NYC Car Crash Data Visualization

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## This code will not be evaluated automatically.  
## (Notice the eval = FALSE declaration in the options section of the  
## code chunk)  
  
my\_packages <- c("tidyverse", "broom", "coefplot", "cowplot",  
 "gapminder", "GGally", "ggrepel", "ggridges", "gridExtra",  
 "here", "interplot", "margins", "maps", "mapproj",  
 "mapdata", "MASS", "quantreg", "rlang", "scales",  
 "survey", "srvyr", "viridis", "viridisLite", "devtools")  
  
install.packages(my\_packages, repos = "http://cran.rstudio.com")

# first we will load the dataset to view all the data on our raw dataset

crash\_data <- read.csv('dataset/Motor\_Vehicle\_Collisions\_\_Person.csv')  
head(crash\_data)

## UNIQUE\_ID COLLISION\_ID CRASH\_DATE CRASH\_TIME  
## 1 10249006 4229554 10/26/2019 9:43  
## 2 10255054 4230587 10/25/2019 15:15  
## 3 10253177 4230550 10/26/2019 17:55  
## 4 6650180 3565527 11/21/2016 13:05  
## 5 10255516 4231168 10/25/2019 11:16  
## 6 10253606 4230743 10/24/2019 19:15  
## PERSON\_ID PERSON\_TYPE PERSON\_INJURY VEHICLE\_ID  
## 1 31aa2bc0-f545-444f-8cdb-f1cb5cf00b89 Occupant Unspecified 19141108  
## 2 4629e500-a73e-48dc-b8fb-53124d124b80 Occupant Unspecified 19144075  
## 3 ae48c136-1383-45db-83f4-2a5eecfb7cff Occupant Unspecified 19143133  
## 4 2782525 Occupant Unspecified NA  
## 5 e038e18f-40fb-4471-99cf-345eae36e064 Occupant Unspecified 19144329  
## 6 84bcb3a7-d201-4c61-9e30-fe29268c1074 Occupant Injured 19143343  
## PERSON\_AGE EJECTION EMOTIONAL\_STATUS BODILY\_INJURY  
## 1 NA   
## 2 33 Not Ejected Does Not Apply Does Not Apply  
## 3 55   
## 4 NA   
## 5 7 Not Ejected Does Not Apply Does Not Apply  
## 6 27 Not Ejected Conscious Back  
## POSITION\_IN\_VEHICLE  
## 1   
## 2 Front passenger, if two or more persons, including the driver, are in the front seat  
## 3   
## 4   
## 5 Right rear passenger or motorcycle sidecar passenger  
## 6 Driver  
## SAFETY\_EQUIPMENT PED\_LOCATION PED\_ACTION COMPLAINT  
## 1   
## 2 Lap Belt & Harness Does Not Apply  
## 3   
## 4   
## 5 Lap Belt Does Not Apply  
## 6 Lap Belt & Harness Complaint of Pain or Nausea  
## PED\_ROLE CONTRIBUTING\_FACTOR\_1 CONTRIBUTING\_FACTOR\_2 PERSON\_SEX  
## 1 Registrant U  
## 2 Passenger F  
## 3 Registrant M  
## 4 Notified Person   
## 5 Passenger F  
## 6 Driver M

# now that we have our whole dataset loaded, we will try to select columns that we consider as important or useful for our project

# we will first see what are the names of the data columns for our dataset  
names(crash\_data)

## [1] "UNIQUE\_ID" "COLLISION\_ID" "CRASH\_DATE"   
## [4] "CRASH\_TIME" "PERSON\_ID" "PERSON\_TYPE"   
## [7] "PERSON\_INJURY" "VEHICLE\_ID" "PERSON\_AGE"   
## [10] "EJECTION" "EMOTIONAL\_STATUS" "BODILY\_INJURY"   
## [13] "POSITION\_IN\_VEHICLE" "SAFETY\_EQUIPMENT" "PED\_LOCATION"   
## [16] "PED\_ACTION" "COMPLAINT" "PED\_ROLE"   
## [19] "CONTRIBUTING\_FACTOR\_1" "CONTRIBUTING\_FACTOR\_2" "PERSON\_SEX"

