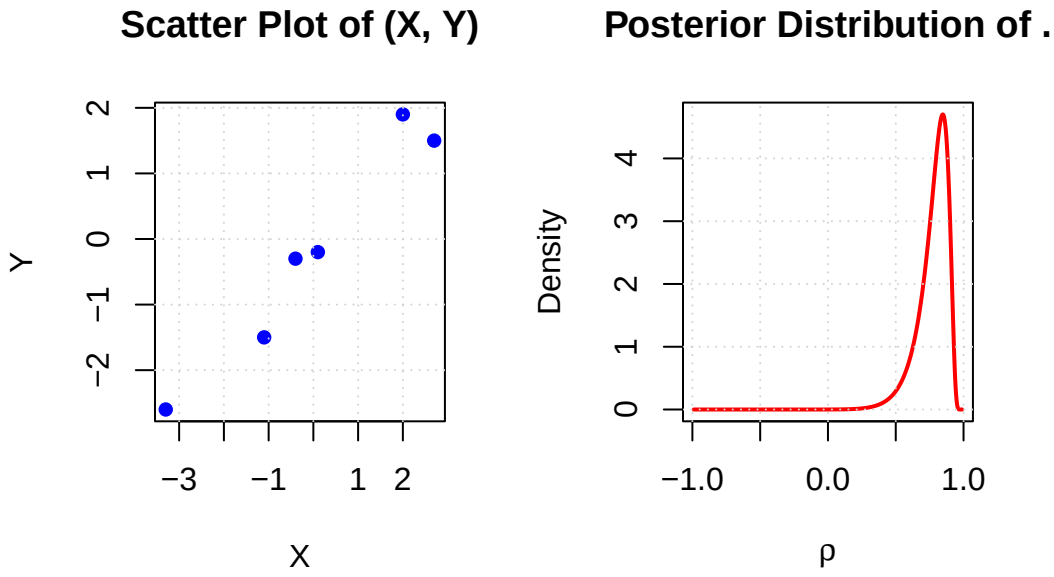
SGupta_HW03Q12

Question 12

Make a scatter plot of the data and, assuming the correlation parameter has a Uniform(-1,1) prior, plot the posterior distribution of .

```
# Data
x <- c(-3.3, 0.1, -1.1, 2.7, 2.0, -0.4)
y <- c(-2.6, -0.2, -1.5, 1.5, 1.9, -0.3)
n <- length(x)

# Create a grid of rho values
rho_grid <- seq(-0.99, 0.99, length.out = 1000)

# Define a function to compute the log-likelihood for a given rho.
log_likelihood_rho <- function(rho, x, y) {

  # Sum this for all values as per the log likelhood from the scanned notes
  log_likelihood <- sum(-0.5*log(2*pi) - 0.5*log(1 - rho^2) -
              (1/(2*(1 - rho^2)))*(x^2 - 2*rho*x*y + y^2))
  return(log_likelihood)
}

# Find the log likelihood for each value of rho
logL <- sapply(rho_grid, log_likelihood_rho, x = x, y = y)

# subtract maximum log likelihood
LogL2 <- exp(logL - max(logL))

# find the posterior density by normalizing.
posterior_rho <- LogL2 / sum(LogL2 * (rho_grid[2] - rho_grid[1]))
```

```r
par(mfrow = c(1, 2))

# Scatter plot of the data
plot(x, y, pch = 16, col = "blue", main = "Scatter Plot of (X, Y)",
     xlab = "X", ylab = "Y")
grid()

# Posterior density plot for rho
plot(rho_grid, posterior_rho, type = "l", lwd = 2, col = "red",
     main = "Posterior Distribution of  ",
     xlab = expression(rho), ylab = "Density")
grid()
```



You can add options to executable code like this