Lab 7

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Q1

```
x <- read.csv("https://tinyurl.com/UK-foods")
dim(x)
```

```
[1] 17  5
```

```
head(x)
```

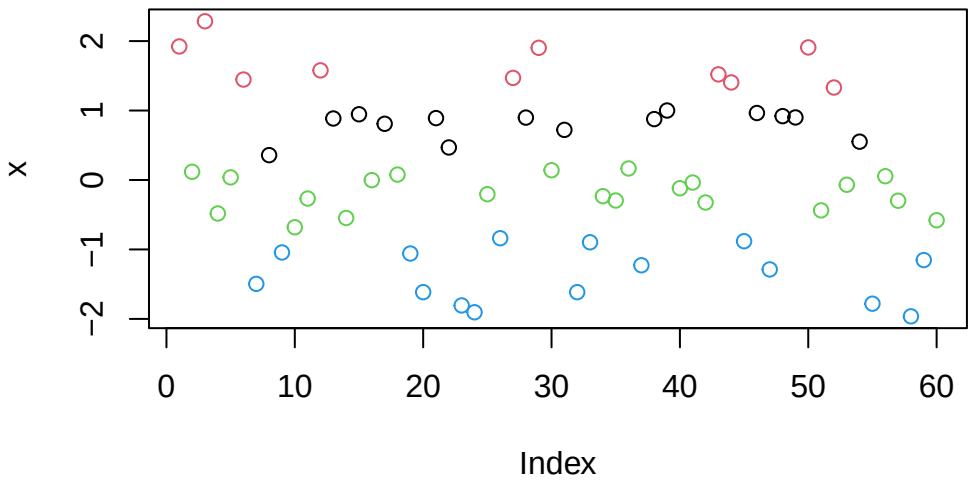
```
              X England Wales Scotland N.Ireland
1        Cheese     105   103      103        66
2  Carcass_meat     245   227      242       267
3    Other_meat     685   803      750       586
4          Fish     147   160      122        93
5 Fats_and_oils     193   235      184       209
6        Sugars     156   175      147       139
```

K means clustering

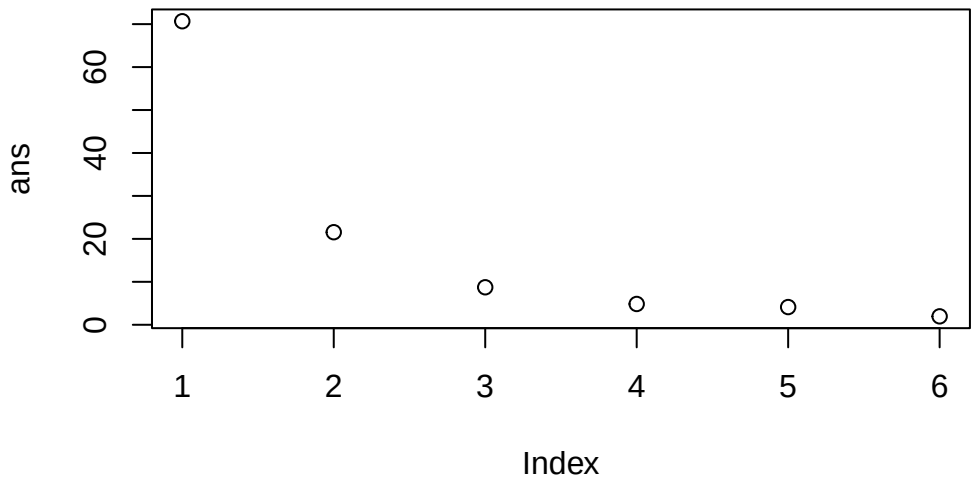
```
x<-(rnorm(60))
```

```
k<- kmeans(x, 4)
```

```
plot(x, col= k$cluster)
```

