```r
#1
library(tidyverse)
library(dplyr)
library(lubridate)
library(readxl)
library(ggplot2)
library(smooth)

getwd()
```

```
## [1] "/home/guest/RStudio Project Folder/EDA_Spring2024"
```

```r
#Importing the data & checking
Config1_Data <- read_excel("OtherSubjects/Qn3bConfig1.xlsx",col_names=TRUE)
glimpse(Config1_Data)
```

```
## Rows: 1,464
## Columns: 4
## $ Month                  <dbl> 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6,~
## $ Day                    <dbl> 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,~
## $ Hour                   <dbl> 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 1~
## $ `AC System Output (W)` <dbl> 0.000, 0.000, 0.000, 0.000, 0.000, 23.288, 226.~
```

```r
Config2_East_Data <- read_excel("OtherSubjects/Qn3bConfig2East.xlsx",col_names=TRUE)
```

```
## New names:
## * `` -> `...5`
```

```r
glimpse(Config2_East_Data)
```

```
## Rows: 1,464
## Columns: 5
## $ Month                          <dbl> 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6~
## $ Day                            <dbl> 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1~
## $ Hour                           <dbl> 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12~
## $ `AC System Output (W) - East`  <dbl> 0.000, 0.000, 0.000, 0.000, 0.000, 11.66~
## $ ...5                           <dbl> NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, ~
```

```r
Config2_West_Data <- read_excel("OtherSubjects/Qn3bConfig2West.xlsx",col_names=TRUE)
glimpse(Config2_West_Data)
```

```
## Rows: 1,464
## Columns: 4
## $ Month                          <dbl> 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6~
## $ Day                            <dbl> 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1~
## $ Hour                           <dbl> 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12~
## $ `AC System Output (W) - West`  <dbl> 0.000, 0.000, 0.000, 0.000, 0.000, 11.66~
```

```r
#Calculating Average Hourly Generation

#Configuration 1
