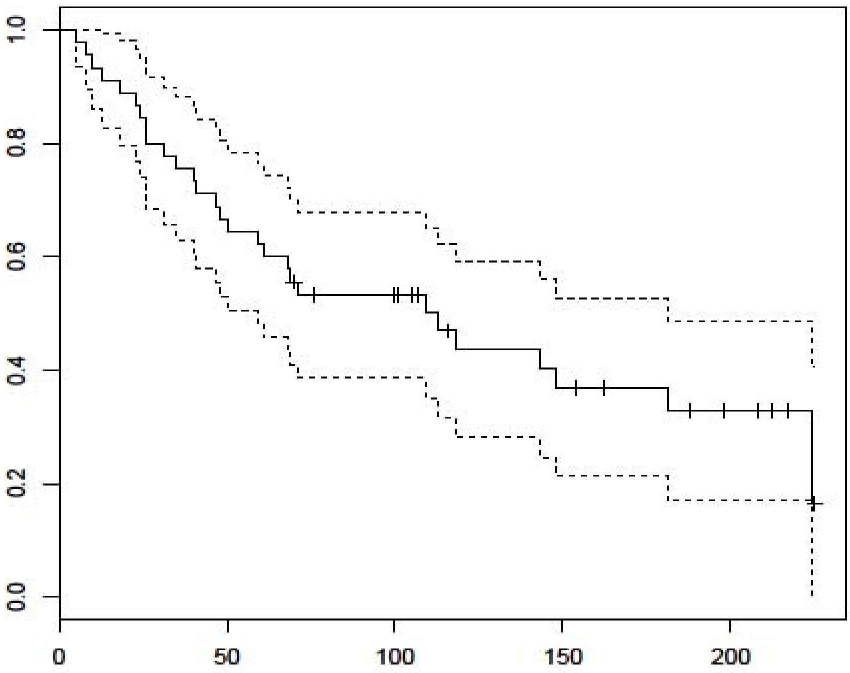
Question One

t_j	d_j	r_j	$\frac{r_j - d_j}{r_j}$	$\hat{S}(t_j) = \prod_{l=1}^{j} \frac{r_l - d_l}{r_l}$
4	1	20	$\frac{19}{20}$	$\frac{19}{20}$
5	1	19	$\frac{18}{19}$	$\frac{19}{20}\frac{18}{19}$
10	2	15	$\frac{13}{15}$	$\frac{19}{20}\frac{18}{19}\frac{13}{15}$
11	1	13	$\frac{12}{13}$	$\frac{19}{20}\frac{18}{19}\frac{13}{15}\frac{12}{13}$
13	1	12	$\frac{11}{12}$	$\frac{19}{20}\frac{18}{19}\frac{13}{15}\frac{12}{13}\frac{11}{12}$
15	1	10	$\frac{9}{10}$	$\frac{19}{20}\frac{18}{19}\frac{13}{15}\frac{12}{13}\frac{11}{12}\frac{9}{10}$
17	2	8	$\frac{6}{8}$	$\frac{19}{20}\frac{18}{19}\frac{13}{15}\frac{12}{13}\frac{11}{12}\frac{9}{10}\frac{6}{8}$
18	2	6	$\frac{4}{6}$	$\frac{19}{20}\frac{18}{19}\frac{13}{15}\frac{12}{13}\frac{11}{12}\frac{9}{10}\frac{6}{8}\frac{4}{6}$
21	1	2	$\frac{1}{2}$	$\frac{19}{20}\frac{18}{19}\frac{13}{15}\frac{12}{13}\frac{11}{12}\frac{9}{10}\frac{6}{8}\frac{4}{6}\frac{1}{2}$
22	1	1	$\frac{0}{1}$	$\frac{19}{20}\frac{18}{19}\frac{13}{15}\frac{12}{13}\frac{11}{12}\frac{9}{10}\frac{6}{8}\frac{4}{6}\frac{1}{2}\frac{0}{1}$

