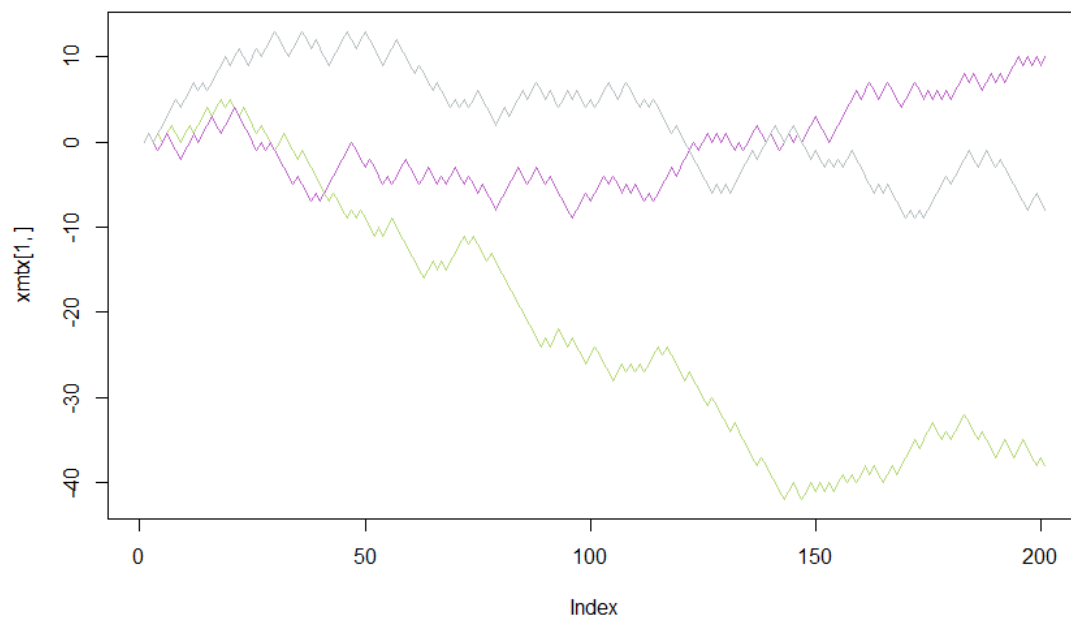
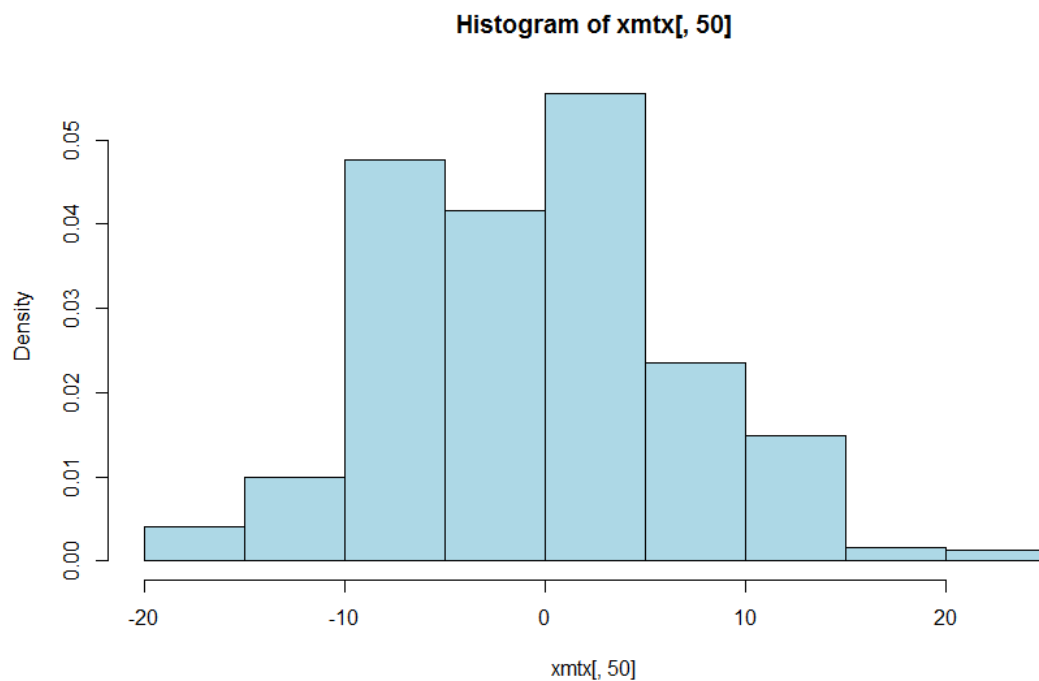