# now we will select the useful (assumed) columns  
  
crash\_data\_selected = crash\_data[,c("UNIQUE\_ID", "COLLISION\_ID", "CRASH\_DATE", "CRASH\_TIME", "PERSON\_INJURY", "EMOTIONAL\_STATUS", "BODILY\_INJURY", "POSITION\_IN\_VEHICLE", "SAFETY\_EQUIPMENT", "COMPLAINT", "PED\_ACTION", "CONTRIBUTING\_FACTOR\_1", "CONTRIBUTING\_FACTOR\_2", "PERSON\_SEX")]  
  
head(crash\_data\_selected)

## UNIQUE\_ID COLLISION\_ID CRASH\_DATE CRASH\_TIME PERSON\_INJURY EMOTIONAL\_STATUS  
## 1 10249006 4229554 10/26/2019 9:43 Unspecified   
## 2 10255054 4230587 10/25/2019 15:15 Unspecified Does Not Apply  
## 3 10253177 4230550 10/26/2019 17:55 Unspecified   
## 4 6650180 3565527 11/21/2016 13:05 Unspecified   
## 5 10255516 4231168 10/25/2019 11:16 Unspecified Does Not Apply  
## 6 10253606 4230743 10/24/2019 19:15 Injured Conscious  
## BODILY\_INJURY  
## 1   
## 2 Does Not Apply  
## 3   
## 4   
## 5 Does Not Apply  
## 6 Back  
## POSITION\_IN\_VEHICLE  
## 1   
## 2 Front passenger, if two or more persons, including the driver, are in the front seat  
## 3   
## 4   
## 5 Right rear passenger or motorcycle sidecar passenger  
## 6 Driver  
## SAFETY\_EQUIPMENT COMPLAINT PED\_ACTION  
## 1   
## 2 Lap Belt & Harness Does Not Apply   
## 3   
## 4   
## 5 Lap Belt Does Not Apply   
## 6 Lap Belt & Harness Complaint of Pain or Nausea   
## CONTRIBUTING\_FACTOR\_1 CONTRIBUTING\_FACTOR\_2 PERSON\_SEX  
## 1 U  
## 2 F  
## 3 M  
## 4   
## 5 F  
## 6 M

# for the purpose of easier access we will change columns name to all lowercase letter  
names(crash\_data\_selected) <- tolower(names(crash\_data\_selected))  
head(crash\_data\_selected)

## unique\_id collision\_id crash\_date crash\_time person\_injury emotional\_status  
## 1 10249006 4229554 10/26/2019 9:43 Unspecified   
## 2 10255054 4230587 10/25/2019 15:15 Unspecified Does Not Apply  
## 3 10253177 4230550 10/26/2019 17:55 Unspecified   
## 4 6650180 3565527 11/21/2016 13:05 Unspecified   
## 5 10255516 4231168 10/25/2019 11:16 Unspecified Does Not Apply  
## 6 10253606 4230743 10/24/2019 19:15 Injured Conscious  
## bodily\_injury  
## 1   
## 2 Does Not Apply  
## 3   
## 4   
## 5 Does Not Apply  
## 6 Back  
## position\_in\_vehicle  
## 1   
## 2 Front passenger, if two or more persons, including the driver, are in the front seat  
## 3   
## 4   
## 5 Right rear passenger or motorcycle sidecar passenger  
## 6 Driver  
## safety\_equipment complaint ped\_action  
## 1   
## 2 Lap Belt & Harness Does Not Apply   
## 3   
## 4   
## 5 Lap Belt Does Not Apply   
## 6 Lap Belt & Harness Complaint of Pain or Nausea   
## contributing\_factor\_1 contributing\_factor\_2 person\_sex  
## 1 U  
## 2 F  
## 3 M  
## 4   
## 5 F  
## 6 M

