Lista 5 - Sobrevivência

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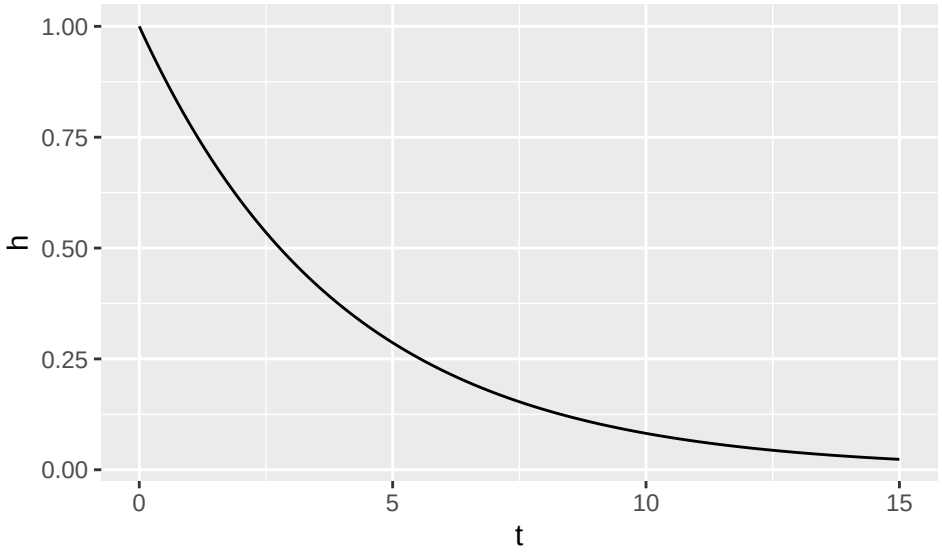
Exercício 1

a)

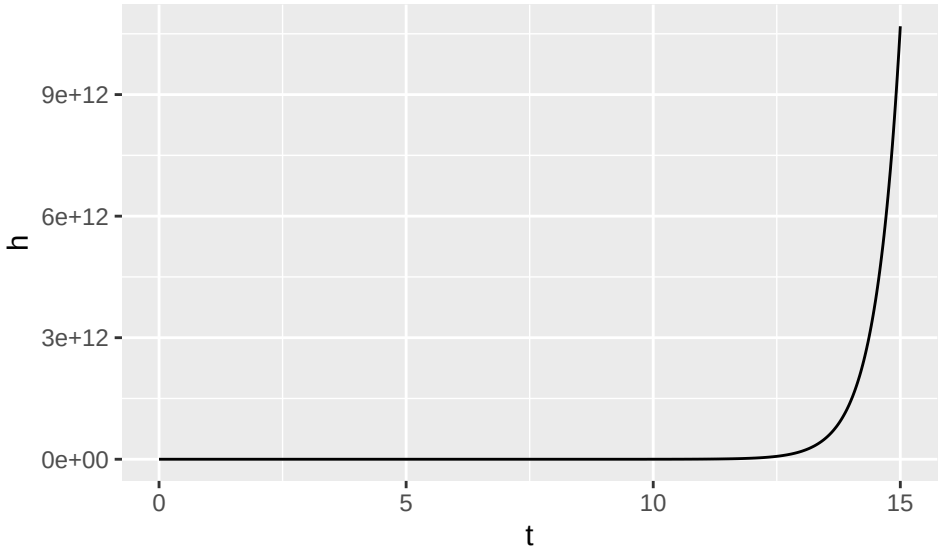
- $\alpha < 0$

```
alpha = -0.25
h <- exp(alpha * seq(0, 15, 0.01))

ggplot() + geom_line(aes(seq(0, 15, 0.01), h)) + ylab("h") + xlab("t")
```



