```
# Lince Rumainum
# Time Series Analysis
# HW1

# Create time sequences from 1 to 500
mainDf <- data.frame(t = seq(1, 500, by = 1))

# Create main data frame for iid epsilon_t values (500 samples)
mainDf$e_t <- rnorm(500, mean = 0, sd = 1)

# Line plot epsilon_t vs t
plot(mainDf$t, mainDf$e_t, type = "l")

# Create epsilon_t-1 and epsilon_t-2
mainDf <- slide(mainDf,"e_t", "t", NewVar="etLag1", slideBy = -1)
mainDf <- slide(mainDf,"e_t","t",NewVar="etLag2", slideBy = -2)

# Line plot epsilon_t vs epsilon_t-1
plot(mainDf$etLag1, mainDf$e_t, type = "l")
# Line plot epsilon_t vs epsilon_t-2
plot(mainDf$etLag2, mainDf$e_t, type = "l")

# Calculate mean and variance of epsilon_t
mean(mainDf$e_t)
var(mainDf$e_t)

# Create the rest of the table for epsilon_t-k
for(k in 3:500){
  # Create new variable name
```

```
  varName <- paste ("etLag", k, sep ="")
  # Create new column and data of epsilon_t-k
  mainDf <- slide(mainDf,"e_t","t",NewVar = varName, slideBy = -k)
}

# Create new data frame with only epsilon_t-k
newDf <- mainDf[,2:(length(t)+1)]

# Create new data frame for k, gamma_k, and rho_k
kDf <- data.frame(k = seq(0, 500, by = 1))

#Calculate gamma_0 for rho_k calculation
gamma_0 <- cov(mainDf$e_t,mainDf$e_t)
j <- 1 # current row for kDf

for(i in colnames(newDf)){
  # Calculate gamma_k and rho_k
  kDf$gamma_k[j] <- cov(newDf[j:500,i],newDf$e_t[j:500])
  kDf$rho_k[j] <-  kDf$gamma_k[j]/gamma_0
  j <- j+1 # increment j for next row
}

# Line plot of gamma_k vs k
plot(kDf$k,kDf$gamma_K,type="l")
# Line plot of rho_k vs k
plot(kDf$k,kDf$rho_k,type="l")

# Compute the min, max and plot the histogram
min(mainDf$e_t)
```

```
max(mainDf$e_t)
hist(mainDf$e_t)



# Problem #2 x_t = 2.0 + epsilon_t, x_0 = 0

# Create time sequences from 0 to 500
xDf <- data.frame(t = seq(0, 500, by = 1))

# Set x_t values from the given equation
xDf$x_t[1] <- 0

# Create the rest of the table for x_t
for(i in 2:501){
  # Calculate data of x_t
  xDf$x_t[i] <- 2.0 + mainDf$e_t[i-1]
}

# Line plot epsilon_t vs t
plot(mainDf$t, xDf$x_t, type = "l")

# Create epsilon_t-1 and epsilon_t-2
xDf <- slide(xDf,"x_t", "t", NewVar="xtLag1", slideBy = -1)
xDf <- slide(xDf,"x_t","t",NewVar="xtLag2", slideBy = -2)

# Line plot epsilon_t vs epsilon_t-1
plot(xDf$xtLag1, xDf$x_t, type = "l")
# Line plot epsilon_t vs epsilon_t-2
plot(xDf$xtLag2, xDf$x_t, type = "l")
```

```
# Calculate mean and variance of epsilon_t
mean(xDf$x_t)
var(xDf$x_t)

# Create the rest of the table for epsilon_t-k
for(k in 3:500){
  # Create new variable name
  varName <- paste ("xtLag", k, sep ="")
  # Create new column and data of epsilon_t-k
  xDf <- slide(xDf,"x_t","t",NewVar = varName, slideBy = -k)
}

# Create new data frame with only epsilon_t-k
newXDf <- xDf[,2:(length(t)+1)]

# Create new data frame for k, gamma_k, and rho_k
xkDf <- data.frame(k = seq(0, 500, by = 1))

#Calculate gamma_0 for rho_k calculation
xgamma_0 <- cov(xDf$x_t,xDf$x_t)
j <- 1 # current row for kDf

for(i in colnames(newXDf)){
  # Calculate gamma_k and rho_k
  xkDf$xgamma_k[j] <- cov(newXDf[j:500,i],newXDf$x_t[j:500])
  xkDf$xrho_k[j] <-  xkDf$xgamma_k[j]/xgamma_0
  j <- j+1 # increment j for next row
}
```

```
# Line plot of gamma_k vs k
plot(xkDf$k,xkDf$xgamma_K,type="l")
# Line plot of rho_k vs k
plot(xkDf$k,xkDf$xrho_k,type="l")

# Compute the min, max and plot the histogram
min(xDf$x_t)
max(xDf$x_t)
hist(xDf$x_t)
```