# checking the datatypes of all columns  
  
str(crash\_data\_selected)

## 'data.frame': 5296228 obs. of 14 variables:  
## $ unique\_id : int 10249006 10255054 10253177 6650180 10255516 10253606 10251336 10248708 10250179 10253792 ...  
## $ collision\_id : int 4229554 4230587 4230550 3565527 4231168 4230743 4230047 4229547 4229808 4230915 ...  
## $ crash\_date : chr "10/26/2019" "10/25/2019" "10/26/2019" "11/21/2016" ...  
## $ crash\_time : chr "9:43" "15:15" "17:55" "13:05" ...  
## $ person\_injury : chr "Unspecified" "Unspecified" "Unspecified" "Unspecified" ...  
## $ emotional\_status : chr "" "Does Not Apply" "" "" ...  
## $ bodily\_injury : chr "" "Does Not Apply" "" "" ...  
## $ position\_in\_vehicle : chr "" "Front passenger, if two or more persons, including the driver, are in the front seat" "" "" ...  
## $ safety\_equipment : chr "" "Lap Belt & Harness" "" "" ...  
## $ complaint : chr "" "Does Not Apply" "" "" ...  
## $ ped\_action : chr "" "" "" "" ...  
## $ contributing\_factor\_1: chr "" "" "" "" ...  
## $ contributing\_factor\_2: chr "" "" "" "" ...  
## $ person\_sex : chr "U" "F" "M" "" ...

# Now from ‘crash\_date’ column we will create two new columns ‘year’ & ‘month’ that later on we will use visualizing data

### ‘year’ -> will be used to visualize accident increament or decrement over the years

### ‘month’ -> will be used to visualize which time of the month has highest & lowest number of crash occured

# we will first change the datatype of 'crash\_date' columns from character to Date type  
  
crash\_data\_selected$crash\_date <- as.Date(crash\_data\_selected$crash\_date, format = "%m/%d/%Y")  
  
# Now, create new columns 'year' & 'month'  
crash\_data\_selected$year <- format(crash\_data\_selected$crash\_date, "%Y")  
crash\_data\_selected$month <- format(crash\_data\_selected$crash\_date, "%m")  
  
# Check the data types of new columns  
str(crash\_data\_selected)

## 'data.frame': 5296228 obs. of 16 variables:  
## $ unique\_id : int 10249006 10255054 10253177 6650180 10255516 10253606 10251336 10248708 10250179 10253792 ...  
## $ collision\_id : int 4229554 4230587 4230550 3565527 4231168 4230743 4230047 4229547 4229808 4230915 ...  
## $ crash\_date : Date, format: "2019-10-26" "2019-10-25" ...  
## $ crash\_time : chr "9:43" "15:15" "17:55" "13:05" ...  
## $ person\_injury : chr "Unspecified" "Unspecified" "Unspecified" "Unspecified" ...  
## $ emotional\_status : chr "" "Does Not Apply" "" "" ...  
## $ bodily\_injury : chr "" "Does Not Apply" "" "" ...  
## $ position\_in\_vehicle : chr "" "Front passenger, if two or more persons, including the driver, are in the front seat" "" "" ...  
## $ safety\_equipment : chr "" "Lap Belt & Harness" "" "" ...  
## $ complaint : chr "" "Does Not Apply" "" "" ...  
## $ ped\_action : chr "" "" "" "" ...  
## $ contributing\_factor\_1: chr "" "" "" "" ...  
## $ contributing\_factor\_2: chr "" "" "" "" ...  
## $ person\_sex : chr "U" "F" "M" "" ...  
## $ year : chr "2019" "2019" "2019" "2016" ...  
## $ month : chr "10" "10" "10" "11" ...

