Homework 1

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Problem Set #1

Problem 1 - Wine Data

```
wine <- read.csv("wine.data", header = FALSE)
#wine
wine_name <- read.csv("wine.names",header = FALSE)
#wine_name
```

a.

```
names(wine) <- c("class","alcohol_content","malic_acid","ash","alcalanity",
                  "magnesium","phenols","flavaniods","nonflavanoiids",
                  "proanthocyanins","color_intensity","hue","od280","proline")
#wine
```

b.

```
table(wine$class)
```

```

 1  2  3
59 71 48
```

The “wine.names” dataset reports the number of instances per class, with class 1 having 59 instances, class 2 having 71 instances, and class 3 having 48 instances. Therefore, the number of wines within each class is correctly calculated here as reported in “wine.names”.

c. (1)

```r
correlation <- cor(wine$alcohol_content, wine$color_intensity)
correlation
```

```
[1] 0.5463642
```

(2)

```r
library(dplyr)
```

```

Attaching package: 'dplyr'

The following objects are masked from 'package:stats':

    filter, lag

The following objects are masked from 'package:base':

    intersect, setdiff, setequal, union
```

```r
correlations <- wine %>% group_by(class) %>%
  summarize(correlation=cor(alcohol_content,color_intensity))
highest <- correlations %>% filter(correlation == max(correlation))
lowest <- correlations %>% filter(correlation == min(correlation))
highest
```

```
# A tibble: 1 x 2
  class correlation
  <int>       <dbl>
1     1       0.408
```

```r
lowest
```

```
# A tibble: 1 x 2
  class correlation
  <int>       <dbl>
1     2       0.270
```

The class 1 has the highest correlation between alcohol content and color intensity, which is 0.4082913. The class 2 has the lowest, which is 0.2697891.

(3)

```r
wine[which.max(wine$color_intensity), "alcohol_content"]
```

```
[1] 14.34
```

(4)

```r
mean(wine$proanthocyanins > wine$ash) * 100
```

```
[1] 8.426966
```

d.

```r
overall_means <- colMeans(wine[, -1])
class1_means <- colMeans(wine[wine$class == 1, -1])
class2_means <- colMeans(wine[wine$class == 2, -1])
class3_means <- colMeans(wine[wine$class == 3, -1])
means <- rbind(overall_means,class1_means, class2_means,class3_means)
means <- as.data.frame(means)
rownames(means) <- c("Overall", "Class 1", "Class 2", "Class 3")
means
```

```
        alcohol_content malic_acid      ash alcalanity magnesium  phenols
Overall        13.00062   2.336348 2.366517   19.49494  99.74157 2.295112
Class 1        13.74475   2.010678 2.455593   17.03729 106.33898 2.840169
Class 2        12.27873   1.932676 2.244789   20.23803  94.54930 2.258873
Class 3        13.15375   3.333750 2.437083   21.41667  99.31250 1.678750
        flavaniods nonflavanoiids proanthocyanins color_intensity       hue
Overall  2.0292697      0.3618539        1.590899        5.058090 0.9574494
Class 1  2.9823729      0.2900000        1.899322        5.528305 1.0620339
Class 2  2.0808451      0.3636620        1.630282        3.086620 1.0562817
Class 3  0.7814583      0.4475000        1.153542        7.396250 0.6827083
           od280   proline
Overall 2.611685  746.8933
Class 1 3.157797 1115.7119
Class 2 2.785352  519.5070
Class 3 1.683542  629.8958
```

