MATH208-A4

Christopher Zheng. ID: 260760794

15/11/2019

ceramic\_data<-dget("ceramic.txt")

1. What class of object is ceramic\_data?

class(ceramic\_data)

## [1] "array"

1. Using the ceramic\_data object, compute the median Mean\_Strength by Batch, i.e. write a line of code that produces a vector that computes the mean of all observations in each batch, respectively. What is the difference in mean by Batch?

# Batch 1  
# avg\_batch\_1 <- sum(ceramic\_data[1:2,1:2,1:2,1:2,1:1][1:16]) / 16  
# Batch 2  
# avg\_batch\_2 <- sum(ceramic\_data[1:2,1:2,1:2,1:2,2:2][1:16]) / 16  
# difference <- abs(avg\_batch\_1 - avg\_batch\_2)  
# avg\_vector <- c(avg\_batch\_1,avg\_batch\_2)  
# print(avg\_vector) # the vector of the two averages  
# print(difference) # the absolute difference between two mean values  
m\_by\_Batch <- apply(ceramic\_data, c(5), median)  
print(m\_by\_Batch)

## Batch 1 Batch 2   
## 605.185 548.015

diff\_by\_Batch <- unname(m\_by\_Batch[1] - m\_by\_Batch[2])  
print(diff\_by\_Batch)

## [1] 57.17

1. Compute the overall standard deviation of the Mean\_Strength values across all 32 observations. Hint: remember that this type of object is stored internally as an generic vector.

all\_obs <- c(ceramic\_data[1:2,1:2,1:2,1:2,1:2][1:32])  
std\_dev <- sd(all\_obs)  
print(std\_dev)

## [1] 112.2785

1. Using the ceramic\_data object, compute the average Mean\_Strength for each of the four groups defined by the cross-classification of Table\_Speed and Direction. Hint: the most succinct way to do this would return a 2x2 table with Table\_Speed levels in the rows and Direction levels in the columns.

#sum\_table <- ceramic\_data[,1,1,,1] + ceramic\_data[,2,1,,1] + ceramic\_data[,1,2,,1] + ceramic\_data[,1,1,,2] +   
# ceramic\_data[,1,2,,2] + ceramic\_data[,2,2,,1] + ceramic\_data[,2,1,,2] + ceramic\_data[,2,2,,2]  
#output\_table <- sum\_table / 8  
output\_table <- apply(ceramic\_data, c(1,4), mean)  
print(output\_table)

## Direction  
## Table\_Speed Longitudinal Transverse  
## Slow 647.9987 435.2200  
## Fast 644.2663 460.0987

1. Compute the difference in means between the Longitudinal and Transverse levels of Direction for each level of Slow and Fast separately. Hint: Use part (d) and the apply function.

# helper function to calculate the difference of the means and to return the absoluate value of the difference  
abs\_diff <-function(x){  
 return(abs(x[[1]]-x[[2]]))  
}  
# apply the difference function horizontally  
apply(output\_table,1,abs\_diff)

## Slow Fast   
## 212.7787 184.1675