# Module 5 - Assignment 1

# Subramanian, Subbu

# Data Wrangling

library(tidyverse)

## ── Attaching packages ─────────────────────────────────────── tidyverse 1.3.2 ──  
## ✔ ggplot2 3.3.6 ✔ purrr 0.3.4  
## ✔ tibble 3.1.7 ✔ dplyr 1.0.9  
## ✔ tidyr 1.2.0 ✔ stringr 1.4.0  
## ✔ readr 2.1.2 ✔ forcats 0.5.1  
## ── Conflicts ────────────────────────────────────────── tidyverse\_conflicts() ──  
## ✖ dplyr::filter() masks stats::filter()  
## ✖ dplyr::lag() masks stats::lag()

library(readxl)  
UN\_migrant <- read\_excel("~/Documents/MBA/Programming for Analytics/Module 5/Assignment 1/Mod5Assignment1/UN\_migrant.xlsx",   
 sheet = "Table 6", col\_types = c("numeric",   
 "text", "text", "numeric", "text",   
 "numeric", "numeric", "numeric",   
 "numeric", "numeric", "numeric",   
 "numeric", "numeric", "numeric",   
 "numeric", "numeric", "numeric",   
 "numeric", "numeric", "numeric",   
 "numeric", "numeric"), skip = 15)

## Warning: Expecting numeric in R26 / R26C18: got '..'

## Warning: Expecting numeric in U26 / R26C21: got '..'

## Warning: Expecting numeric in V26 / R26C22: got '..'

## Warning: Expecting numeric in R28 / R28C18: got '..'

## Warning: Expecting numeric in R31 / R31C18: got '..'

## Warning: Expecting numeric in S31 / R31C19: got '..'

## Warning: Expecting numeric in T31 / R31C20: got '..'

## Warning: Expecting numeric in U31 / R31C21: got '..'

## Warning: Expecting numeric in V31 / R31C22: got '..'

## Warning: Expecting numeric in R33 / R33C18: got '..'

## Warning: Expecting numeric in S33 / R33C19: got '..'

## Warning: Expecting numeric in T33 / R33C20: got '..'

## Warning: Expecting numeric in U33 / R33C21: got '..'

## Warning: Expecting numeric in V33 / R33C22: got '..'

## Warning: Expecting numeric in R34 / R34C18: got '..'

## Warning: Expecting numeric in S34 / R34C19: got '..'

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## Warning: Expecting numeric in R38 / R38C18: got '..'

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## Warning: Expecting numeric in T38 / R38C20: got '..'

## Warning: Expecting numeric in U38 / R38C21: got '..'

## Warning: Expecting numeric in V38 / R38C22: got '..'

## Warning: Expecting numeric in F40 / R40C6: got '..'

## Warning: Expecting numeric in G40 / R40C7: got '..'

## Warning: Expecting numeric in H40 / R40C8: got '..'

## Warning: Expecting numeric in I40 / R40C9: got '..'

## Warning: Expecting numeric in L40 / R40C12: got '..'

## Warning: Expecting numeric in M40 / R40C13: got '..'

## Warning: Expecting numeric in N40 / R40C14: got '..'

## Warning: Expecting numeric in O40 / R40C15: got '..'

## Warning: Expecting numeric in R40 / R40C18: got '..'

## Warning: Expecting numeric in S40 / R40C19: got '..'

## Warning: Expecting numeric in T40 / R40C20: got '..'

## Warning: Expecting numeric in U40 / R40C21: got '..'

## Warning: Expecting numeric in R49 / R49C18: got '..'

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## Warning: Expecting numeric in R54 / R54C18: got '..'

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## Warning: Expecting numeric in R58 / R58C18: got '..'

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## Warning: Expecting numeric in V198 / R198C22: got '..'

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## Warning: Expecting numeric in V199 / R199C22: got '..'

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## Warning: Expecting numeric in R202 / R202C18: got '..'

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## Warning: Expecting numeric in R203 / R203C18: got '..'

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## Warning: Expecting numeric in T204 / R204C20: got '..'

