

MATH208-A4

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15/11/2019

```
ceramic_data<-dget("ceramic.txt")
```

(a) What class of object is ceramic_data?

```
class(ceramic_data)
```

```
## [1] "array"
```

(b) 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
```

(c) 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
```

(d) 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] + ce
ramic_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

```

- (e) 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
absolute 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

```