Introduction (1A)

Young W. Lim
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Please send corrections (or suggestions) to youngwlim@hotmail.com.

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Create Ordered Collection

```
> x <- c(1,2,3,4,5,6)    # Create ordered collection (vector)

> y <- x^2               # Square the elements of x

> print(y)               # print (vector) y
[1]  1  4  9 16 25 36

> mean(y)                # Calculate average (arithmetic mean) of (vector) y;
                         # result is scalar
[1] 15.16667

> var(y)                 # Calculate sample variance
[1] 178.9667
```

Linear Regression Model

```
> lm_1 <- lm(y ~ x)      # Fit a linear regression model "y = f(x)" or
                         # "y = B0 + (B1 * x)"
                         # store the results as lm_1

> print(lm_1)            # Print the model from the (linear model object) lm_1

Call:
lm(formula = y ~ x)

Coefficients:
(Intercept)          x
     -9.333       7.000
```

Summary

```
> summary(lm_1)          # Compute and print statistics for the fit
                         # of the (linear model object) lm_1

Call:
lm(formula = y ~ x)

Residuals:
1       2       3       4       5       6
3.3333 -0.6667 -2.6667 -2.6667 -0.6667  3.3333

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  - 9.3333     2.8441  -3.282 0.030453 *
x              7.0000     0.7303   9.585 0.000662 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 3.055 on 4 degrees of freedom
Multiple R-squared: 0.9583,     Adjusted R-squared: 0.9478
F-statistic: 91.88 on 1 and 4 DF,  p-value: 0.000662
```

Plot

```
> par(mfrow=c(2, 2))  # Request 2x2 plot layout
> plot(lm_1)          # Diagnostic plot of regression model
```

Regression : Linear Model

Y ~ A Y = βo + β1
A Straight-line with an implicit y-intercept

Y ~ -1 + A Y = β1
A Straight-line with no y-intercept; that is, a fit forced through (0,0)

Y ~ A + I(A^2) Y = βo+ β1A + β2A2
Polynomial model; note that the identity function I( ) allows terms in the model to include normal mathematical symbols.

Y ~ A + B Y = βo+ β1A + β2B
A first-order model in A and B without interaction terms.

Y ~ A:B Y = βo + β1AB
A model containing only first-order interactions between A and B.

Y ~ A*B Y = βo+ β1A + β2B + β3AB
A full first-order model with a term; an equivalent code is Y ~ A + B + A:B.

Y ~ (A + B + C)^2 Y = βo+ β1A + β2B + β3C + β4AB + β5AC + β6AC
A model including all first-order effects and interactions up to the nth order, where n is given by ( )^n. An equivalent code in this case is Y ~ A*B*C – A:B:C.

References

[1] en.wikipedia.org
[2] en.wiktionary.org
[3] https://en.wikibooks.org/wiki/R_Programming
[4] http://www.montefiore.ulg.ac.be/ Using R for Linear Regression