# View the dataset  
print(head(crash\_data\_selected))

## unique\_id collision\_id crash\_date crash\_time person\_injury emotional\_status  
## 1 10249006 4229554 2019-10-26 9:43 Unspecified   
## 2 10255054 4230587 2019-10-25 15:15 Unspecified Does Not Apply  
## 3 10253177 4230550 2019-10-26 17:55 Unspecified   
## 4 6650180 3565527 2016-11-21 13:05 Unspecified   
## 5 10255516 4231168 2019-10-25 11:16 Unspecified Does Not Apply  
## 6 10253606 4230743 2019-10-24 19:15 Injured Conscious  
## bodily\_injury  
## 1   
## 2 Does Not Apply  
## 3   
## 4   
## 5 Does Not Apply  
## 6 Back  
## position\_in\_vehicle  
## 1   
## 2 Front passenger, if two or more persons, including the driver, are in the front seat  
## 3   
## 4   
## 5 Right rear passenger or motorcycle sidecar passenger  
## 6 Driver  
## safety\_equipment complaint ped\_action  
## 1   
## 2 Lap Belt & Harness Does Not Apply   
## 3   
## 4   
## 5 Lap Belt Does Not Apply   
## 6 Lap Belt & Harness Complaint of Pain or Nausea   
## contributing\_factor\_1 contributing\_factor\_2 person\_sex year month  
## 1 U 2019 10  
## 2 F 2019 10  
## 3 M 2019 10  
## 4 2016 11  
## 5 F 2019 10  
## 6 M 2019 10

crash\_data\_selected <- subset(crash\_data\_selected, year > 2015)  
head(crash\_data\_selected)

## unique\_id collision\_id crash\_date crash\_time person\_injury emotional\_status  
## 1 10249006 4229554 2019-10-26 9:43 Unspecified   
## 2 10255054 4230587 2019-10-25 15:15 Unspecified Does Not Apply  
## 3 10253177 4230550 2019-10-26 17:55 Unspecified   
## 4 6650180 3565527 2016-11-21 13:05 Unspecified   
## 5 10255516 4231168 2019-10-25 11:16 Unspecified Does Not Apply  
## 6 10253606 4230743 2019-10-24 19:15 Injured Conscious  
## bodily\_injury  
## 1   
## 2 Does Not Apply  
## 3   
## 4   
## 5 Does Not Apply  
## 6 Back  
## position\_in\_vehicle  
## 1   
## 2 Front passenger, if two or more persons, including the driver, are in the front seat  
## 3   
## 4   
## 5 Right rear passenger or motorcycle sidecar passenger  
## 6 Driver  
## safety\_equipment complaint ped\_action  
## 1   
## 2 Lap Belt & Harness Does Not Apply   
## 3   
## 4   
## 5 Lap Belt Does Not Apply   
## 6 Lap Belt & Harness Complaint of Pain or Nausea   
## contributing\_factor\_1 contributing\_factor\_2 person\_sex year month  
## 1 U 2019 10  
## 2 F 2019 10  
## 3 M 2019 10  
## 4 2016 11  
## 5 F 2019 10  
## 6 M 2019 10

# above we see year & month column datatype is 'double', we will change the datatype to integer for convenience  
  
crash\_data\_selected$year <- as.factor(crash\_data\_selected$year)  
crash\_data\_selected$month <- as.factor(crash\_data\_selected$month)  
  
# checking the datatype again to verify change was made  
  
str(crash\_data\_selected)

## 'data.frame': 5108918 obs. of 16 variables:  
## $ unique\_id : int 10249006 10255054 10253177 6650180 10255516 10253606 10251336 10248708 10250179 10253792 ...  
## $ collision\_id : int 4229554 4230587 4230550 3565527 4231168 4230743 4230047 4229547 4229808 4230915 ...  
## $ crash\_date : Date, format: "2019-10-26" "2019-10-25" ...  
## $ crash\_time : chr "9:43" "15:15" "17:55" "13:05" ...  
## $ person\_injury : chr "Unspecified" "Unspecified" "Unspecified" "Unspecified" ...  
## $ emotional\_status : chr "" "Does Not Apply" "" "" ...  
## $ bodily\_injury : chr "" "Does Not Apply" "" "" ...  
## $ position\_in\_vehicle : chr "" "Front passenger, if two or more persons, including the driver, are in the front seat" "" "" ...  
## $ safety\_equipment : chr "" "Lap Belt & Harness" "" "" ...  
## $ complaint : chr "" "Does Not Apply" "" "" ...  
## $ ped\_action : chr "" "" "" "" ...  
## $ contributing\_factor\_1: chr "" "" "" "" ...  
## $ contributing\_factor\_2: chr "" "" "" "" ...  
## $ person\_sex : chr "U" "F" "M" "" ...  
## $ year : Factor w/ 9 levels "2016","2017",..: 4 4 4 1 4 4 4 4 4 4 ...  
## $ month : Factor w/ 12 levels "01","02","03",..: 10 10 10 11 10 10 10 10 10 10 ...