AvgHourlyGen_Config1 <- aggregate(Config1_Data$`AC System Output (W)`, by = list(Config1_Data$Month, Co

colnames(AvgHourlyGen_Config1) <- c("Month", "Hour", "AC_Generation")

AvgHourlyGen_Config1 <- arrange(AvgHourlyGen_Config1, Month)

glimpse(AvgHourlyGen_Config1)
```

```
## Rows: 48
## Columns: 3
## $ Month         <dbl> 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6,~
## $ Hour          <dbl> 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16~
## $ AC_Generation <dbl> 0.00000, 0.00000, 0.00000, 0.00000, 0.00000, 28.26227, 1~
```

```r
#Configuration 2 (East)

AvgHourlyGen_Config2_East <- aggregate(Config2_East_Data$`AC System Output (W) - East`, by = list(Confi

colnames(AvgHourlyGen_Config2_East) <- c("Month", "Hour", "AC_Generation")

AvgHourlyGen_Config2_East <- arrange(AvgHourlyGen_Config2_East, Month)

glimpse(AvgHourlyGen_Config2_East)
```

```
## Rows: 48
## Columns: 3
## $ Month         <dbl> 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6,~
## $ Hour          <dbl> 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16~
## $ AC_Generation <dbl> 0.00000, 0.00000, 0.00000, 0.00000, 0.00000, 73.32117, 4~
```

```r
#Configuration 3 (West)
AvgHourlyGen_Config2_West <- aggregate(Config2_West_Data$`AC System Output (W) - West`, by = list(Confi

colnames(AvgHourlyGen_Config2_West) <- c("Month", "Hour", "AC_Generation")

AvgHourlyGen_Config2_West <- arrange(AvgHourlyGen_Config2_West, Month)

glimpse(AvgHourlyGen_Config2_West)
```

```
## Rows: 48
## Columns: 3
## $ Month         <dbl> 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6,~
## $ Hour          <dbl> 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16~
## $ AC_Generation <dbl> 0.00000, 0.00000, 0.00000, 0.00000, 0.00000, 14.17487, 7~
```

```r
#Plotting for Qn3b1

#Copying the Generation data from both configurations into 1 dataframe
```

```r
AvgHourlyGen <- cbind(AvgHourlyGen_Config1, AvgHourlyGen_Config2_East$AC_Generation, AvgHourlyGen_Confi
colnames(AvgHourlyGen) <- c("Month", "Hour", "Config1Gen", "Config2EastGen", "Config2WestGen")