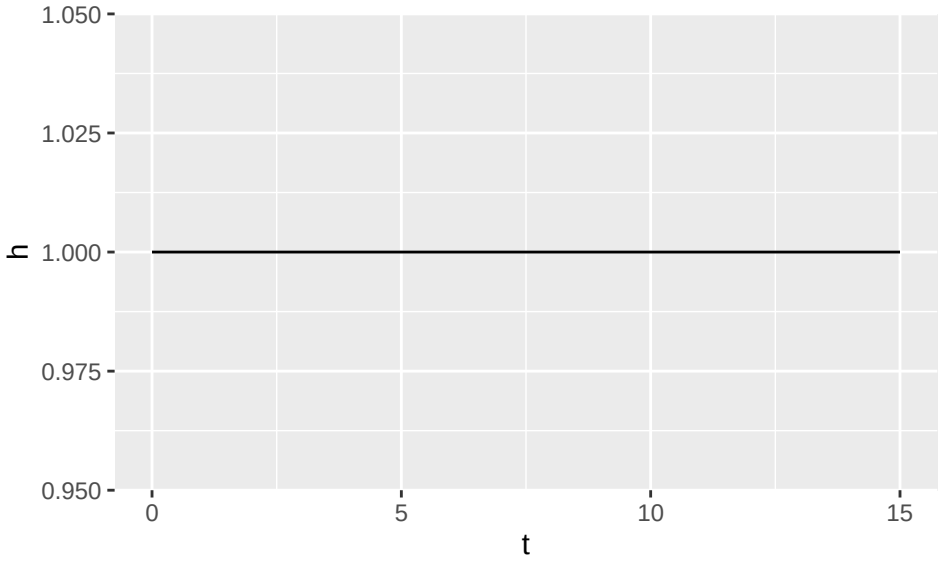
- $\alpha > 0$

```
alpha = 2
h <- exp(alpha * seq(0, 15, 0.01))

ggplot() + geom_line(aes(seq(0, 15, 0.01), h)) + ylab("h") + xlab("t")
```



- $\alpha = 0$

```
alpha = 0
h <- exp(alpha * seq(0, 15, 0.01))

ggplot() + geom_line(aes(seq(0, 15, 0.01), h)) + ylab("h") + xlab("t")
```

