

# p8131\_hw9\_xy2395

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## Problem 1

We have

$$h(t) = \frac{2t}{1+t^2} = \frac{d}{dt}[\log(1+t^2)] = \frac{d}{dt}[-\log S(t)]$$

$$\log(1+t^2) = -\log S(t)$$

Therefore, the survival function is

$$S(t) = \frac{1}{1+t^2}$$

The cumulative density function is

$$F(t) = 1 - S(t) = 1 - \frac{1}{1+t^2}$$

The probability density function is

$$f(t) = \frac{d}{dt}F(t) = \frac{2t}{(1+t^2)^2}$$

## Problem 2

$t_i$	$n_i$	$d_i$	$c_i$	$\hat{\lambda}_i$	$\hat{S}(t)$	$\hat{H}(t)$	$\exp(-\hat{H}(t))$
1	10	1	0	$\frac{1}{10}$	$1 * (1 - \frac{1}{10}) = \frac{9}{10}$	$\frac{1}{10}$	0.905
2	9	2	0	$\frac{2}{9}$	$\frac{9}{10} * (1 - \frac{2}{9}) = \frac{7}{10}$	$\frac{1}{10} + \frac{2}{9} = \frac{29}{90}$	0.725
4	7	0	1	0	$\frac{7}{10}$	$\frac{29}{90}$	0.725
5	6	0	1	0	$\frac{7}{10}$	$\frac{29}{90}$	0.725
6	5	1	0	$\frac{1}{5}$	$\frac{7}{10} * (1 - \frac{1}{5}) = \frac{14}{25}$	$\frac{29}{90} + \frac{1}{5} = \frac{47}{90}$	0.593
7	4	0	1	0	$\frac{14}{25}$	$\frac{47}{90}$	0.593
8	3	0	1	0	$\frac{14}{25}$	$\frac{47}{90}$	0.593
9	2	0	1	0	$\frac{14}{25}$	$\frac{47}{90}$	0.593
10	1	0	1	0	$\frac{14}{25}$	$\frac{47}{90}$	0.593

## Problem 3

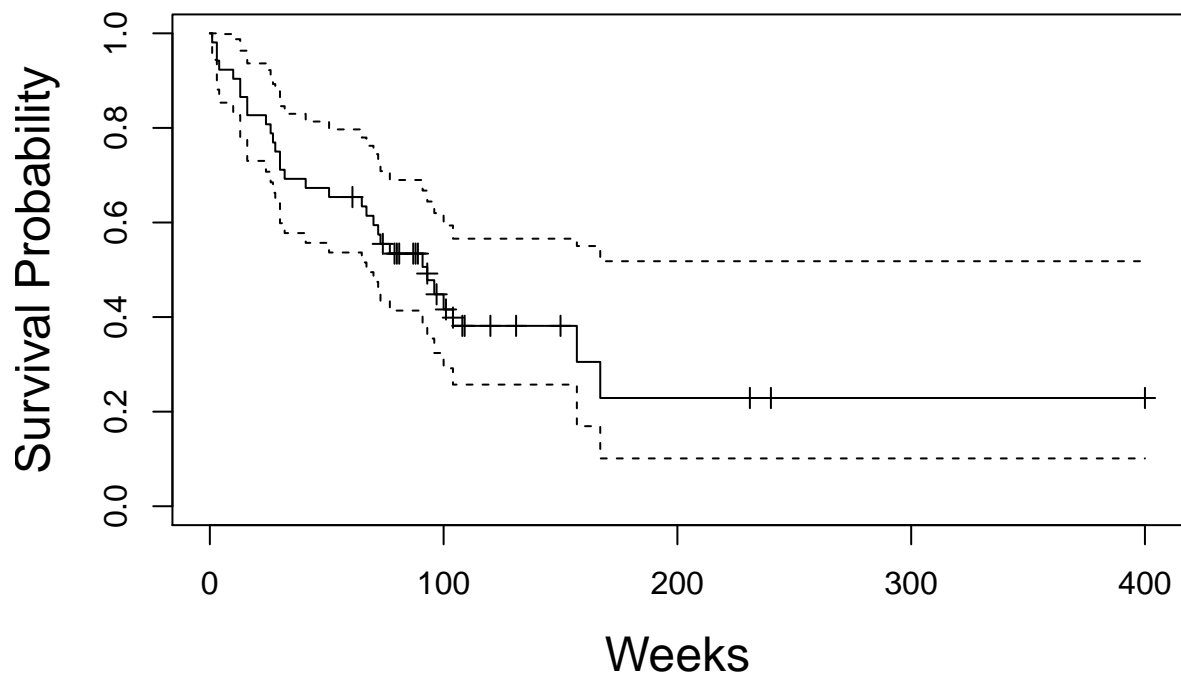
```
library(tidyverse)
library(KMsurv) # data source
library(survival) # problem 3

data(tongue)
tongue_df =
  tongue %>% as.tibble() %>%
  mutate(type = if_else(type == 1, "Aneuploid", "Diploid"))

# Aneuploid K-M curve
KM1 = survfit(Surv(time,delta)~1, data = subset(tongue_df, type == "Aneuploid"), conf.type = 'log')
plot(KM1,
      conf.int = TRUE, mark.time = TRUE,
```