AvgHourlyGen$Config2TotalGen <- AvgHourlyGen$Config2EastGen + AvgHourlyGen$Config2WestGen
glimpse(AvgHourlyGen)
```

```
## Rows: 48
## Columns: 6
## $ Month           <dbl> 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, ~
## $ Hour            <dbl> 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, ~
## $ Config1Gen      <dbl> 0.00000, 0.00000, 0.00000, 0.00000, 0.00000, 28.26227,~
## $ Config2EastGen  <dbl> 0.00000, 0.00000, 0.00000, 0.00000, 0.00000, 73.32117,~
## $ Config2WestGen  <dbl> 0.00000, 0.00000, 0.00000, 0.00000, 0.00000, 14.17487,~
## $ Config2TotalGen <dbl> 0.00000, 0.00000, 0.00000, 0.00000, 0.00000, 87.49603,~
```

```r
#Breaking up dataframe into one for June and one for December
AvgHourlyGen_June <- AvgHourlyGen[1:24,]
glimpse(AvgHourlyGen_June)
```

```
## Rows: 24
## Columns: 6
## $ Month           <dbl> 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, ~
## $ Hour            <dbl> 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, ~
## $ Config1Gen      <dbl> 0.00000, 0.00000, 0.00000, 0.00000, 0.00000, 28.26227,~
## $ Config2EastGen  <dbl> 0.00000, 0.00000, 0.00000, 0.00000, 0.00000, 73.32117,~
## $ Config2WestGen  <dbl> 0.00000, 0.00000, 0.00000, 0.00000, 0.00000, 14.17487,~
## $ Config2TotalGen <dbl> 0.00000, 0.00000, 0.00000, 0.00000, 0.00000, 87.49603,~
```

```r
tail(AvgHourlyGen_June)
```

```
##    Month Hour Config1Gen Config2EastGen Config2WestGen Config2TotalGen
## 19     6   18    110.008       55.20557       334.9883        390.1939
## 20     6   19      0.000        0.00000         0.0000          0.0000
## 21     6   20      0.000        0.00000         0.0000          0.0000
## 22     6   21      0.000        0.00000         0.0000          0.0000
## 23     6   22      0.000        0.00000         0.0000          0.0000
## 24     6   23      0.000        0.00000         0.0000          0.0000
```

```r
AvgHourlyGen_Dec <- AvgHourlyGen[25:48,]
glimpse(AvgHourlyGen_Dec)
```

```