e.

```r
t.test(wine$phenols[wine$class == 1], wine$phenols[wine$class == 2])
```

```

	Welch Two Sample t-test

data:  wine$phenols[wine$class == 1] and wine$phenols[wine$class == 2]
t = 7.4206, df = 119.14, p-value = 1.889e-11
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.4261870 0.7364055
sample estimates:
mean of x mean of y 
 2.840169  2.258873 
```

```r
t.test(wine$phenols[wine$class == 1], wine$phenols[wine$class == 3])
```

```

	Welch Two Sample t-test

data:  wine$phenols[wine$class == 1] and wine$phenols[wine$class == 3]
t = 17.12, df = 98.356, p-value < 2.2e-16
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 1.026801 1.296038
sample estimates:
mean of x mean of y 
 2.840169  1.678750 
```

```r
t.test(wine$phenols[wine$class == 2], wine$phenols[wine$class == 3])
```

```

	Welch Two Sample t-test

data:  wine$phenols[wine$class == 2] and wine$phenols[wine$class == 3]
t = 7.0125, df = 116.91, p-value = 1.622e-10
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.4162855 0.7439610
```

```
sample estimates:
mean of x mean of y
 2.258873  1.678750
```

The t-tests show that there are significant differences in phenol levels between all three class pairs, with very small p-values indicating that the differences in means are highly statistically significant.

Problem 2 - AskAManager.org Data

a.

```r
AAM <- read.csv("AskAManager.csv", header = FALSE)
#AAM
```

b.

```r
names(AAM) <- c("ID","Timestamp","Age","Industry","Job_Title",
                "Job_Title_Context","Annual_Salary","Additional_Compensation",
                "Currency","Other_Currency","Income_Context","Country",
                "State","City","Years_Professional_Experience_Overall",
                "Years_Professional_Experience_Field","Highest_Education",
                "Gender","Race")
#AAM
```

c.

```r
nrow(AAM)
```

```
[1] 28063
```

```r
nrow(AAM[AAM$Currency=="USD",])
```

```
[1] 23374
```

d.

```r
unique(AAM$Years_Professional_Experience_Field)
```

```
[1] "How.many.years.of.professional.work.experience.do.you.have.in.your.field."
[2] "5-7 years"
[3] "2 - 4 years"
[4] "21 - 30 years"
[5] "11 - 20 years"
[6] "1 year or less"
[7] "8 - 10 years"
[8] "31 - 40 years"
[9] "41 years or more"
```

```
unique(AAM$Years_Professional_Experience_Overall)
```

```
[1] "How.many.years.of.professional.work.experience.do.you.have.overall."
[2] "5-7 years"
[3] "8 - 10 years"
[4] "2 - 4 years"
[5] "21 - 30 years"
[6] "11 - 20 years"
[7] "1 year or less"
[8] "41 years or more"
[9] "31 - 40 years"
```

```
experience_vector <- c("1 year or less" ,"2 - 4 years", "5-7 years",
                       "8 - 10 years","11 - 20 years","21 - 30 years",
                       "31 - 40 years","41 years or more")

AAM_sub=AAM[AAM$Years_Professional_Experience_Overall>=
              AAM$Years_Professional_Experience_Field,]
cat("Number of observations before cleaning:", nrow(AAM), "\n")
```

```
Number of observations before cleaning: 28063
```

```
cat("Number of observations after cleaning:", nrow(AAM_sub[AAM_sub$Age>=18,]), "\n")
```

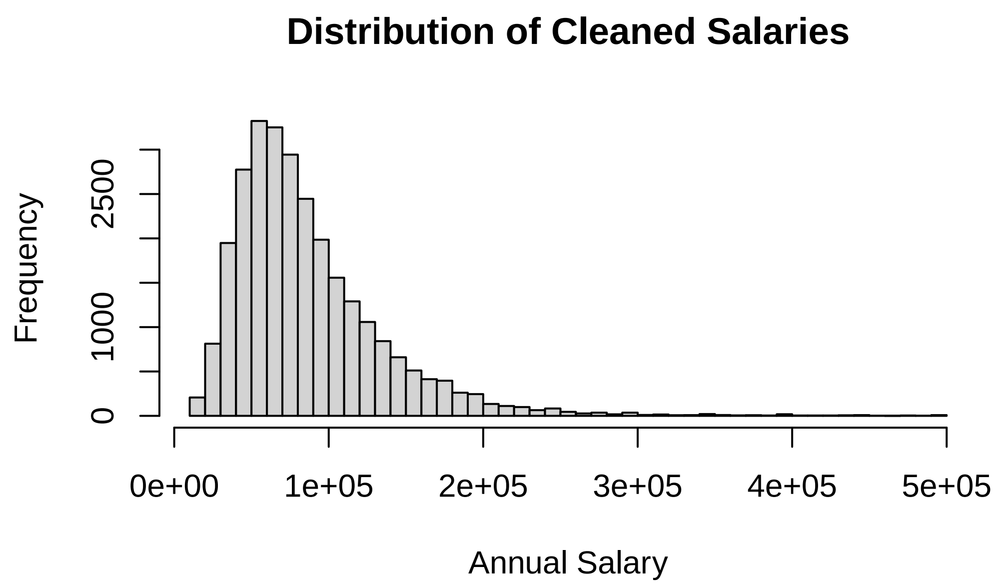
```
Number of observations after cleaning: 22773
```

