R code for posteriors: Poisson-gamma and normal-normal case

First install the *Bolstad* package from CRAN and load it in R

For a ***Poisson model with parameter mu and with a gamma prior***, use the command ***poisgamp*.**

one observation of 4 and a gamma(1,1), i.e. an exponential prior on mu

```
poisgamp(4,1,1)
```

The output gives

```
Summary statistics for posterior
--------------------------------
Shape parameter r:       5
Rate parameter v:        2
99% credible interval for mu:   [0.54 , 6.3 ]
```

Same as the previous example but a gamma(10,1) prior

```
poisgamp(4,10,1)
```

The output gives

```
Summary statistics for posterior
--------------------------------
Shape parameter r:       14
Rate parameter v:        2
99% credible interval for mu:   [ 3.12 , 12.75 ]
```

Same as the previous example but an improper gamma(1,0) prior

```
poisgamp(4,1,0)
```

The output gives

```
Summary statistics for posterior
--------------------------------
Shape parameter r:       5
Rate parameter v:        1
99% credible interval : [ 1.08 ,  12.59 ]
```

A random sample of 50 observations from a Poisson distribution with
mu = 3 and gamma(6,3) prior

```
y<-rpois(50,3)
poisgamp(y,6,3)
```

The output gives

```
Summary statistics for data
---------------------------
Number of observations:  50
Sum of observations:     162

Summary statistics for posterior
--------------------------------
Shape parameter r:       168
Rate parameter v:        53
99% credible interval for mu:   [ 2.58 , 3.84 ]
```

In this example we have a random sample from a Poisson distribution
with an unknown mean. We will use a gamma(6,3) prior to obtain the
posterior gamma distribution, and use the R function qgamma to get a
95% credible interval for mu

```
y<-c(3,4,4,3,3,4,2,3,1,7)
retval<-poisgamp(y,6,3,ret=TRUE)
c.i.<-qgamma(c(0.025,0.975),retval$r, retval$v)
cat(paste("95% credible interval for mu: [",round(c.i.[1],3), ",",
round(c.i.[2],3)),"]\n")
```

For a ***Normal model with known variance 1 and with a normal prior***, use the command ***normnp.***

generate a sample of 20 observations from a N(-0.5,1) population

```
x<-rnorm(20,-0.5,1)
```

find the posterior density with a N(0,1) prior on mu

```
normnp(x,sigma=1)
```

The output gives

Posterior mean : -0.5493965
Posterior std. deviation : 0.2182179

find the posterior density with N(0.5,3) prior on mu

```
normnp(x,0.5,3,1)
```

The output gives

Posterior mean : -0.5709168
Posterior std. deviation : 0.2229882

Find the posterior density for mu, given a random sample of 4
observations from N(mu,sigma^2=1), y = [2.99, 5.56, 2.83, 3.47],
and a N(3,sd=2)$ prior for mu

```
y<-c(2.99,5.56,2.83,3.47)
normnp(y,3,2,1)
```

The output gives

Posterior mean : 3.6705882
Posterior std. deviation : 0.4850713