# Since we have our initial version of desired dataset we will first export it (for keeping it safe) and then will start visualizing our data

# Export dataset to a CSV file  
write.csv(crash\_data\_selected, "dataset/crash\_data\_selected.csv", row.names = FALSE)

### 1) visualizing crash number over the years

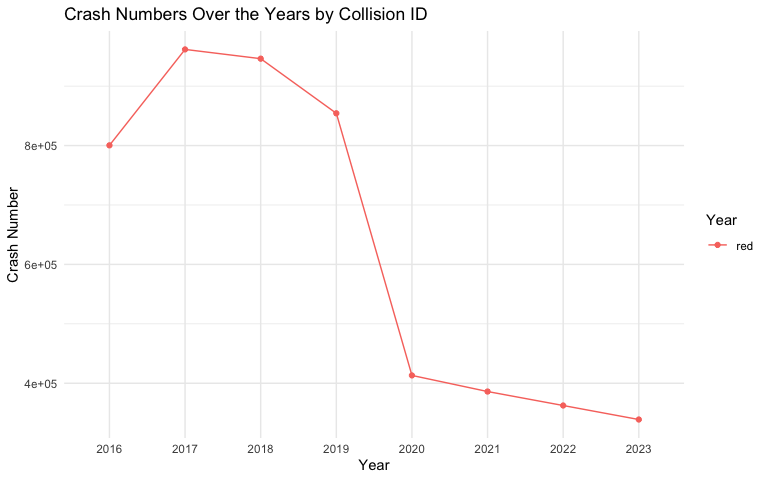
number\_of\_years <- length(unique(crash\_data\_selected$year))  
number\_of\_years

## [1] 9

# droping rows with 2024 data beacuse it is not a full year yet  
crash\_data\_selected <- crash\_data\_selected[crash\_data\_selected$year != 2024, ]  
  
# Aggregate crash numbers by collision ID and year  
  
crash\_counts\_year <- aggregate(collision\_id ~ year, data = crash\_data\_selected, FUN = function(collision\_id) length(collision\_id))  
  
# Rename the column  
names(crash\_counts\_year)[2] <- "frequency"  
  
crash\_counts\_year

## year frequency  
## 1 2016 800353  
## 2 2017 961775  
## 3 2018 946203  
## 4 2019 854269  
## 5 2020 413193  
## 6 2021 386075  
## 7 2022 362555  
## 8 2023 338984

# Create the plot using crash\_counts dataframe  
time\_line <- ggplot(crash\_counts\_year, aes(x = year, y = frequency, color = 'red')) + geom\_point() +  
 geom\_line(group = 1) +  
 labs(title = "Crash Numbers Over the Years by Collision ID",  
 x = "Year",  
 y = "Crash Number",  
 color = "Year") +  
 theme\_minimal()  
  
# showing plot  
time\_line



ggsave('over the years crash data.png', plot = time\_line)

## Saving 8 x 5 in image

### From the timeline graph we see number of collision was gradually rising 2012 to 2017 and it starts gradually droping from 2018 to 2023

### we may want to find out what happened in 2017 that helped redusing the number of collisions in NYC

### 2) visualizing crash by months

number\_of\_months <- length(unique(crash\_data\_selected$month))  
number\_of\_months

