Two-Stock Portfolio

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Here, I am adapting the lab associated with Chapter 5 of the textbook.

There is no reason for us to repeatedly be doing this, but this is the first time we are using the library associated with the book. So, it's a good idea to install the package `ISLR2` and make the library accessible.

```
library(ISLR2)
#Portfolio
```

Here is the content by *Hastie and Tibshirani*:

One of the great advantages of the bootstrap approach is that it can be applied in almost all situations. No complicated mathematical calculations are required. Performing a bootstrap analysis in `R` entails only two steps. First, we must create a function that computes the statistic of interest.

```
alpha.fn<-function(data, index){
  X=data$X[index]
  Y=data$Y[index]
  (var(Y)-cov(X,Y))/(var(X)+var(Y)-2*cov(X,Y))
}
alpha.fn(Portfolio, 1)
```

```
## [1] NA
```

Second, we use the `boot()` function, which is part of the `boot` library, to perform the bootstrap by repeatedly sampling observations from the data set with replacement.

The `Portfolio` data set in the `ISLR2` package is simulated data of 100 pairs of returns, generated in the fashion described in Section 5.2. To illustrate the use of the bootstrap on this data, we must first create a function, `alpha.fn()`, which takes as input the (X, Y) data as well as a vector indicating which observations should be used to estimate α. The function then outputs the estimate for α based on the selected observations.*

This function **returns** *, or outputs, an estimate for α based on applying (5.7) from the book to the observations indexed by the argument `index`. For instance, the following command tells `R` to estimate α using all* 100 *observations.*

The next command uses the `sample()` function to randomly select 100 observations from the range 1 to 100, with replacement. This is equivalent to constructing a new bootstrap data set and recomputing $\hat{\alpha}$ based on the new data set.

We can implement a bootstrap analysis by performing this command many times, recording all of the corresponding estimates for α, and computing the resulting standard deviation. However, the `boot()` function automates this approach. Below we produce $R = 1,000$ bootstrap estimates for α.

The final output shows that using the original data, $\hat{\alpha} = ...$, and that the bootstrap estimate for $\mathrm{SE}(\hat{\alpha})$ is $\ldots$.