## Warning: Expecting numeric in R205 / R205C18: got '..'

## Warning: Expecting numeric in S205 / R205C19: got '..'

## Warning: Expecting numeric in T205 / R205C20: got '..'

## Warning: Expecting numeric in L207 / R207C12: got '..'

## Warning: Expecting numeric in M207 / R207C13: got '..'

## Warning: Expecting numeric in N207 / R207C14: got '..'

## Warning: Expecting numeric in O207 / R207C15: got '..'

## Warning: Expecting numeric in R207 / R207C18: got '..'

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## Warning: Expecting numeric in R208 / R208C18: got '..'

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## Warning: Expecting numeric in R210 / R210C18: got '..'

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## Warning: Expecting numeric in R211 / R211C18: got '..'

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## Warning: Expecting numeric in V212 / R212C22: got '..'

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## Warning: Expecting numeric in R214 / R214C18: got '..'

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## Warning: Expecting numeric in U214 / R214C21: got '..'

## Warning: Expecting numeric in V214 / R214C22: got '..'

## Warning: Expecting numeric in R215 / R215C18: got '..'

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## Warning: Expecting numeric in R219 / R219C18: got '..'

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## Warning: Expecting numeric in V219 / R219C22: got '..'

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## Warning: Expecting numeric in G220 / R220C7: got '..'

## Warning: Expecting numeric in H220 / R220C8: got '..'

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## Warning: Expecting numeric in M220 / R220C13: got '..'

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## Warning: Expecting numeric in R220 / R220C18: got '..'

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## Warning: Expecting numeric in T220 / R220C20: got '..'

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## Warning: Expecting numeric in R245 / R245C18: got '..'

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## Warning: Expecting numeric in R251 / R251C18: got '..'

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## Warning: Expecting numeric in R259 / R259C18: got '..'

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## Warning: Expecting numeric in U260 / R260C21: got '..'

## Warning: Expecting numeric in V260 / R260C22: got '..'

## Warning: Expecting numeric in R262 / R262C18: got '..'

## Warning: Expecting numeric in S262 / R262C19: got '..'

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## Warning: Expecting numeric in T263 / R263C20: got '..'

