

1 Question 1

- 1.1 Design an R function (or use another programme if you prefer) to evaluate the empirical ACF for a given series up to a specified maximum lag and plots it along with a data plot.

```
my.acf <- function(y, lag) {  
  
  N <- length(y)  
  y.mean <- mean(y)  
  
  out <- numeric(lag + 1)  
  out[1] <- var(y)  
  
  # Evaluating ACF for each lag  
  for(h in 2:(lag + 1)) {  
    temp <- 0.0  
    for(t in 1:(N-(h-1))) {  
      temp <- temp + (y[t] - y.mean)*(y[t+(h-1)] - y.mean)  
    }  
    out[h] <- temp/N  
  }  
  
  # Plotting ACF and time series  
  par(mfrow = c(2, 1))  
  grid <- seq(from = 0, to = lag, len = length(out))  
  plot.ts(y, type = "l", ylab = expression(Y[t]))  
  plot(grid, out, type = "h", main = "ACF", xlab = "Lag", ylab = "ACF")  
  abline(h = 0)  
  par(mfrow = c(1, 1))  
}
```

- 1.2 Take $Y_t = \epsilon_t$ where ϵ_t is Gaussian white noise.