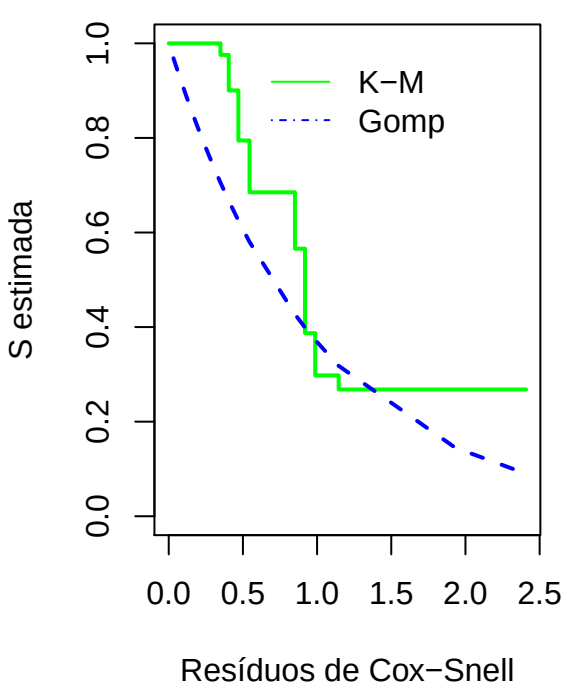


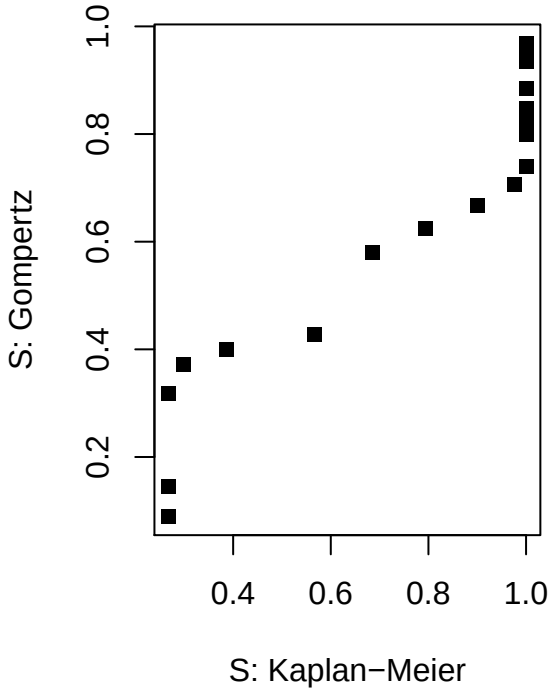
Exercício 3

```
tempos <- c(31, 33, 36, 40, 40, 42, 43, 44, 44, 46, 46, 47, 48, 48, 49, 50, 50,
            rep(60, 9), 47, 48, 48, 48, rep(49, 4), rep(50, 4), rep(53, 4),
            rep(54, 3), rep(55, 7))
embal <- c(rep(0, 26), rep(1, 26))
cens <- c(rep(1, 21), rep(0, 5), rep(1, 20), rep(0, 6))
mgump = flexsurvreg( Surv(tempos, cens) ~ as.factor(embal), dist = 'gompertz')
mgump
```

```
## Call:
## flexsurvreg(formula = Surv(tempos, cens) ~ as.factor(embal),
##     dist = "gompertz")
##
## Estimates:
##                     data mean  est        L95%       U95%       se
## shape                     NA   1.49e-01   1.10e-01   1.88e-01   1.99e-02
## rate                      NA   3.85e-05   5.05e-06   2.93e-04   3.99e-05
## as.factor(embal)1   5.00e-01   2.21e-01  -4.20e-01   8.61e-01   3.27e-01
##                     exp(est)   L95%       U95%
## shape                     NA         NA         NA
## rate                      NA         NA         NA
## as.factor(embal)1   1.25e+00   6.57e-01   2.37e+00
##
## N = 52,  Events: 41,  Censored: 11
## Total time at risk: 2623
## Log-likelihood = -157.1575, df = 3
## AIC = 320.3149
```

```
#Coeficientes e residuos
a = as.numeric(mgump$coefficients[1])
l = as.numeric(exp(mgump$coefficients[2]))
b = as.numeric(mgump$coefficients[3])
res <- l * ((exp(a * tempos) - 1) / a) * exp(b * cens)

# Ajuste Kaplan-Meier
kaplan<- survfit(Surv(res, embal) ~ 1)
tmp <- kaplan$time
s<- kaplan$surv
se <- exp(-tmp)

#Plotagem

par(mfrow = c(1,2))


plot(kaplan, conf.int = FALSE, mark.time = FALSE, xlab = "Resíduos de Cox-Snell",
     ylab= "S estimada",
     col = "green", lwd = 2)
lines(tmp, se, lty = 2, col = "blue", lwd = 2)
legend(0.5, 1, lty = c(1, 4), c("K-M", "Gomp"), col = c("green", "blue"),
       cex = 1, bty = "n")
plot(s, se, xlab = "S: Kaplan-Meier", ylab = "S: Gompertz", pch = 15)
```


S estimada
0.0
0.2
0.4
0.6
0.8
1.0
K−M
Gomp
0.0
0.5
1.0
1.5
2.0
2.5
Resíduos de Cox−Snell


S: Gompertz
0.2
0.4
0.6
0.8
1.0
0.4
0.6
0.8
1.0
S: Kaplan−Meier

Exercício 5

a)

```
rm(list = ls())

compath <- c(8, 11, 19, 24, 28, 33, 36, 38, 44, 96, 124, 130, 250, 250, 250)
cesn_comp <- c(1,1,1,0,1,1,0, rep(1,6),0,0)

zema <- c(7, 8, 10, 12, 13, 14, 19, 23, 25, 26, 27, 31, 31, 49, 59, 64, 87, 89, 107, 117, 119, 130, 148
cesn_z <- c(rep(1,5),0,1,1,0,1,1,1,0,1,0,0, rep(1,12), rep(0,16))
data <- data.frame(t = c(compath, zema), grupo = rep(c("C", "Z"), c(15, 44)), cens = c(cesn_comp, cesn_z
m.c <- survfit(Surv(compath,cesn_comp) ~ 1, se.fit = FALSE)
m.z <- survfit(Surv(zema,cesn_z) ~ 1, se.fit = FALSE)
m.c
```

```
## Call: survfit(formula = Surv(compath, cesn_comp) ~ 1, se.fit = FALSE)
##
##      n events median
##     15     11     44
```