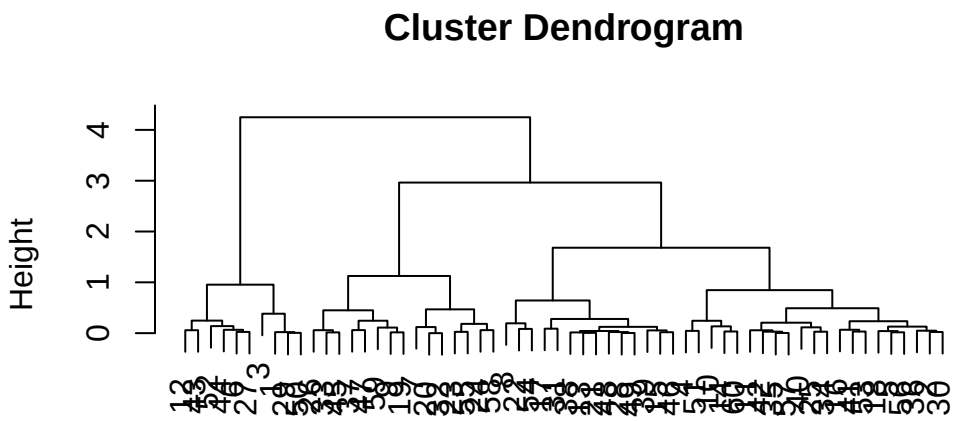



```
ans <- NULL
for (i in 1:6){
  ans <- c(ans, kmeans(x, centers=i)$tot.withinss)
}
plot(ans)
```

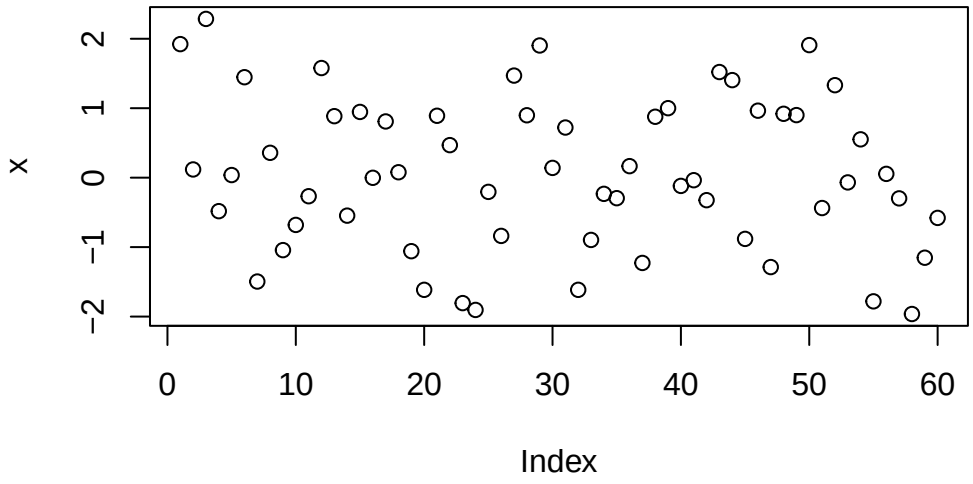



```
d<- dist(x)
hc <- hclust(d)
```

```
plot(hc)
```




```
grps <- cutree(hc, h=7)
plot(x, col= grps)
```



PCA

Q1 How many rows and columns are in your new data frame named x? What R functions could you use to answer this questions?

```
x <- read.csv("https://tinyurl.com/UK-foods")
dim(x)
```

```
[1] 17  5
```

```
head(x)
```

```
               X England Wales Scotland N.Ireland
1         Cheese     105   103      103        66
2  Carcass_meat      245   227      242       267
3    Other_meat      685   803      750       586
4           Fish     147   160      122        93
5 Fats_and_oils      193   235      184       209
6         Sugars     156   175      147       139
```

```
rownames(x) <- x[,1]
x <- x[,-1]
head(x)
```

```
              England Wales Scotland N.Ireland
Cheese            105   103      103        66
Carcass_meat      245   227      242       267
Other_meat        685   803      750       586
Fish              147   160      122        93
Fats_and_oils     193   235      184       209
Sugars            156   175      147       139
```

```
x <- read.csv("https://tinyurl.com/UK-foods", row.names=1)
head(x)
```

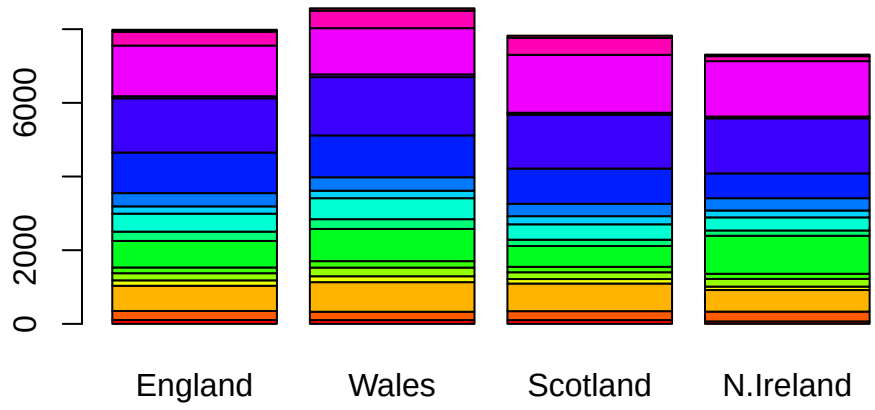
```
              England Wales Scotland N.Ireland
Cheese            105   103      103        66
Carcass_meat      245   227      242       267
Other_meat        685   803      750       586
Fish              147   160      122        93
Fats_and_oils     193   235      184       209
Sugars            156   175      147       139
```