## Warning: Expecting numeric in U263 / R263C21: got '..'

## Warning: Expecting numeric in R264 / R264C18: got '..'

## Warning: Expecting numeric in S264 / R264C19: got '..'

## Warning: Expecting numeric in T264 / R264C20: got '..'

## Warning: Expecting numeric in U264 / R264C21: got '..'

## Warning: Expecting numeric in V264 / R264C22: got '..'

## Warning: Expecting numeric in R265 / R265C18: got '..'

## Warning: Expecting numeric in S265 / R265C19: got '..'

## Warning: Expecting numeric in T265 / R265C20: got '..'

## Warning: Expecting numeric in U265 / R265C21: got '..'

## Warning: Expecting numeric in V265 / R265C22: got '..'

## Warning: Expecting numeric in R266 / R266C18: got '..'

## Warning: Expecting numeric in S266 / R266C19: got '..'

## Warning: Expecting numeric in T266 / R266C20: got '..'

## Warning: Expecting numeric in U266 / R266C21: got '..'

## Warning: Expecting numeric in V266 / R266C22: got '..'

## Warning: Expecting numeric in R267 / R267C18: got '..'

## Warning: Expecting numeric in S267 / R267C19: got '..'

## Warning: Expecting numeric in T267 / R267C20: got '..'

## Warning: Expecting numeric in U267 / R267C21: got '..'

## Warning: Expecting numeric in V267 / R267C22: got '..'

## Warning: Expecting numeric in R268 / R268C18: got '..'

## Warning: Expecting numeric in S268 / R268C19: got '..'

## Warning: Expecting numeric in T268 / R268C20: got '..'

## Warning: Expecting numeric in U268 / R268C21: got '..'

## Warning: Expecting numeric in V268 / R268C22: got '..'

## Warning: Expecting numeric in R269 / R269C18: got '..'

## Warning: Expecting numeric in S269 / R269C19: got '..'

## Warning: Expecting numeric in T269 / R269C20: got '..'

## Warning: Expecting numeric in U269 / R269C21: got '..'

## Warning: Expecting numeric in V269 / R269C22: got '..'

## Warning: Expecting numeric in R270 / R270C18: got '..'

## Warning: Expecting numeric in S270 / R270C19: got '..'

## Warning: Expecting numeric in T270 / R270C20: got '..'

## Warning: Expecting numeric in U270 / R270C21: got '..'

## Warning: Expecting numeric in V270 / R270C22: got '..'

## Warning: Expecting numeric in R271 / R271C18: got '..'

## Warning: Expecting numeric in S271 / R271C19: got '..'

## Warning: Expecting numeric in T271 / R271C20: got '..'

## Warning: Expecting numeric in U271 / R271C21: got '..'

## Warning: Expecting numeric in V271 / R271C22: got '..'

## Warning: Expecting numeric in R272 / R272C18: got '..'

## Warning: Expecting numeric in S272 / R272C19: got '..'

## Warning: Expecting numeric in T272 / R272C20: got '..'

## Warning: Expecting numeric in U272 / R272C21: got '..'

## Warning: Expecting numeric in V272 / R272C22: got '..'

## Warning: Expecting numeric in R273 / R273C18: got '..'

## Warning: Expecting numeric in S273 / R273C19: got '..'

## Warning: Expecting numeric in T273 / R273C20: got '..'

## Warning: Expecting numeric in U273 / R273C21: got '..'

## Warning: Expecting numeric in V273 / R273C22: got '..'

## Warning: Expecting numeric in R274 / R274C18: got '..'

## Warning: Expecting numeric in S274 / R274C19: got '..'

## Warning: Expecting numeric in T274 / R274C20: got '..'

## Warning: Expecting numeric in U274 / R274C21: got '..'

## Warning: Expecting numeric in V274 / R274C22: got '..'

## Warning: Expecting numeric in R275 / R275C18: got '..'

## Warning: Expecting numeric in S275 / R275C19: got '..'

## Warning: Expecting numeric in T275 / R275C20: got '..'

## Warning: Expecting numeric in U275 / R275C21: got '..'

## Warning: Expecting numeric in V275 / R275C22: got '..'

## Warning: Expecting numeric in R276 / R276C18: got '..'

## Warning: Expecting numeric in S276 / R276C19: got '..'

## Warning: Expecting numeric in T276 / R276C20: got '..'

## Warning: Expecting numeric in U276 / R276C21: got '..'

