-Solutions Manual-

Actuarial Statistics with R

Theory and Case Studies

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Chapter 2

Case Study: Implementing the Capital Asset Pricing Model

Answer 2.1 If we do not specify `stringsAsFactors=FALSE` in the call of `read.csv`, the dates are automatically converted to factors. As a result, the mode of the Date variable is numeric.

Answer 2.2 We can convert the vector of strings to a vector of dates as follows

```
as.Date(mfc$Date, '%Y-%m-%d')
```

Answer 2.3

(a) We can write the function `calculateStd(x)` as follows:

```
calculateStd <- function(x) {
  n <- length(x)
  barx <- sum(x) / n
  varx <- sum( (x-barx)^2 ) / (n-1)
  return(sqrt(varx))
}
```

Calling `calculateStd(dat10y$mfc)` returns 0.1145846.

(b) We can write the function `calculateCorr(x,y)` as follows:

```
calculateCorr <- function(x, y) {
  n <- length(x)
  barx <- sum(x) / n
  bary <- sum(y) / n
```

```
  sx <- calculateStd(x)
  sy <- calculateStd(y)
  covxy <- sum( (x - barx) * (y - bary)) / (n - 1)
  return( covxy / (sx * sy ))
}
```

Calling `calculateCorr(dat10y$mfc, dat10y$sp500)` returns 0.725671.

Answer 2.4 We can calculate the regression coefficients using the formulas as follows:

```
r <- with(dat10y, cor(mfc, sp500))
sx <- with(dat10y, sd(sp500))
sy <- with(dat10y, sd(mfc))
barx <- with(dat10y, mean(sp500))
bary <- with(dat10y, mean(mfc))
beta <- r * sy / sx
alpha <- bary - beta * barx
```

Answer 2.5

(a) We can calculate the sum as follows:

```
barx <- mean(x)
sx <- sd(x)
n <- length(x)
w <- (x - barx) / (sx^2 * (n-1))
sum(w * y)
```

(b) Yes, the value of the sum is equal to the slope estimate $\hat{\beta}$.

Answer 2.6

(a) We can calculate these quantities as follows:

```
haty <- fit$fitted.values
bary <- mean(dat10y$mfc)
SST <- sum( (dat10y$mfc - bary)^2 )
SSE <- sum( (dat10y$mfc - haty)^2 )
SSR <- sum( (haty - bary)^2 )
SSE + SSR - SST
```