

Extra Practice Questions for Midterm 1

1. What would be the result from running the following code?

```
all( c(1,2,3,4,5) > 0)
```

2. Consider the following function

```
a_function <- function(n) {  
  out <- 0  
  for (i in 1:n) {  
    out <- out + i^2  
  }  
  out  
}
```

If you run the following code, what will it output?

```
a_function(5)
```

3. Suppose there are two random variables X and Y .
- a) If you know that X and Y are independent, do you know what their covariance is equal to? Explain. If yes, what is the covariance equal to?
 - b) If you know that $\text{cov}(X, Y) = 0$, are X and Y independent? Explain.
 - c) If you know that $\text{cov}(X, Y) = 1$, are X and Y independent? Explain.
4. Suppose that X_1 and X_2 are two random variables such that $\mathbb{E}[X_1] = 0$, $\mathbb{E}[X_2] = 5$, $\text{var}(X_1) = 1$, $\text{var}(X_2) = 10$ and $\text{cov}(X_1, X_2) = -1$. Suppose that $Y = X_1 + X_2$.
- a) What is $\mathbb{E}[Y]$?
 - b) What is $\text{var}(Y)$?

5. Suppose that we have a random sample of n observations of X and Y .
- a) Suppose that you want to estimate the covariance between X and Y using the data that we have. Propose an estimator for the covariance. **Hint:** Try using the analogy principle and the expression $\text{cov}(X, Y) = \mathbb{E}[XY] - \mathbb{E}[X]\mathbb{E}[Y]$.
 - b) Alternatively, the definition of covariance is $\text{cov}(X, Y) = \mathbb{E}[(X - \mathbb{E}[X])(Y - \mathbb{E}[Y])]$. Propose an estimator for the covariance based on this expression. Would you expect this to give you the same estimate of the covariance as in part a?