HW4_Salem

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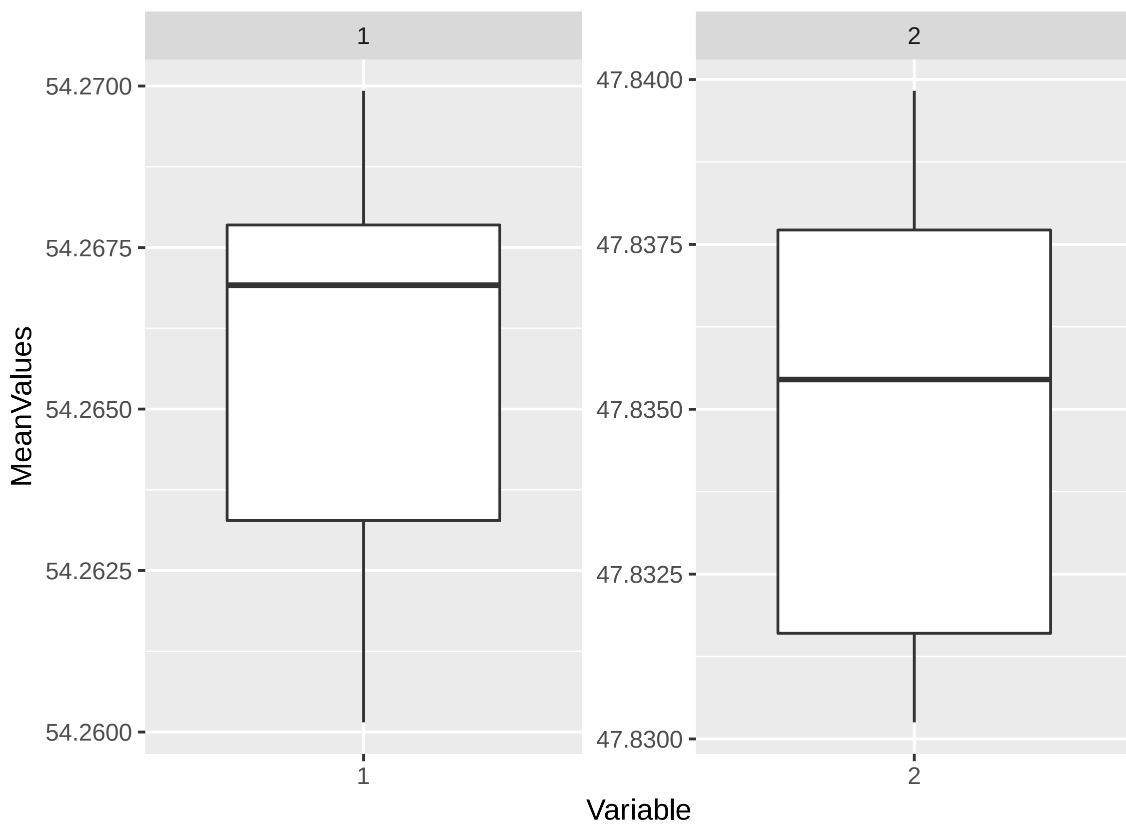
I concluded that there is value in adopting a specific style. Personally, given my current coding style, I've resolved to evolve my style to follow the conventions of using BigCamelCase and not using the attach function.

The main recommendation I received was to add spaces between my operators. I was also pointed towards not having my code exceed 80 characters per line.