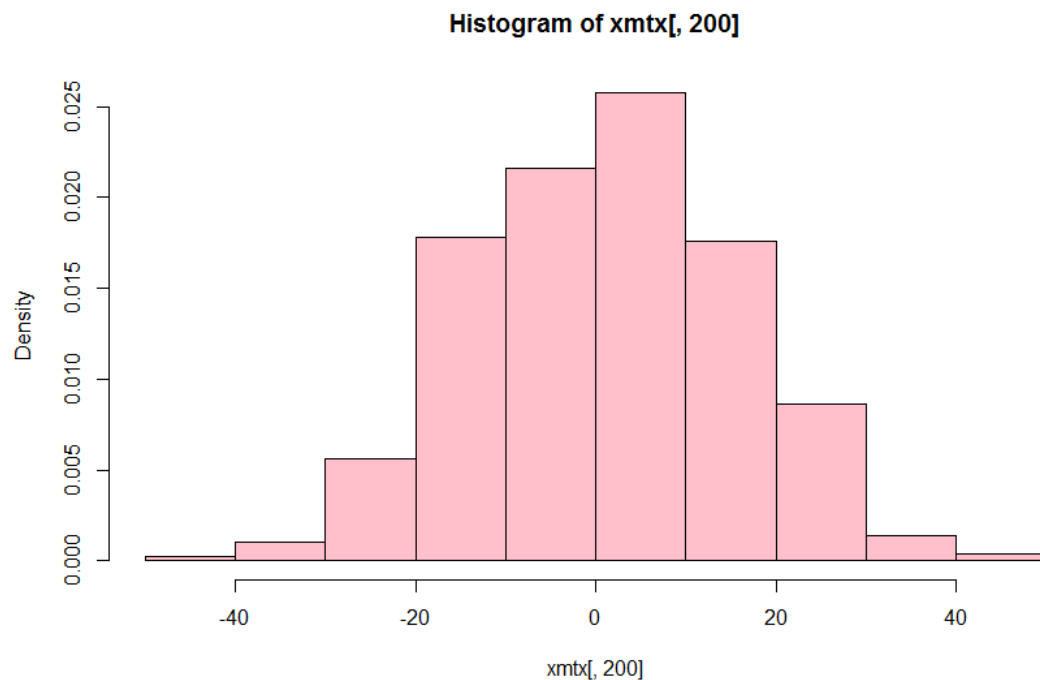
Problem 1.

This is the line graph of three random walks.



These are the histograms at time 50 and 200 of 500 random walks.





```
> mean(xmtx[, 50])  
[1] -0.016  
> var(xmtx[, 50])  
[1] 52.19213  
> mean(xmtx[, 200])  
[1] 1.084  
> var(xmtx[, 200])  
[1] 214.51
```

The mean of both time locations is fairly similar but the variances are vastly different because at time 200, there is a larger range that the random walk can get take. The range of the walk is $(-200, 200)$ at time 200, and $(-50, 50)$ at time 50.

Problem 2.

$$\begin{aligned} P(X_1 = 1, X_2 = 3, X_3 = 2) = & \\ (P(X_1 = 1|X_0 = 1)P(X_0 = 1) & \\ + P(X_1 = 1|X_0 = 2)P(X_0 = 2) & \\ + P(X_1 = 1|X_0 = 3)P(X_0 = 3)) & P(X_2 = 3|X_1 = 1)P(X_3 = 2|X_2 = 3) \end{aligned}$$

$$(0.2 * 0.5 + 0.1 * 0.3 + 0.5 * 0.2)(0.4)(0.5) = 0.046$$

Here is a line graph of 1000 iterations, with 2000 chains.

