# AFT

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## Simulated Data

```
# Log Normal

AFT_Simulation <- function(n,beta,lower,upper,
                           lower_cens, upper_cens){
  x = runif(length(beta)*n,lower,upper)
  X = matrix(x,n,length(beta))


  time = exp(X%*%beta+rnorm(n))
  cens_time <- runif(n, min=lower_cens, max=upper_cens)
  Y <- pmin(time, cens_time)
  delta <- ifelse(time <= cens_time, 1, 0)
  return(list(Y=Y, delta=delta, Time = time,
              X = X))
}


tst <- AFT_Simulation(200, beta=c(1,2,3), lower=0, upper=1,
                      lower_cens=0, upper_cens=300)
```

```
Cox = summary(coxph(Surv(tst$Y,tst$delta)~tst$X))
Cox
```

```
## Call:
## coxph(formula = Surv(tst$Y, tst$delta) ~ tst$X)
##
##   n= 200, number of events= 168
##
##             coef exp(coef) se(coef)      z Pr(>|z|)
## tst$X1 -0.87886   0.41526  0.26408 -3.328 0.000875 ***
## tst$X2 -1.91431   0.14744  0.28188 -6.791 1.11e-11 ***
## tst$X3 -3.08226   0.04586  0.32895 -9.370  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##        exp(coef) exp(-coef) lower .95 upper .95
## tst$X1   0.41526      2.408   0.24747   0.69679
```

```
## tst$X2   0.14744      6.782   0.08486   0.25619
## tst$X3   0.04586     21.808   0.02407   0.08738
##
## Concordance= 0.775  (se = 0.016 )
## Likelihood ratio test= 124.2  on 3 df,   p=<2e-16
## Wald test            = 117.2  on 3 df,   p=<2e-16
## Score (logrank) test = 126  on 3 df,   p=<2e-16
```

```
AFT_EXP = summary(survreg(Surv(tst$Y, tst$delta) ~ tst$X,
        dist="lognormal",scale = 1))
AFT_EXP
```

```
##
## Call:
## survreg(formula = Surv(tst$Y, tst$delta) ~ tst$X, dist = "lognormal",
##     scale = 1)
##              Value Std. Error     z       p
## (Intercept) 0.0393     0.2280  0.17 0.86309
## tst$X1      0.9079     0.2449  3.71 0.00021
## tst$X2      1.9560     0.2509  7.80 6.4e-15
## tst$X3      2.9100     0.2502 11.63 < 2e-16
##
## Scale fixed at 1
##
## Log Normal distribution
## Loglik(model)= -698.5   Loglik(intercept only)= -803
##  Chisq= 209.02 on 3 degrees of freedom, p= 4.7e-45
## Number of Newton-Raphson Iterations: 3
## n= 200
```

## Prepare the parameter

```
system.time({

  result1 = MH_Sampling(tti,Y,Y.test,delta,delta.test,tau,
                        A,A.test,beta0,sigma0,var.prop,
                        m,B,eta,
                        Wmat_option=0)

})
```

```
##    user  system elapsed
##   72.02    9.21  109.62
```

```
system.time({

  result2 = MH_GP_Sampling(tti,Y,Y.test,delta,delta.test,tau,
                        A,A.all,beta0,alpha0,v0,kappa,
                        m,B,eta,K.all,n,
                        Wmat_option=0)
```

```
})
```

```
##    user  system elapsed
## 1142.89   13.70 1531.28
```

```
system.time({
  result3 = MH_horseshoe_Sampling(tti,Y,Y.test,delta,delta.test,tau,
                                  A,A.test,beta0,sigma0,var.prop,
                                  m,B,eta,v,
                                  Wmat_option=0)

})
```

```
##    user  system elapsed
##   65.42    6.21   80.27
```

```
Wmat = HarrellC_Wmat(Y,delta,tau)
Wmat.test = HarrellC_Wmat(Y.test,delta.test,tau)
```

```
all = data.frame(Model = c("Cox","Linear Regression","Gaussian Process",
                           "LR with horseshoe"),
        C_train = c(C_index(THETA(A,Cox$coefficients[,1]),Wmat),
                    C_index(colMeans(result1$THETA),Wmat),
                    C_index(colMeans(result2$BETA),Wmat),
                    C_index(colMeans(result3$THETA),Wmat)),
        C_test = c(C_index(THETA(A.test,Cox$coefficients[,1]),Wmat.test),
                   C_index(colMeans(result1$THETA.test),Wmat.test),
                   C_index(colMeans(result2$BETA_test),Wmat.test),
                   C_index(colMeans(result3$THETA.test),Wmat.test)),
        Spearman = c(cor(THETA(A.test,Cox$coefficients[,1]),
                         THETA(A.test,c(1,2,3)), method="spearman"),
                     cor(colMeans(result1$THETA.test),
                         THETA(A.test,c(1,2,3)), method="spearman"),
                     cor(colMeans(result2$BETA_test),
                         THETA(A.test,c(1,2,3)), method="spearman"),
                     cor(colMeans(result3$THETA.test),
                         THETA(A.test,c(1,2,3)), method="spearman")),
        Kendall = c(cor(THETA(A.test,Cox$coefficients[,1]),
                         THETA(A.test,c(1,2,3)), method="kendall"),
                     cor(colMeans(result1$THETA.test),
                         THETA(A.test,c(1,2,3)), method="kendall"),
                     cor(colMeans(result2$BETA_test),
                         THETA(A.test,c(1,2,3)), method="kendall"),
                    cor(colMeans(result3$THETA.test),
                         THETA(A.test,c(1,2,3)), method="kendall")
                     ))
all
```

```
##               Model   C_train   C_test   Spearman    Kendall
```

```
## 1               Cox 0.9345992 0.987013 -0.9973734 -0.9769231
## 2 Linear Regression 0.9894515 0.961039 -0.7639775 -0.5717949
## 3  Gaussian Process 1.0000000 0.974026 -0.7225141 -0.5487179
## 4 LR with horseshoe 0.9915612 0.961039 -0.7624765 -0.5641026
```

```
par(mfrow=c(3,2))
plot(1:(m-B),result1$C_stat,type = "l",
     xlab = "Iteration",ylab = "C Statistics",main = "LR Training")
plot(1:(m-B),result1$C_stat.test,type = "l",
     xlab = "Iteration",ylab = "C Statistics",main = "LR Testing")
plot(1:(m-B),result2$C_stat,type = "l",
     xlab = "Iteration",ylab = "C Statistics",main = "GP Training")
plot(1:(m-B),result2$C_stat_test,type = "l",
     xlab = "Iteration",ylab = "C Statistics",main = "GP Testing")
plot(1:(m-B),result3$C_stat,type = "l",
     xlab = "Iteration",ylab = "C Statistics",main = "Horseshoe Training")
plot(1:(m-B),result3$C_stat.test,type = "l",
     xlab = "Iteration",ylab = "C Statistics",main = "Horseshoe Testing")
```