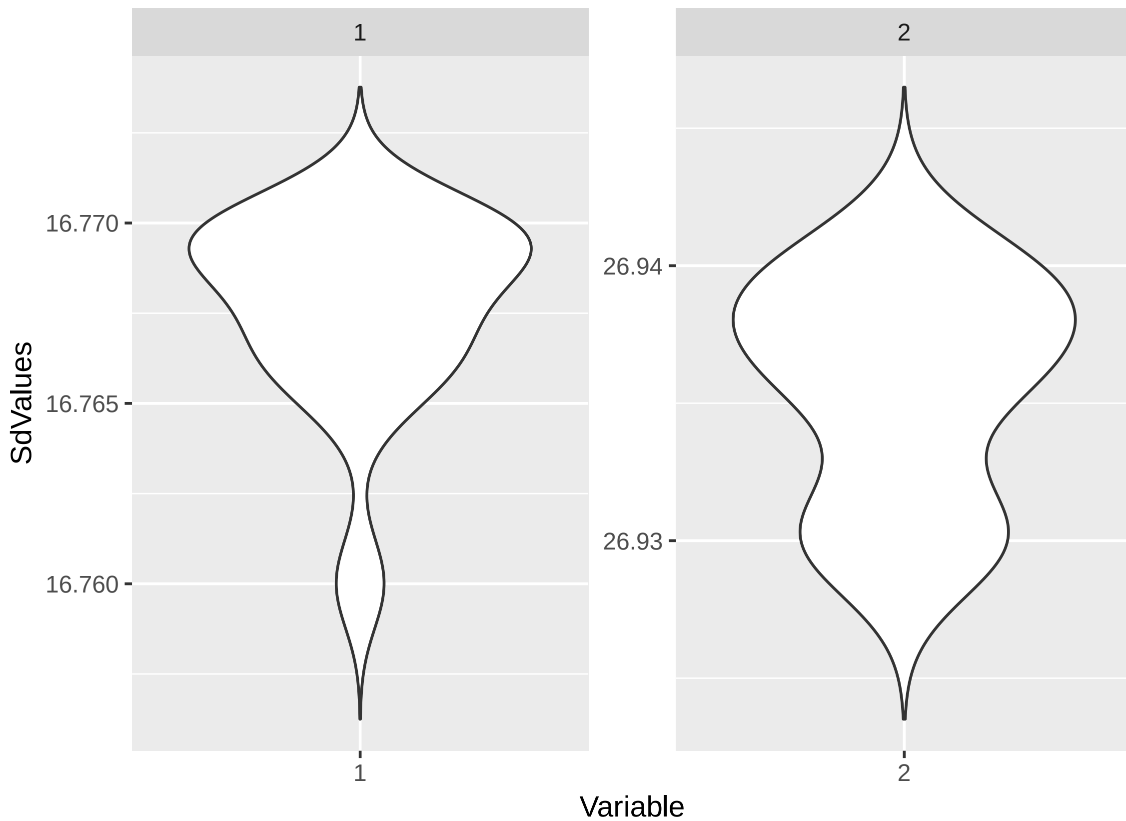
```
# Read and import the object
data <- readRDS(file = "D:/Vtech/Statistical Programming/HW4_data.rds")

# A function that takes the dataset and performs a number of
# prespecified exploratory analyses on them
AnalyzeData <- function(x) {
    SumData <- x
    names(SumData) <- c("Observer", "Var_1", "Var_2")
    SumData <- SumData %>% group_by(Observer) %>% summarise(dev1_mean = mean(Var_1,
        na.rm = T), dev2_mean = mean(Var_2, na.rm = T), dev1_sd = sd(Var_1,
        na.rm = T), dev2_sd = sd(Var_2, na.rm = T), dev_corr = cor(Var_1,
        Var_2, method = "pearson"))

    SumDataMelted <- data.frame(matrix(rep(c(1, 2), each = length(SumData$dev1_mean),
        nrow = length(SumData$dev1_mean), ncol = 1)))
    names(SumDataMelted) <- c("Variable")
    RowMeltmean <- rbind(data.frame(means = SumData$dev1_mean), data.frame(means = SumData$dev2_mean))
    RowMeltsd <- rbind(data.frame(means = SumData$dev1_sd), data.frame(means = SumData$dev2_sd))
    SumDataMelted <- data.frame(cbind(as.factor(SumDataMelted$Variable),
        RowMeltmean$means, RowMeltsd))
    names(SumDataMelted) <- c("Variable", "MeanValues", "SdValues")
    SumDataMelted$Variable <- as.factor(SumDataMelted$Variable)

    bxplt <- ggplot(data = SumDataMelted, aes(x = Variable, y = MeanValues)) +
        geom_boxplot()