Q2 Which approach to solving the 'row-names problem' mentioned above do you prefer and why? Is one approach more robust than another under certain circumstances? I like to read the names as it comes in via the url, since we don't have to deal with dropping a column after.

```
rainbow(nrow(x))
```

```
 [1] "#FF0000" "#FF5A00" "#FFB400" "#F0FF00" "#96FF00" "#3CFF00" "#00FF1E"
 [8] "#00FF78" "#00FFD2" "#00D2FF" "#0078FF" "#001EFF" "#3C00FF" "#9600FF"
[15] "#F000FF" "#FF00B4" "#FF005A"
```

```
barplot(as.matrix(x), beside=F, col=rainbow(nrow(x)))
```



Q3: Changing what optional argument in the above barplot() function results in the following plot? beside=F

```
library(tidyr)
```

```
Warning: package 'tidyr' was built under R version 4.3.3
```

```
# Convert data to long format for ggplot with `pivot_longer()`
x_long <- x |>
          tibble::rownames_to_column("Food") |>
          pivot_longer(cols = -Food,
                       names_to = "Country",
                       values_to = "Consumption")

dim(x_long)
```

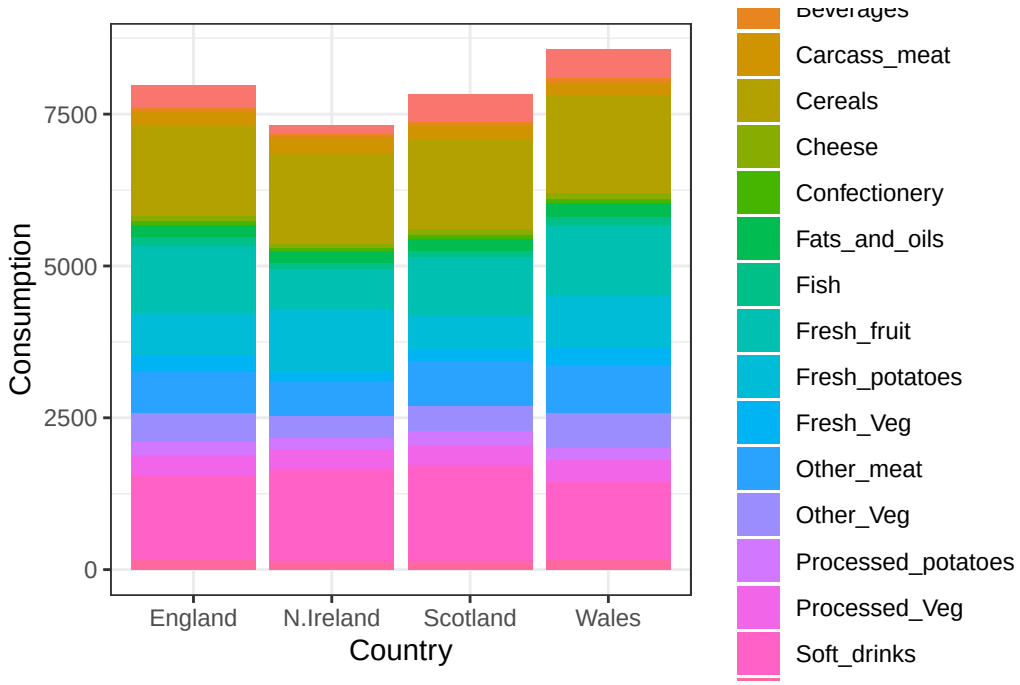
```
[1] 68  3
```

Q4: Changing what optional argument in the above ggplot() code results in a stacked barplot figure? Change position = "dodge" to "stack"

```
library(ggplot2)
```