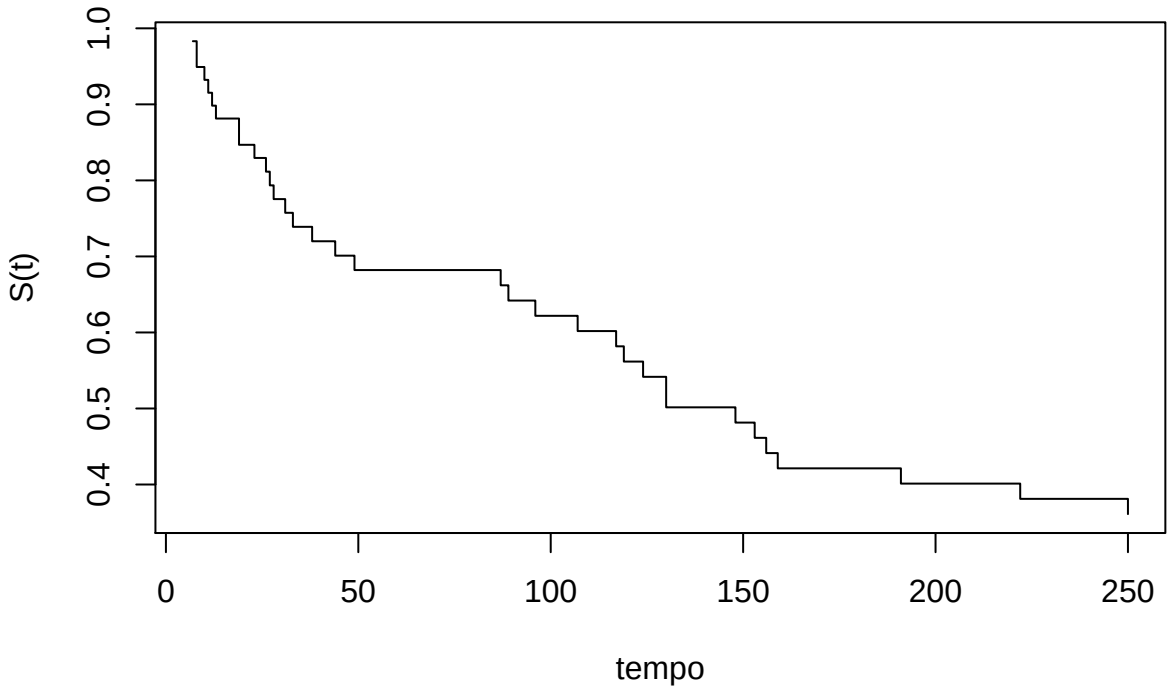
```
m.z
```

```
## Call: survfit(formula = Surv(zema, cesn_z) ~ 1, se.fit = FALSE)
##
##      n events median
##     44     23    159
```