    plotB <- bxplt + facet_wrap(~Variable, scales = "free")

    vlnplot <- ggplot(data = SumDataMelted, aes(x = Variable, y = SdValues)) +
        geom_violin(trim = FALSE)

    plotA <- vlnplot + facet_wrap(~Variable, scales = "free")

    return(list(SumData, plotB, plotA))
}
```

```r
# Testing out our function
AnalyzeData(data)
```

```
## [[1]]
## # A tibble: 13 x 6
##    Observer dev1_mean dev2_mean dev1_sd dev2_sd dev_corr
##       <dbl>     <dbl>     <dbl>   <dbl>   <dbl>    <dbl>
##  1        1      54.3      47.8    16.8    26.9  -0.0641
##  2        2      54.3      47.8    16.8    26.9  -0.0686
##  3        3      54.3      47.8    16.8    26.9  -0.0683
##  4        4      54.3      47.8    16.8    26.9  -0.0645
##  5        5      54.3      47.8    16.8    26.9  -0.0603
##  6        6      54.3      47.8    16.8    26.9  -0.0617
##  7        7      54.3      47.8    16.8    26.9  -0.0685
##  8        8      54.3      47.8    16.8    26.9  -0.0690
##  9        9      54.3      47.8    16.8    26.9  -0.0686
## 10       10      54.3      47.8    16.8    26.9  -0.0630
## 11       11      54.3      47.8    16.8    26.9  -0.0694
## 12       12      54.3      47.8    16.8    26.9  -0.0666
## 13       13      54.3      47.8    16.8    26.9  -0.0656
##
## [[2]]
```




```
##
## [[3]]
```


1
2
SdValues
16.770
16.765
16.760
26.94
26.93
1
2
Variable