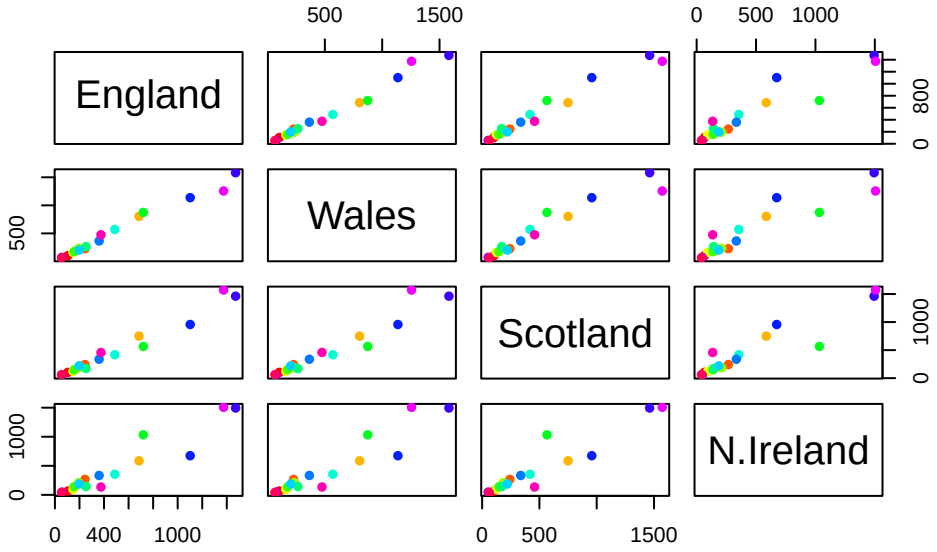
```
Warning: package 'ggplot2' was built under R version 4.3.3
```

```
ggplot(x_long) +
  aes(x = Country, y = Consumption, fill = Food) +
  geom_col(position = "stack") +
  theme_bw()
```



Q5: We can use the pairs() function to generate all pairwise plots for our countries. Can you make sense of the following code and resulting figure? What does it mean if a given point lies on the diagonal for a given plot? It is the correlation of the two countries together. Dots on the diagnol are the same for both countries on the axis.

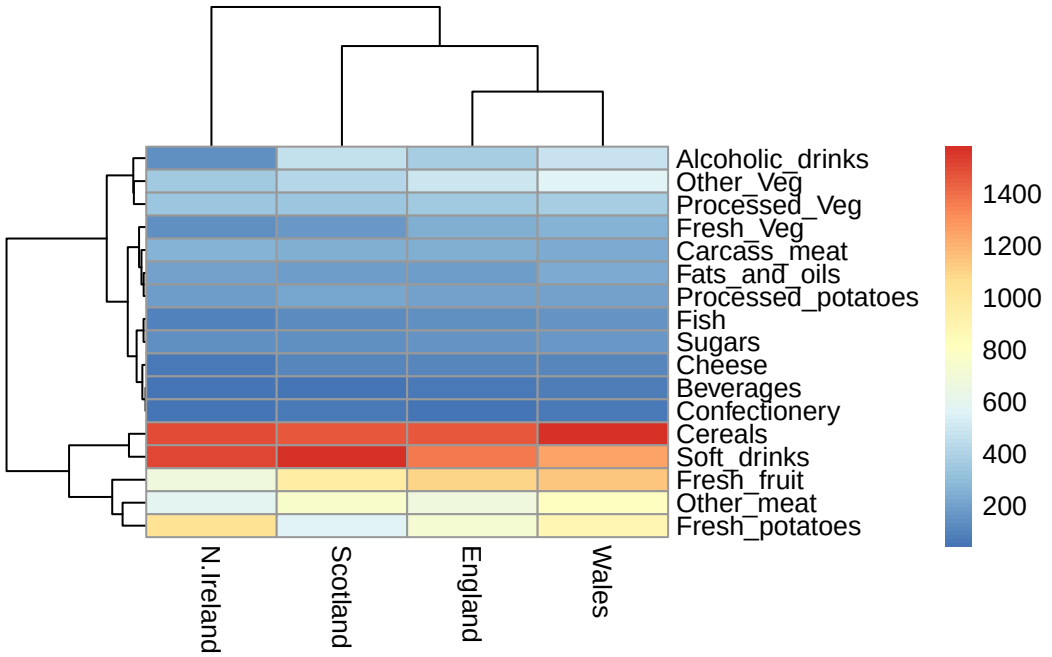
```
pairs(x, col=rainbow(nrow(x)), pch=16)
```



