Bios 323 Lab II

Objective

- Simulation of parametric survival distributions

Example

1. Simulate 10,000 random variables from T $\sim$ Exp(2)
   (a) Simulate S(t) $\sim$ Uniform(0,1) first
   (b) Directly simulate using rexp()
2. Draw histograms and compare.
3. Make the survival curve and cumulative hazard curve
4. Show memoryless property

R

```
> set.seed(123)
> n <- 10000
> y <- runif(n, min=0, max=1)
> x1 <- -log(y)/2
> x2 <- rexp(n, rate=2)

> par(mfrow=c(2,1))
> hist(x1, breaks=100)
> hist(x2, breaks=100)

> S <- y[order(x1)]
> plot(sort(x1), S, type="o", xlab="t")
> H <- -log(S)
> plot(sort(x1), H, type="o", xlab="t")

> t0 <- 0.5
> x3 <- x2[x2>t0] - t0
> hist(x2, breaks=100)
> hist(x3, breaks=100)
```

STATA

```
. set obs 10000
. set seed 123
. generate y1=uniform()
. generate x1=-ln(y1)/2
. histogram x1, name(hist1)
. sort x1
. twoway (line y1 x1)
. generate H=-ln(y1)
. twoway (line H x1)
. generate x2=.
. replace x2=x1-0.5 if x1>0.5
. histogram x2, name(hist2)
. graph combine hist1 hist2, cols(1)
```

Exercises

1. Simulate random variable from Weibull distribution with λ=1 and γ=2, using rweibull(). Plot ln(H(t)) vs. ln(t).
2. Simulate random variable T from log logistic distribution with α=1.5 and λ=0.01, using rlogis(). Based on this, calculate S(t=100) and mean of T, and compare your results with those of HW2.3.
3. Simulate random variable T from Gompertz distribution with θ=0.01 and α=0.25 (S(t)=exp[$\frac{\theta}{\alpha}(1 - e^{\alpha x})$]). Calculate median of T and the probability of T greater than 12. Compare your results with those of HW2.6.

R

 # Weibull distribution #

```
> x <- rweibull(n, shape=2, scale=1)
> S <- 1-cumsum(rep(1,n))/n
> H <- -log(S)
> plot(log(sort(x)), log(H), type="o", xlab="ln(t)", ylab="ln(H)")
```

 # Log logistic distribution #

```
> alpha <- 1.5
> lamda <- 0.01
> sigma <- 1/alpha
> mu <- -log(lamda)*sigma
> y <- rlogis(n, location=mu, scale=sigma)
> x <- exp(y)
> sum(x>50)/n
> mean(x)
```

 # Gompertz distribution #

```
> theta <- 0.01
> alpha <- 0.25
> y <- runif(n, min=0, max=1)
> x <- log(1-log(y)*alpha/theta)/alpha
> sum(x>=12)/n
> median(x)
```