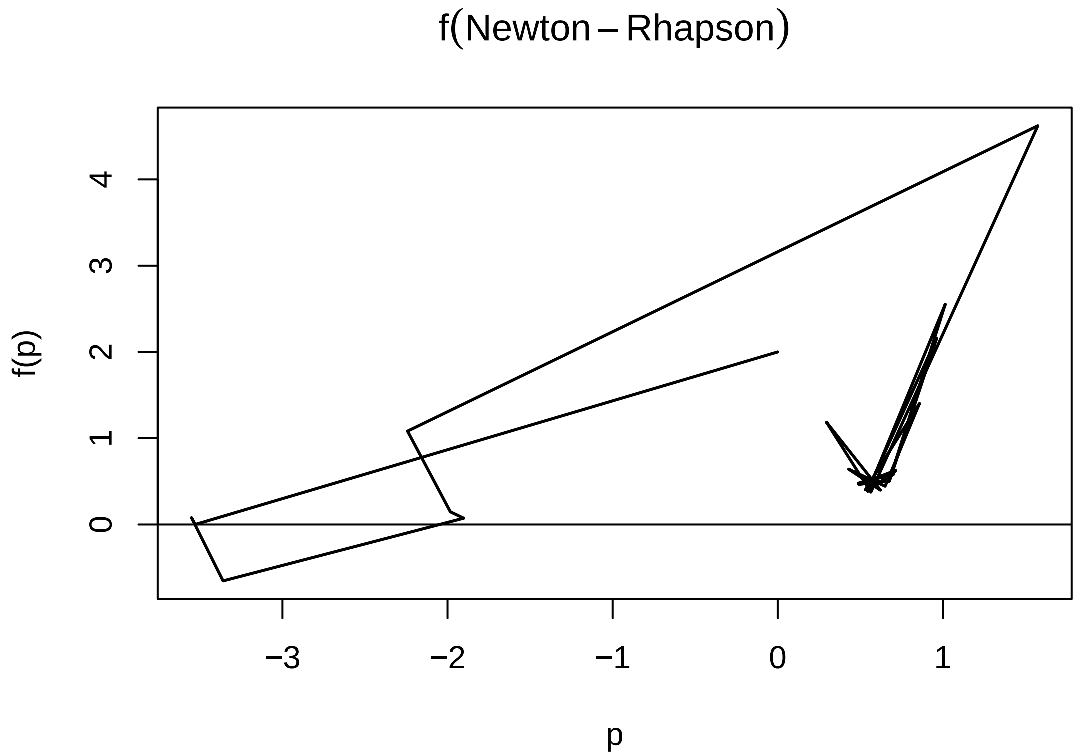
```r
# A function to implement the Riemann sum method of finding areas
# with the arguments a, b, f, eps, N, representing the starting
# point of a continuous domain, the ending point of a continuous
# domain, our function, our tolerance level, and maximum number of
# iterations, respectively.
RamenSum <- function(a, b, f, eps = 1e-06, N = 10000) {
    i = 1
    h = 1
    SliceWidths = numeric(N)
    SliceWidths[1] = h
    IntrmSoln = numeric(N)
    RSum = 0
    cdf = integrate(f, 0, 1)
    while (abs(RSum - cdf$value) > eps) {
        Pts = seq(a, b, by = h)
        NumPts = length(Pts)
        midpts = 0.5 * (Pts[2:NumPts] + Pts[1:(NumPts - 1)])
        RSum = sum(h * f(midpts))
        h = 0.5 * h
        i = i + 1
        SliceWidths[i] = h
    }
    return(list(paste("Solution = ", RSum), paste("Soln Slice Width = ",
        h), paste("True Integral = ", cdf$value), SliceWidths[1:(i -
        1)]))
}
```

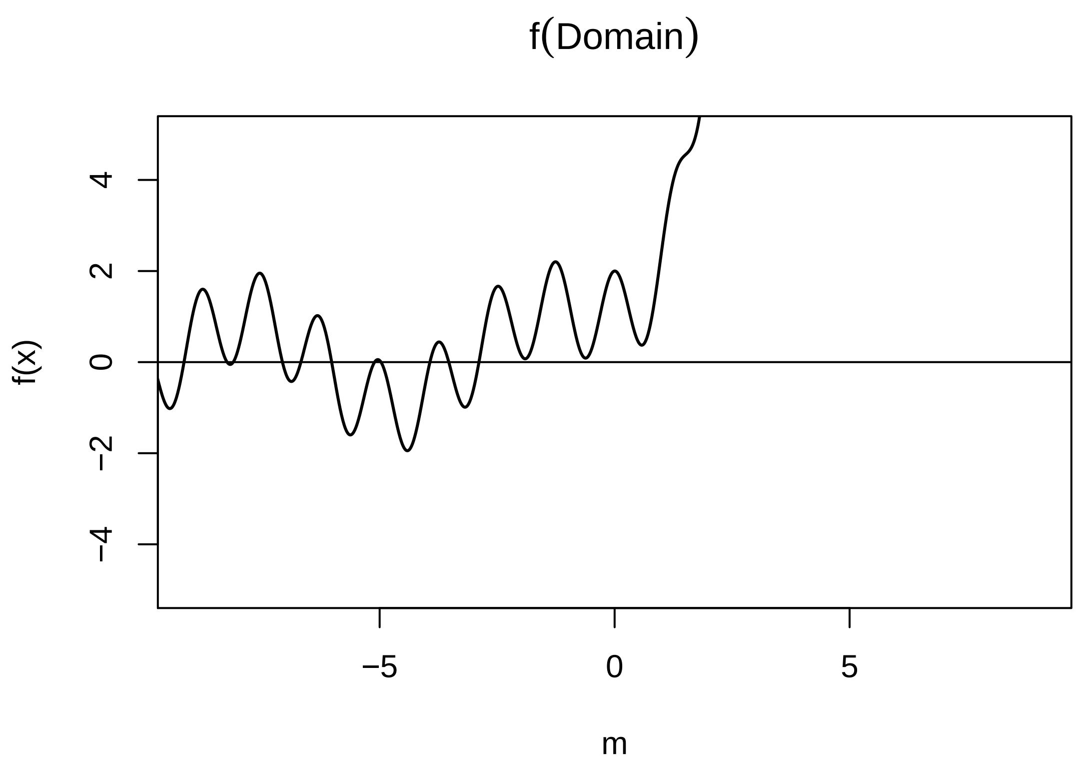
```r
# Testing out our function
f <- function(x) {
    exp(-(x^2)/2)
}
RamenSum(0, 1, f)
```

```
## [[1]]
## [1] "Solution =  0.8556247775143"
##
## [[2]]
## [1] "Soln Slice Width =  0.001953125"
##
## [[3]]
## [1] "True Integral =  0.855624391892149"
##
## [[4]]
## [1] 1.00000000 0.50000000 0.25000000 0.12500000 0.06250000 0.03125000
## [7] 0.01562500 0.00781250 0.00390625
```

```r
# A function to implement the Newton-Rhapson method of finding
# roots with the arguments f, eps, x0, N, representing our
# function, our tolerance level, our initial guess, and maximum
# number of iterations, respectively. Function adapted from code
# by Yin Zhao, available at:
# https://www.academia.edu/7031789/Newton-Raphson_Method_in_R
# Adapted on 9/24/2019

NewtonRhapson <- function(f, eps = 0.001, x0 = 1, N = 10000) {