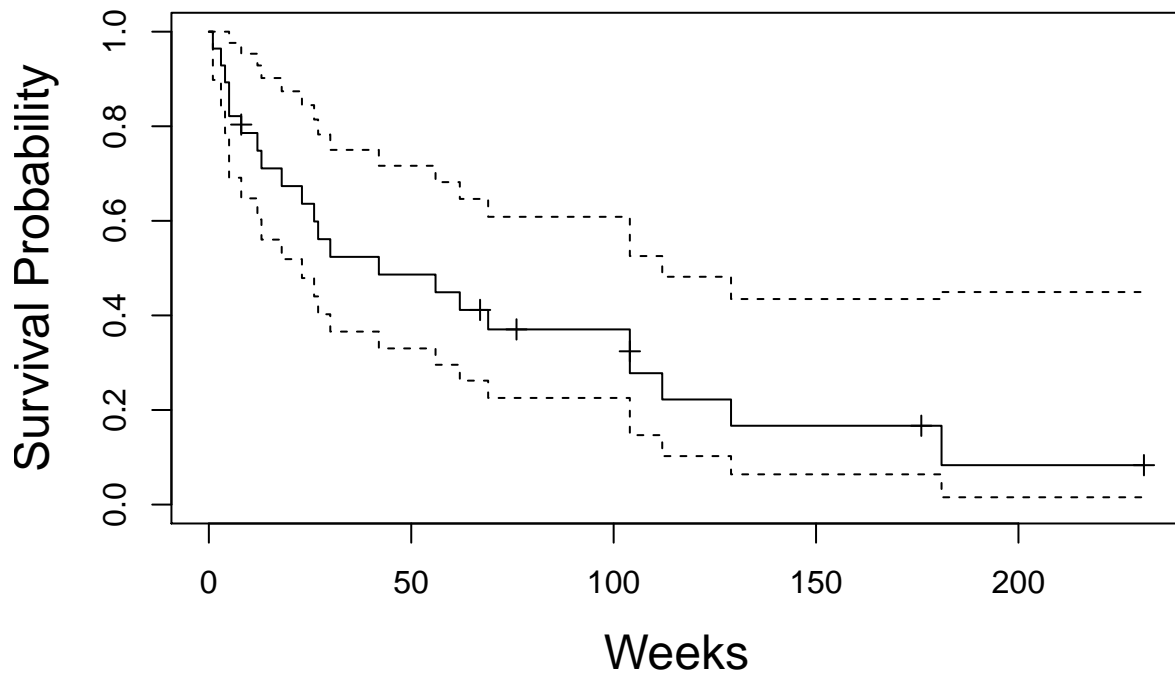
```
xlab = "Weeks", ylab = "Survival Probability", main="Aneuploid K-M curve",
cex.lab = 1.5, cex.main = 1.5)
```

## Aneuploid K-M curve



```
# Diploid K-M curve
KM2 = survfit(Surv(time,delta)~1, data = subset(tongue_df, type == "Diploid"), conf.type = 'log')
plot(KM2,
      conf.int = TRUE, mark.time = TRUE,
      xlab = "Weeks", ylab = "Survival Probability", main="Diploid K-M curve",
      cex.lab = 1.5, cex.main = 1.5)
```

## Diploid K-M curve



```
# one-year survival rate
# Aneuploid
summary(KM1, time = 365/7)
```

```
## Call: survfit(formula = Surv(time, delta) ~ 1, data = subset(tongue_df,
##   type == "Aneuploid"), conf.type = "log")
##
##   time n.risk n.event survival std.err lower 95% CI upper 95% CI
## 52.1    34    18   0.654   0.066   0.537   0.797
```

```
# Diploid
summary(KM2, time = 365/7)
```

```
## Call: survfit(formula = Surv(time, delta) ~ 1, data = subset(tongue_df,
##   type == "Diploid"), conf.type = "log")
##
##   time n.risk n.event survival std.err lower 95% CI upper 95% CI
## 52.1    13    14   0.486  0.0961   0.33   0.716
```

The estimated 1-year survival rate (95% CI) is 0.654 (0.537, 0.797) for Aneuploid and 0.486 (0.33, 0.716) for Diploid.