## Rows: 24
## Columns: 6
## $ Month           <dbl> 12, 12, 12, 12, 12, 12, 12, 12, 12, 12, 12, 12, 12, 12~
## $ Hour            <dbl> 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, ~
## $ Config1Gen      <dbl> 0.00000, 0.00000, 0.00000, 0.00000, 0.00000, 0.00000, ~
## $ Config2EastGen  <dbl> 0.00000, 0.00000, 0.00000, 0.00000, 0.00000, 0.00000, ~
## $ Config2WestGen  <dbl> 0.000000, 0.000000, 0.000000, 0.000000, 0.000000, 0.00~
## $ Config2TotalGen <dbl> 0.00000, 0.00000, 0.00000, 0.00000, 0.00000, 0.00000, ~
```

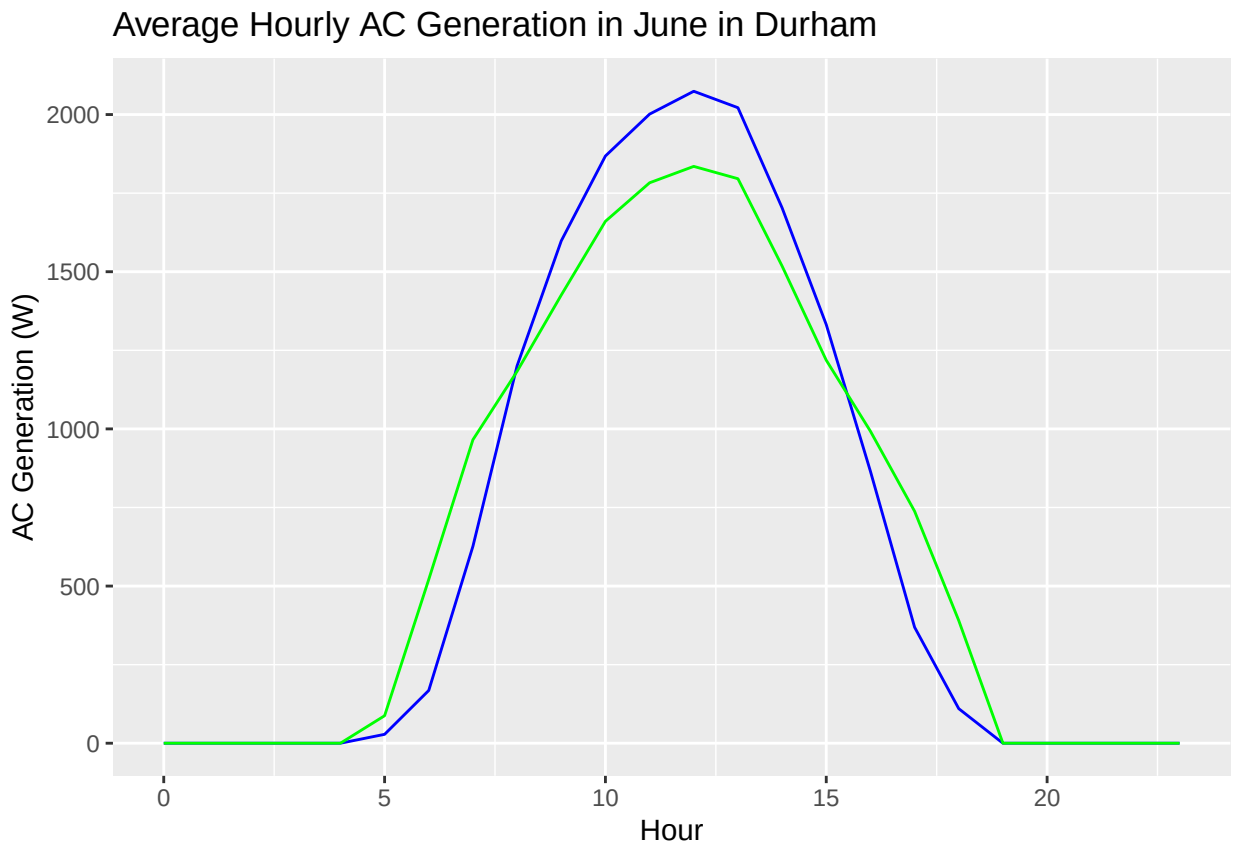
```
tail(AvgHourlyGen_Dec)
```

```
##    Month Hour Config1Gen Config2EastGen Config2WestGen Config2TotalGen
## 43    12   18          0              0              0               0
## 44    12   19          0              0              0               0
## 45    12   20          0              0              0               0
## 46    12   21          0              0              0               0
## 47    12   22          0              0              0               0
## 48    12   23          0             NA             NA              NA
```

```
#Plotting for June and December

AvgHourlyGen_June_Plot <- ggplot(AvgHourlyGen_June)+
  geom_line(aes(x=Hour, y=Config1Gen), col="blue")+
  geom_line(aes(x=Hour, y=Config2TotalGen), col="green")+
  ggtitle("Average Hourly AC Generation in June in Durham")+
  ylab("AC Generation (W)")+
  theme(legend.position = "right")

AvgHourlyGen_June_Plot
```

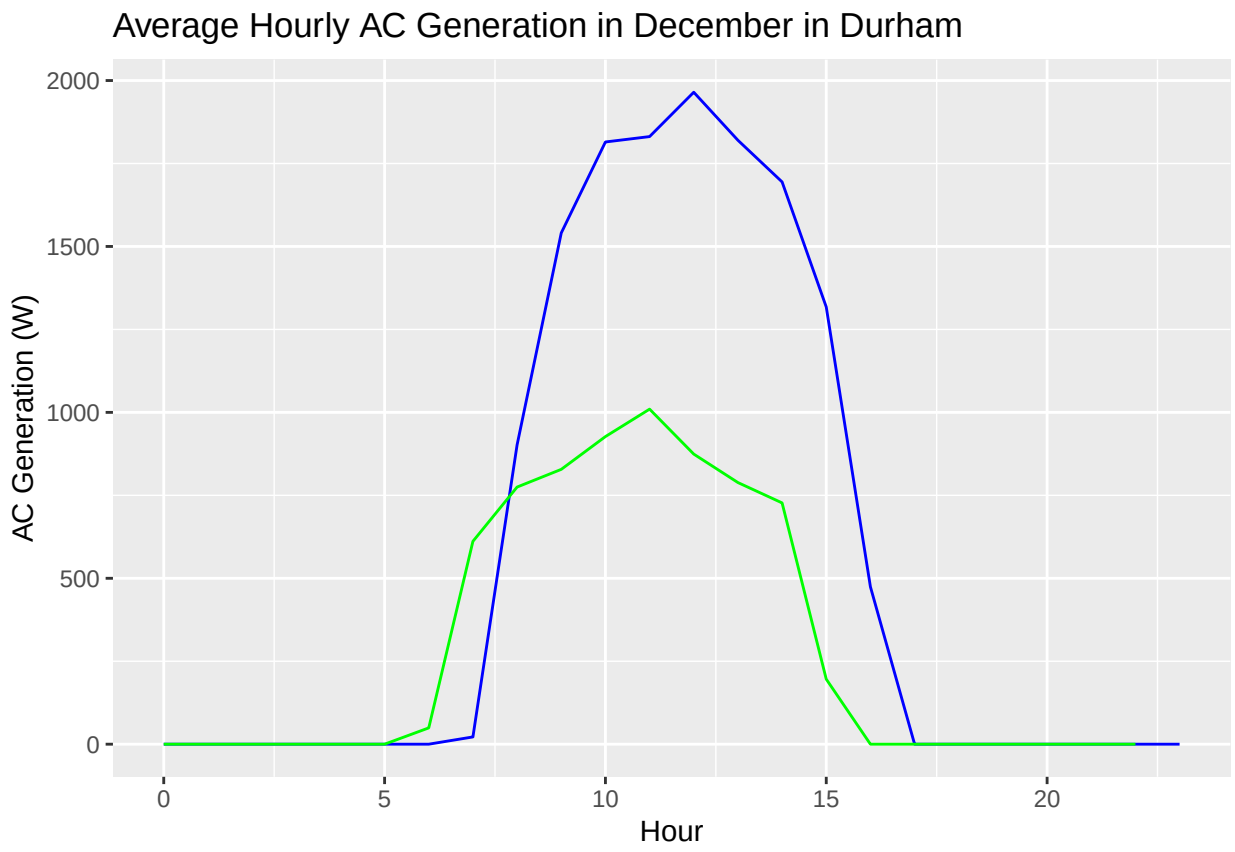



```
AvgHourlyGen_Dec_Plot <- ggplot(AvgHourlyGen_Dec)+
  geom_line(aes(x=Hour, y=Config1Gen), col="blue")+
  geom_line(aes(x=Hour, y=Config2TotalGen), col="green")+
```

```
  ggtitle("Average Hourly AC Generation in December in Durham")+
  ylab("AC Generation (W)")+
  theme(legend.position = "right")

AvgHourlyGen_Dec_Plot
```

```
## Warning: Removed 1 row containing missing values (`geom_line()`).
```




```
#Exporting the data
write.csv(AvgHourlyGen, file = "AvgHourlyGen.csv", row.names = FALSE)
```