Applied Statistics (Chapter 3)

Yasuhiro Omori

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University of Tokyo

Chapter 3

Section 3.2

```
library(LearnBayes)
data(footballscores);attach(footballscores)
# Define d and let n be a sample size
d = favorite - underdog - spread
n = length(d)
# v:  sum of squares.  d1^2+...+dn^2
v = sum(d^2)
# Generate 1000 random samples ~G(n/2,v/2)
p=rgamma(1000,shape=n/2,rate=v/2)
# Draw histograms of sigma and find 95% interval
s = sqrt(1/P)
hist(s)
quantile(s,probs=c(0.025,0.5,0.975))
```

```
# ******Hospital A******
# Prior parameters for Gamma(alpha,beta)
alpha=16;beta=15174
# Obs. for y:1, Number of exposures:66
yobs=1; ex=66; y=0:10
# Posterior mean of lambda
lam=alpha/beta
# Compute prior predictive density at y=0,...,10
py=dpois(y,lam*ex)*dgamma(lam,shape=alpha,rate=beta)
/dgamma(lam,shape=alpha+y,rate=beta+ex)
cbind(y, round(py, 3))
# Generate 1000 random samples from posterior
lambdaA=rgamma(1000,shape=alpha+yobs,rate=beta+ex)
```

```
# ******Hospital B******
# Obs.  for y:4, Number of exposures:1767
ex=1767;yobs=4;y=0:10
# Compute prior predictive density at y=0,...,10
py=dpois(y,lam*ex)*dgamma(lam,shape=alpha,rate=beta)
/dgamma(lam,shape=alpha+y,rate=beta+ex)
cbind(y, round(py, 3))
# Generate 1000 random samples from posterior
lambdaB=rgamma(1000,shape=alpha+yobs,rate=beta+ex)
```

Section 3.3 (continued)

```
# Draw prior and posterior densities
# Output:  2 x 1 matrix
par(mfrow = c(2, 1))
# ******Hospital A******
# Plot posterior density
plot(density(lambdaA),main="HOSPITAL A",
xlab="lambdaA",lwd=3)
# Overwrite the prior density
curve(dgamma(x,shape=alpha,rate=beta),add=TRUE)
# Legend at top right
legend("topright",legend=c("prior","posterior"),
lwd=c(1,3)))
```

```
# ******Hospital B******
plot(density(lambdaB),main="HOSPITAL B",
xlab="lambdaB",lwd=3)
curve(dgamma(x,shape=alpha,rate=beta),add=TRUE)
legend("topright",legend=c("prior","posterior"),
lwd=c(1,3)))
```