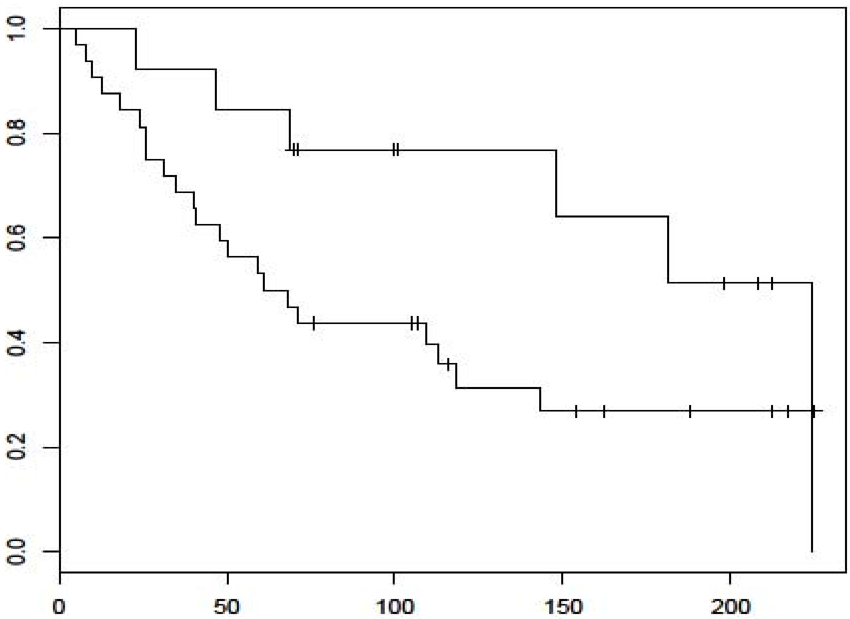
Question Two

```
treatment<-c(23,47,69,70,71,100,101,148,181,198,208,212,224)
tstatus<-c(rep(1,13))
tstatus[c(4:7,10:12)]<-0
control<-
c(5,8,10,13,18,24,26,26,31,35,40,41,48,50,59,61,68,71,76,105,107,109,113,116,118,143,154,162,1
88,212,217,225)
cstatus<-rep(1,length(control))
cstatus[c(19:21,24,27:32)]<-0
group<-c(rep(1,length(treatment)),rep(2,length(control)))

library(survival)
#combining both groups
kmcombined<-survfit(Surv(c(treatment,control),c(tstatus,cstatus))~1,conf.type="plain")
```



#individual curves
kmindividual<-survfit(Surv(c(treatment,control),c(tstatus,cstatus))~group,conf.type="plain")
plot(kmindividual)



Question Three

(a)

$$g(y)=\log\left(1+y^2\right) \text{ then } g'(y)=\frac{2y}{1+y^2}$$

$$g'(\mu)=g'(6)=\frac{2(6)}{1+6^2}=\frac{12}{37}$$

Let

$$\therefore E\left[\log\left(1+Y^2\right)\right]\approx\log(37) \text{ and}$$

$$Var\left[\log\left(1+Y^2\right)\right]\approx 2\left(\frac{12}{37}\right)^2$$

(b)

The estimated hazard is $\hat{q}=\frac{d}{r}$. We know that $Var(\hat{q})=\frac{\frac{d}{r}\left(1-\frac{d}{r}\right)}{r}=\frac{d(r-d)}{r^3}$

Now we are given that $\hat{q}=1-\exp\left(-\hat{\lambda}\right)$ and hence $\hat{\lambda}=-\log(1-\hat{q})$.

We now apply the delta method to find the approximate variance of $\hat{\lambda}$ given that we know the variance of $\hat{q}$.

If $g(y)=-\log(1-y)$ then $g'(y)=\frac{1}{1-y}$.

Hence

$$E\left[\hat{\lambda}\right]=E\left[-\log(1-q)\right]\approx-\log(1-q)$$

$$Var\left(\hat{\lambda}\right)\approx\frac{d(r-d)}{r^3(1-q)^2}$$

Question Four

Treatment Group

Range of t	$\hat{F}(t)$	Approximate SE of $\hat{F}(t)$
$t<6$	0.0000	0.0000
$6\le t<7$	0.1111	0.0741
$7\le t<10$	0.1704	0.0898
$10\le t<13$	0.2342	0.1031
$13\le t<16$	0.3108	0.1178

$16 \le t < 23$	0.3874	0.1272
$23 \le t < 35$	0.4895	0.1412
$35 \le t$	1.0000	-

Control Group

Range of t	$\hat{F}(t)$	Approximate SE of $\hat{F}(t)$
$t < 1$	0.0000	0.0000
$1 \le t < 2$	0.1111	0.0741
$2 \le t < 3$	0.1667	0.0878
$3 \le t < 5$	0.2222	0.0980
$5 \le t < 8$	0.3519	0.1169
$8 \le t < 9$	0.4167	0.1219
$9 \le t < 10$	0.5463	0.1246
$10 \le t < 11$	0.6975	0.1205
$11 \le t < 12$	0.7731	0.1116
$12 \le t < 18$	0.8488	0.0967
$18 \le t < 25$	0.9244	0.0721
$25 \le t$	1.0000	-