e.

```
AAM$Annual_Salary <- as.numeric(as.character(AAM$Annual_Salary))
```

```
Warning: NAs introduced by coercion
```

```
AAM_cleaned <- AAM[AAM$Annual_Salary >= 12000 & AAM$Annual_Salary <= 500000, ]
hist(AAM_cleaned$Annual_Salary, breaks = 50, main = "Distribution of Cleaned Salaries",
     xlab = "Annual Salary")
```



Because the federal poverty line for an individual is around $12,000 annually in the U.S., I choose 12000 as the low salary threshold. For the high-income threshold decision, I'd go with 50,000, because that way the distribution of salary remains balanced and not overly skewed, making the data easier to interpret.

```
cat("Number of rows before eliminating extreme salaries:", nrow(AAM), "\n")
```

```
Number of rows before eliminating extreme salaries: 28063
```

```
cat("Number of rows after eliminating extreme salaries:", nrow(AAM_cleaned), "\n")
```

```
Number of rows after eliminating extreme salaries: 27724
```

Problem 3 - Palindromic Numbers

a.

```
isPalindromic <- function(num) {
  if (!is.numeric(num) || num <= 0 || floor(num) != num) {
    stop("Input should be a positive integer.")
  }
  reversed_str <- paste(rev(strsplit(as.character(num), "")[[1]]), collapse = "")
  reversed_to_num <- as.numeric(reversed_str)
  return(list(isPalindromic = (num == reversed_to_num), reversed = reversed_to_num))
}
isPalindromic(728827)
```

```
$isPalindromic
[1] TRUE

$reversed
[1] 728827
```

```
isPalindromic(39951)
```

```
$isPalindromic
[1] FALSE

$reversed
[1] 15993
```

b.

```
isPalindromic_logic <- function(num) {
  reversed_str <- paste(rev(strsplit(as.character(num), "")[[1]]), collapse = "")
  return(num == as.numeric(reversed_str))
}

nextPalindrome <- function(num) {
  if (!is.numeric(num)|| num <= 0 || floor(num) != num) {
    stop("Input should be a positive integer.")
  }
  next_num <- num + 1
  while (!isPalindromic_logic(next_num)) {
```

```
    next_num <- next_num + 1
  }
  return(next_num)
}
nextPalindrome(7152)
```

```
[1] 7227
```

```
nextPalindrome(765431537)
```

```
[1] 765434567
```

c.

```
cat("1.",nextPalindrome(391),"  ")
```

```
1. 393
```

```
cat("2.",nextPalindrome(9928),"  ")
```

```
2. 9999
```

```
cat("3.",nextPalindrome(19272719),"  ")
```

```
3. 19277291
```

```
cat("4.",nextPalindrome(109),"  ")
```

```
4. 111
```

```
cat("5.",nextPalindrome(2),"  ")
```

```
5. 3
```

Link to GitHub repository

https://github.com/LAREINA-SHAO/Yuchen-Shao.git

git@github.com:LAREINA-SHAO/Yuchen-Shao.git

It's my first time to use this platform, please contact me if I paste the wrong GitHub repository!