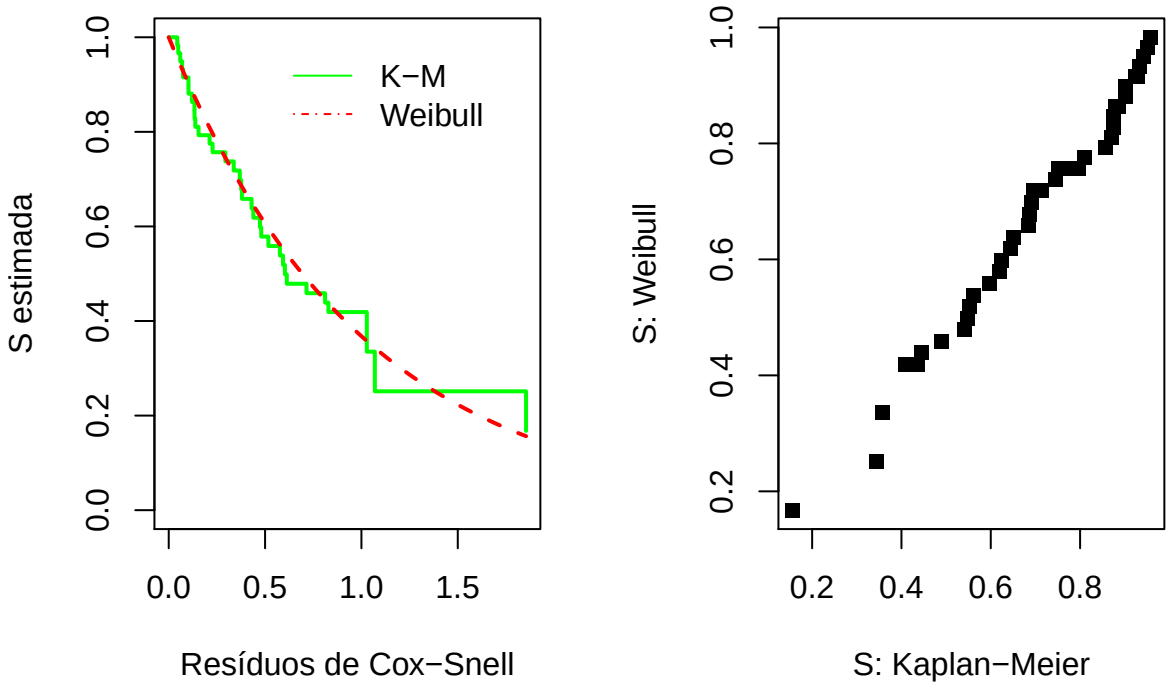
b)

Gráfico Kaplan-Meier

```
plot(survfit(Surv(data$t, data$cens) ~ 1)$time, survfit(Surv(data$t, data$cens) ~ 1)$surv, ty = "s", xla
     ylab = "S(t)")
```



```r
# Resíduos do modelo Weibull
m.w <- survreg(Surv(data$t, data$cens) ~ data$grupo, data = data, dist = "wei")
# Ajuste do modelo Weibull
rk <- survfit(Surv(-log(exp(-(data$t / exp(m.w$linear.predictors)) ^ (1 / m.w$scale))), data$cens) ~ 1,
par(mfrow = c(1, 2))

plot(rk, conf.int = FALSE, mark.time = FALSE, xlab = "Resíduos de Cox-Snell",
     ylab= "S estimada",
     col = "green", lwd = 2)
curve(exp(-x), 0, max(rk$time), add = T, lwd = 2, lty = 2, col = "red")
legend(0.5, 1, lty = c(1, 4), c("K-M", "Weibull"), col = c("green", "red"), cex = 1, bty = "n")
plot(exp(-rk$time), rk$surv, xlab = "S: Kaplan-Meier", ylab = "S: Weibull", pch = 15)
```



c)

```r
2 * (m.w$loglik[2] - m.w$loglik[1])  < qchisq(0.95, 1)
```

```
## [1] TRUE
```

$3.51 < 3.84$ não se rejeita a hipótese de que não existe diferença entre as drogas ao nível de 5% de significância.

d)

```
tempo_mediano_compath = predict(m.w, type = 'quantile', p = 0.5)[1]
tempo_mediano_zema = predict(m.w, type = 'quantile', p = 0.5)[59]
tempo_mediano_compath
```

```
## [1] 77.6351
```

```
tempo_mediano_zema
```

```
## [1] 184.123
```

e)

```
tempo_mediano_zema / tempo_mediano_compath
```

```
## [1] 2.371646
```

O fator de aceleração encontrado é igual a 2.37.

f)

```
# Intervalo de 90% de confiança para o beta_1
IC <- c(max(0, (m.w$coefficients[2]) - 1.64 * sqrt(m.w$var[2, 2])),(m.w$coefficients[2]) + 1.64 * sqrt(m
IC
```

```
##             data$grupoZ
##   0.1383423   1.5888261
```