R function for Weibull distribution

Here is an R function to evaluate the posterior distribution of the parameters of a Weibull distribution when they have independent gamma priors. I have omitted some details which you will need to supply.

Suppose our data are independent samples from a Weibull distribution with probability density function

\[ f(t) = \alpha \rho (\rho t)^{\alpha - 1} \exp\{- (\rho t)^\alpha\} \]

Suppose that the prior distribution for \( \alpha \) is a gamma\((a_\alpha, \ b_\alpha)\) distribution and the prior distributions for \( \rho \) is independent of that for \( \alpha \) and is a gamma\((a_\rho, \ b_\rho)\) distribution.

Note that anything following a \# in the function is a comment and will be ignored by R. I have missed out the right hand sides of the two lines which do the main bits of the calculation. These are marked \# GAP 1 \ and \# GAP 2. The function is not programmed in the most efficient way possible. Rather it is written in a way which is meant to make it easier to understand what is happening. We start with the log of the prior density (apart from a constant) and then add the log likelihood contributions from the observations one at a time.

**GAP 1**: Here you should calculate the log of the prior density (apart from a constant).

**GAP 2**: Here you should add the contribution to the log likelihood from observation \( i \).

```r
weibpost<-function(alphavals,rhovals,t,prior){
#Evaluates posterior density in Weibull/gamma problem.
 a.alpha<-prior[1] # I have put these four lines in to make it clear what
 a.rho<-prior[3]
 b.rho<-prior[4]
 na<-length(alphavals)
 nr<-length(rhovals)
 astep<-alphavals[2]-alphavals[1]
 rstep<-rhovals[2]-rhovals[1]
 nd<-length(t)
 alpha<-rep(alphavals,nr)
 rho<-rep(rhovals,na)
 alpha<-matrix(alpha,nrow=na)
 rho<-matrix(rho,nrow=na,byrow=T)
 logpos<- # GAP 1.
 lgalro<-log(alpha*rho) # You might find this useful.
 for (i in 1:nd)
 {rt<-rho*t[i] # You might find this useful.
  logpos<-logpos+ # GAP 2.
  }
 logpos<-logpos-max(logpos)
 posterior<-exp(logpos)
 int<-sum(posterior)*astep*rstep
 posterior<-posterior/int
 posterior
}
```

The function requires four arguments. Here is an example of its use. This is just an *illustrative example*. You will need to change some of the numbers.

\[ t<-read.table("project07.dat") \]
\[ t1<-t[,1] \]
\[ alphagrid<-seq(0.5,1.5,0.1) \]
\[ rhogrid<-seq(0.0005,0.0055,0.0005) \]
\[ prior<-c(1,1,3,1000) \]
\[ posterior<-weibpost(alphagrid,rhogrid,t1,prior) \]

You can use the `contour` function, for example, to display the results. See Lecture 7.