Homework 15

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1)

$E[X(1)] = 0$

$V[X(1)] = 1$, since $t = 1$ and $\sigma^2 = 1$

2)

Since $X(1) \sim N(0, 1)$, we can use pnorm funtions.

$P(-1 < X(1) < 2) = 0.81859$

```
pnorm(2) - pnorm(-1)
```

```
## [1] 0.8185946
```

I will write the code for both 3) and 4) in the same block and just use 5 of the realizations for 3).

```
realizations <- list()
# Variance = t*sigma^2, t = 0.02 because the interval to the next time is 0.02
# and simga^2 = 1
sig2 <- 0.02
time_vec <- seq(0,1,0.02)

for( i in seq(1:1000) ){

  real_vec <- numeric()

  real_vec[1] <- 0


  for (j in seq(2,51)){

    real_vec[j] <- real_vec[j-1] + rnorm(1, 0, sqrt(sig2))

  }

  realizations[[i]] <- real_vec
}
```

3)

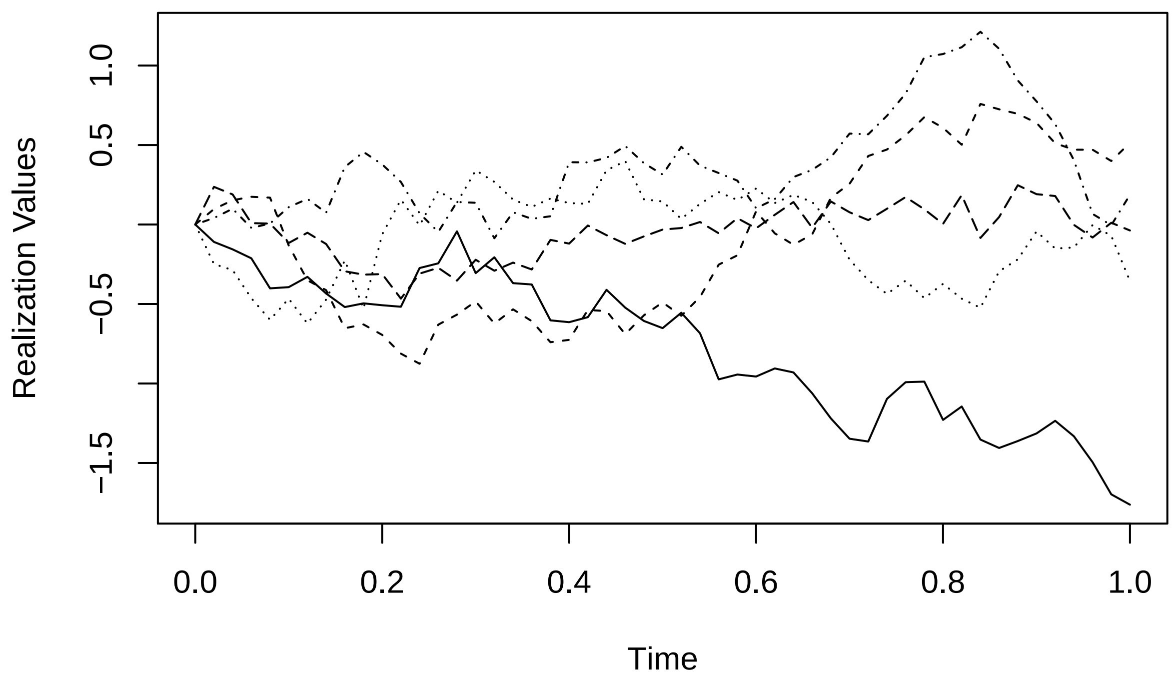
```
vec <- c(realizations[[1]],
         realizations[[2]],
         realizations[[3]],
         realizations[[4]],
         realizations[[5]])
```

```r
plot(time_vec, realizations[[1]],
     ylab = "Realization Values",
     xlab = "Time",
     lty = 1,
     type = "l",
     ylim = c(min(vec), max(vec)))

for (i in seq(2,5)){

  lines(time_vec, realizations[[i]], lty = i, type = "l")

}
```



4)

Making a vector of the last values in the simulation.

```r
X_1 <- numeric()

for ( i in seq(1:length(realizations))){

  X_1[i] <- realizations[[i]][length(realizations[[i]])]

}
```

a)

$E[X(t)]$

```r
mean(X_1)
```

```
## [1] -0.02384918
```

b)

$V[X(t)]$

```r
var(X_1)
```

```
## [1] 1.043409
```

c)

```r
# P( X(1) < 2 )
less_2 <- sum((X_1 < 2))/length(X_1)

# P( X(1) < -1 )
less_neg1 <- sum((X_1 < -1))/length(X_1)

# P( -1 < X(1) < 2 )
less_2 - less_neg1
```

```
## [1] 0.811
```