## Warning: Expecting numeric in V276 / R276C22: got '..'

## Warning: Expecting numeric in R277 / R277C18: got '..'

## Warning: Expecting numeric in S277 / R277C19: got '..'

## Warning: Expecting numeric in T277 / R277C20: got '..'

## Warning: Expecting numeric in U277 / R277C21: got '..'

## Warning: Expecting numeric in V277 / R277C22: got '..'

## Warning: Expecting numeric in R278 / R278C18: got '..'

## Warning: Expecting numeric in S278 / R278C19: got '..'

## Warning: Expecting numeric in T278 / R278C20: got '..'

## Warning: Expecting numeric in U278 / R278C21: got '..'

## Warning: Expecting numeric in V278 / R278C22: got '..'

## Warning: Expecting numeric in R279 / R279C18: got '..'

## Warning: Expecting numeric in S279 / R279C19: got '..'

## Warning: Expecting numeric in T279 / R279C20: got '..'

## Warning: Expecting numeric in U279 / R279C21: got '..'

## Warning: Expecting numeric in V279 / R279C22: got '..'

## Warning: Expecting numeric in R280 / R280C18: got '..'

## Warning: Expecting numeric in S280 / R280C19: got '..'

## Warning: Expecting numeric in T280 / R280C20: got '..'

## Warning: Expecting numeric in U280 / R280C21: got '..'

## Warning: Expecting numeric in V280 / R280C22: got '..'

## Warning: Expecting numeric in R281 / R281C18: got '..'

## Warning: Expecting numeric in S281 / R281C19: got '..'

## Warning: Expecting numeric in T281 / R281C20: got '..'

## Warning: Expecting numeric in U281 / R281C21: got '..'

## Warning: Expecting numeric in V281 / R281C22: got '..'

## New names:  
## • `` -> `...1`  
## • `` -> `...2`  
## • `` -> `...3`  
## • `` -> `...4`  
## • `` -> `...5`  
## • `1990` -> `1990...6`  
## • `1995` -> `1995...7`  
## • `2000` -> `2000...8`  
## • `2005` -> `2005...9`  
## • `2010` -> `2010...10`  
## • `2015` -> `2015...11`  
## • `1990` -> `1990...12`  
## • `1995` -> `1995...13`  
## • `2000` -> `2000...14`  
## • `2005` -> `2005...15`  
## • `2010` -> `2010...16`  
## • `2015` -> `2015...17`

## Part 2 – Cleaning Data with dplyr

UN\_migrant<-rename(UN\_migrant,"Country"="...2","Country\_Code"="...4","Type"="...5","1990"="1990...6","1995"="1995...7","2000"="2000...8","2005"="2005...9","2010"="2010...10","2015"="2015...11")  
  
Migration<-select(UN\_migrant,"Country","Country\_Code","Type","1990","1995","2000","2005","2010","2015")  
as\_tibble(Migration)

## # A tibble: 265 × 9  
## Country Country\_Code Type `1990` `1995` `2000` `2005` `2010` `2015`  
## <chr> <dbl> <chr> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 WORLD 900 <NA> 1.88e7 1.79e7 1.58e7 1.33e7 1.54e7 1.96e7  
## 2 Developed regio… 901 <NA> 2.01e6 3.61e6 3.00e6 2.36e6 2.05e6 1.95e6  
## 3 Developing regi… 902 <NA> 1.68e7 1.42e7 1.28e7 1.09e7 1.33e7 1.76e7  
## 4 Least developed… 941 <NA> 5.05e6 5.16e6 3.05e6 2.36e6 1.96e6 3.44e6  
## 5 Less developed … 934 <NA> 1.18e7 9.08e6 9.78e6 8.55e6 1.14e7 1.42e7  
## 6 Sub-Saharan Afr… 947 <NA> 5.52e6 5.75e6 3.42e6 2.56e6 2.22e6 3.64e6  
## 7 Africa 903 <NA> 5.69e6 5.95e6 3.61e6 2.75e6 2.41e6 4.02e6  
## 8 Eastern Africa 910 <NA> 3.17e6 2.05e6 1.64e6 1.42e6 1.01e6 2.09e6  
## 9 Burundi 108 B R 2.68e5 1.73e5 2.71e4 2.07e4 2.94e4 4.78e4  
## 10 Comoros 174 B 0 5 e0 1 e1 5 e0 0 0   
## # … with 255 more rows

# Part 3 – Creating tidy data using tidyr

Migration2 <- pivot\_longer(Migration,c('1990','1995','2000','2005','2010','2015'),names\_to="year",values\_to="cases")  
Migration2$year<-as.integer(Migration2$year)  
head(Migration2,6)

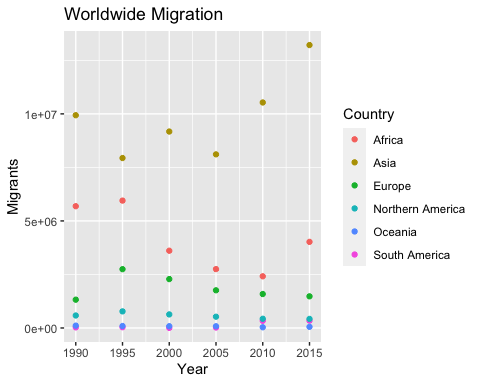
## # A tibble: 6 × 5  
## Country Country\_Code Type year cases  
## <chr> <dbl> <chr> <int> <dbl>  
## 1 WORLD 900 <NA> 1990 18836571  
## 2 WORLD 900 <NA> 1995 17853840  
## 3 WORLD 900 <NA> 2000 15827803  
## 4 WORLD 900 <NA> 2005 13276733  
## 5 WORLD 900 <NA> 2010 15370755  
## 6 WORLD 900 <NA> 2015 19577474