Q6. Based on the pairs and heatmap figures, which countries cluster together and what does this suggest about their food consumption patterns? Can you easily tell what the main differences between N. Ireland and the other countries of the UK in terms of this data-set? No, it's hard to tell

```
library(pheatmap)

pheatmap( as.matrix(x) )
```



PCA Time

```
t(x)
```

```
          Cheese Carcass_meat  Other_meat  Fish Fats_and_oils  Sugars
England      105           245         685  147            193    156
Wales        103           227         803  160            235    175
Scotland     103           242         750  122            184    147
N.Ireland     66           267         586   93            209    139
          Fresh_potatoes  Fresh_Veg  Other_Veg  Processed_potatoes
England              720        253        488                 198
Wales                874        265        570                 203
Scotland             566        171        418                 220
N.Ireland           1033        143        355                 187
          Processed_Veg  Fresh_fruit  Cereals  Beverages Soft_drinks
England             360         1102     1472         57         1374
Wales               365         1137     1582         73         1256
Scotland            337          957     1462         53         1572
N.Ireland           334          674     1494         47         1506
          Alcoholic_drinks  Confectionery
England                375             54
```

```
Wales                  475              64
Scotland               458              62
N.Ireland              135              41
```

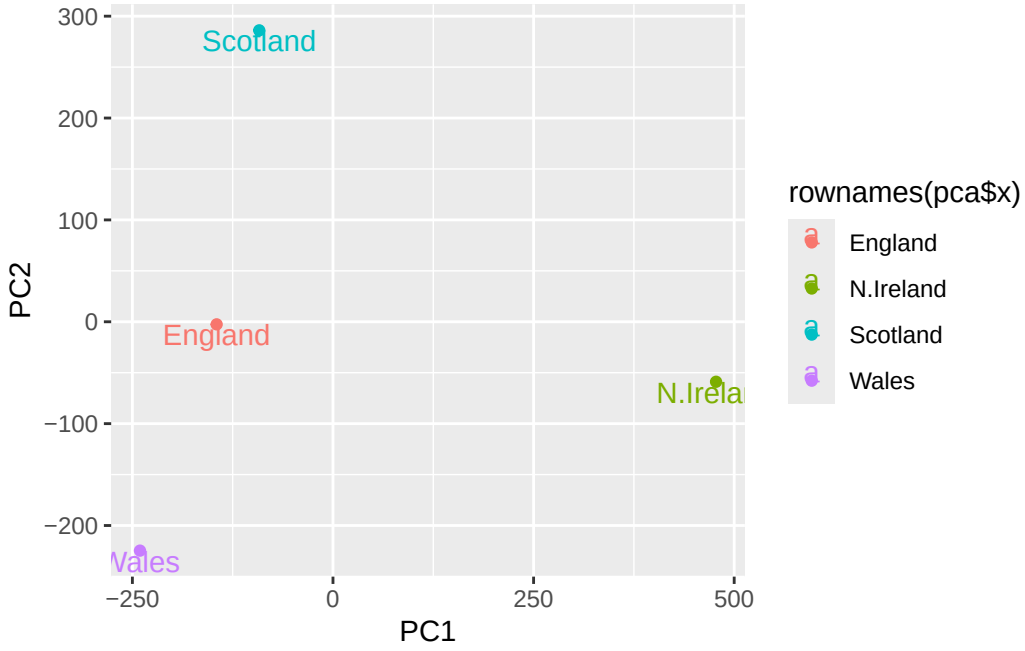
```
pca <- prcomp(t(x))

summary(pca)
```

```
Importance of components:
                            PC1      PC2      PC3       PC4
Standard deviation     324.1502 212.7478 73.87622 3.176e-14
Proportion of Variance   0.6744   0.2905  0.03503 0.000e+00
Cumulative Proportion    0.6744   0.9650  1.00000 1.000e+00
```

Q7. Complete the code below to generate a plot of PC1 vs PC2. The second line adds text labels over the data points. Q8. Customize your plot so that the colors of the country names match the colors in our UK and Ireland map and table at start of this document.

```
library(ggplot2)
ggplot(pca$x) + aes(PC1, PC2, label=rownames(pca$x), colour = rownames(pca$x)) + geom_point()
  ylab("PC2")
```



```
ggplot(pca$x) + aes(PC1, PC2, label=rownames(pca$x)) + geom_point()+ geom_text(vjust=1) + xla
  ylab("PC2")
```