    h = 0.001
    i = 1
    x1 = x0
    xstatic = x0
    p = numeric(N)
    while (i <= N) {
        derv = (f(x0 + h) - f(x0))/h
        x1 = (x0 - (f(x0)/derv))
        p[i] = x1
        i = i + 1
        if (abs(x1 - x0) < eps)
            break
        x0 = x1
    }

    m <- seq(-50, 50, length = 10000)
    RootGrph <- plot(p, f(p), type = "l", lwd = 1.5, main = expression(f(Newton -
        Rhapson), xlim = c(-9, 9), ylim = c(-5, 5), ylab = "f(x)"))
    abline(h = 0)
    FnGrph <- plot(m, f(m), type = "l", lwd = 1.5, main = expression(f(Domain)),
        xlim = c(-9, 9), ylim = c(-5, 5), ylab = "f(x)")
    abline(h = 0)

    return(list(paste("Solution = ", x1), paste("tolerance = ", eps),
        paste("Initial Guess = ", xstatic), paste("Initial Interval = ",
            xstatic, " to ", xstatic + h), Solution_Iterations = p[1:(i -
            1)], RootGrph, FnGrph))
}
```

```r
# Testing Out Our Function
f <- function(x) {
    3^x - sin(x) + cos(5 * x)
}
NewtonRhapson(f)
```


f(Newton – Rhapson)
f(p)
4
3
2
1
0
−3
−2
−1
0
1
p


f(Domain)
f(x)
4
2
0
−2
−4
−5
0
5
m

```
## [[1]]
## [1] "Solution =  -3.52872159591386"
##
## [[2]]
## [1] "tolerance =  0.001"
##
## [[3]]
## [1] "Initial Guess =  1"
##
## [[4]]
## [1] "Initial Interval =  1  to  1.001"
##
## $Solution_Iterations
##  [1]  0.6764805  0.4917700  0.7107228  0.5426332  0.9624917  0.6772893
##  [7]  0.4932623  0.7141221  0.5466665  1.0147837  0.6741682  0.4873978
## [13]  0.7013121  0.5306938  0.8584602  0.6502529  0.4295528  0.6220424
## [19]  0.2955926  0.5640025  1.5752758 -2.2422711 -1.9828445 -1.9018960
## [25] -3.3596057 -3.5505636 -3.5280662 -3.5287216
##
## [[6]]
## NULL
##
## [[7]]
## NULL
```