## Part 4 - Research Questions

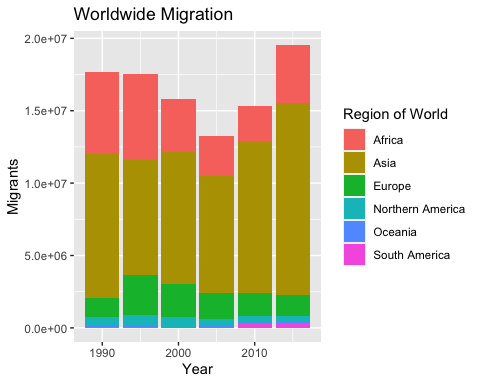
RegionalMigration<-Migration2 %>%  
 select(Country,Country\_Code,Type,year,cases) %>%  
 filter(Country %in% c("Africa", "Asia", "Europe", "Oceania", "Northern America", "South America"))   
  
Americas<-Migration2 %>%  
 select(Country,Country\_Code,Type,year,cases) %>%  
 filter(Country %in% c("Central America", "South America", "Northern America"))

## Wordwide Migration based on Regions

ggplot(data=RegionalMigration,aes(x=year,y=cases,color=Country)) +  
 geom\_point() +  
 labs(title = "Worldwide Migration", x = "Year", y="Migrants")



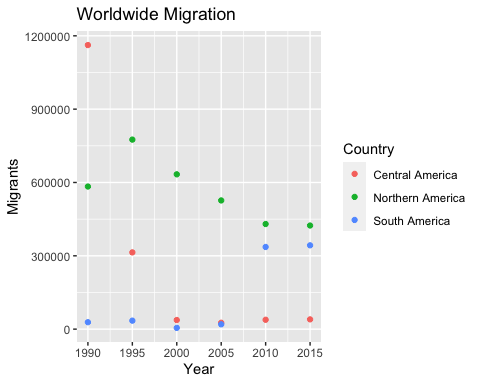
ggplot(data=RegionalMigration,aes(x=year,y=cases,fill=Country)) +  
 geom\_col() +  
 labs(title = "Worldwide Migration", x = "Year", y="Migrants") +  
 scale\_fill\_discrete(name="Region of World")



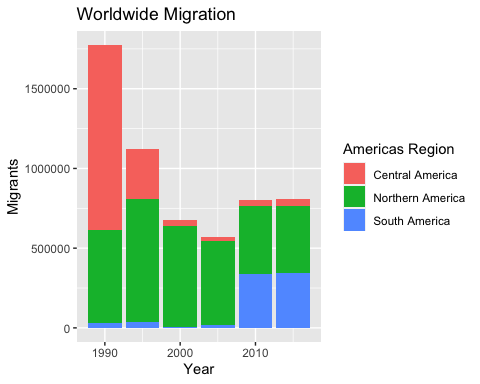
* 1. Which region in the world had the highest number of migrants in the year 2005? Asia
  2. Over the years, which region consistently has the most migrants every 5 year span? Which has the second most? First = Asia, Second = Africa
  3. What region has seen the fewest migrants over the years? Oceania
  4. Which plot was most useful in answering these questions and why? Bar/col, because it was visually easier to figure out the regions, whereas with scattter plot the size of the points were too small to see and determine the correct answer.

## Americas Migration by Region

ggplot(data=Americas,aes(x=year,y=cases,color=Country)) +  
 geom\_point() +  
 labs(title = "Worldwide Migration", x = "Year", y="Migrants")



ggplot(data=Americas,aes(x=year,y=cases,fill=Country)) +  
 geom\_col() +  
 labs(title = "Worldwide Migration", x = "Year", y="Migrants") +  
 scale\_fill\_discrete(name="Americas Region")



* 1. In 1990, which region had the largest number of migrants for the Americas? Central America
  2. Has this region continued to grow since 1990? No
  3. What trends do you notice happening in the Americas over the years? Migrants to Central America has subsided
  4. Specifically, has Northern America increased or decreased over the years? Increased over the years
  5. Which plot was most useful in answering these questions and why? Bar/col, because it was visually easier to figure out the regions, whereas with scattter plot the size of the points were too small to see and determine the correct answer.