## [1] 12

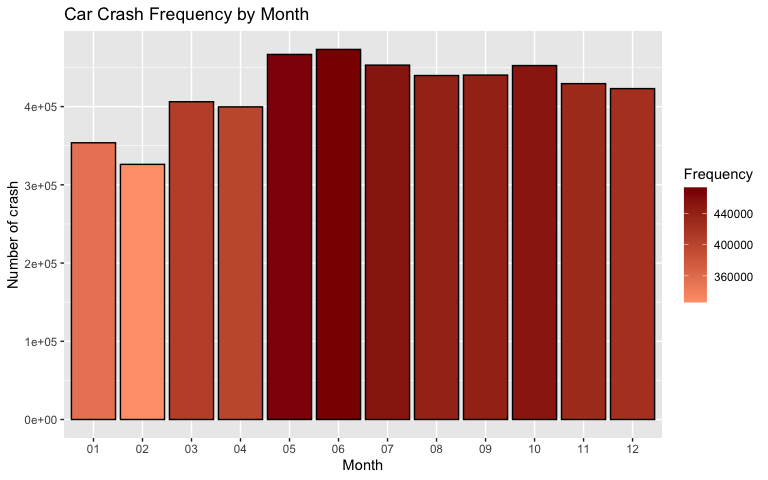
# Aggregate crash numbers by collision ID and month  
  
crash\_counts\_month <- aggregate(collision\_id ~ month, data = crash\_data\_selected, FUN = function(collision\_id) length(collision\_id))  
  
# Rename the column  
names(crash\_counts\_month)[2] <- "frequency"  
  
crash\_counts\_month

## month frequency  
## 1 01 353755  
## 2 02 326154  
## 3 03 406222  
## 4 04 399656  
## 5 05 466689  
## 6 06 473092  
## 7 07 453020  
## 8 08 439712  
## 9 09 440289  
## 10 10 452458  
## 11 11 429356  
## 12 12 423004

# Create a bar plot using crash by month  
bar\_graph\_month <- ggplot(data = crash\_counts\_month, aes(x = month, y = frequency, fill = frequency)) +  
 geom\_bar(stat = "identity", color = "black") + # Create bars with specified colors  
 labs(title = "Car Crash Frequency by Month", x = "Month", y = "Number of crash") + # Add title and axis labels  
 scale\_fill\_gradient(low = "lightsalmon", high = "darkred", name = "Frequency")  
 theme\_minimal() + # Use a minimal theme  
 theme(axis.text.x = element\_text(angle = 45, hjust = 1)) # Rotate x-axis labels for better readability

## List of 97  
## $ line :List of 6  
## ..$ colour : chr "black"  
## ..$ linewidth : num 0.5  
## ..$ linetype : num 1  
## ..$ lineend : chr "butt"  
## ..$ arrow : logi FALSE  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_line" "element"  
## $ rect :List of 5  
## ..$ fill : chr "white"  
## ..$ colour : chr "black"  
## ..$ linewidth : num 0.5  
## ..$ linetype : num 1  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_rect" "element"  
## $ text :List of 11  
## ..$ family : chr ""  
## ..$ face : chr "plain"  
## ..$ colour : chr "black"  
## ..$ size : num 11  
## ..$ hjust : num 0.5  
## ..$ vjust : num 0.5  
## ..$ angle : num 0  
## ..$ lineheight : num 0.9  
## ..$ margin : 'margin' num [1:4] 0points 0points 0points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : logi FALSE  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ title : NULL  
## $ aspect.ratio : NULL  
## $ axis.title : NULL  
## $ axis.title.x :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : NULL  
## ..$ vjust : num 1  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 2.75points 0points 0points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ axis.title.x.top :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : NULL  
## ..$ vjust : num 0  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 0points 0points 2.75points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ axis.title.x.bottom : NULL  
## $ axis.title.y :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : NULL  
## ..$ vjust : num 1  
## ..$ angle : num 90  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 0points 2.75points 0points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ axis.title.y.left : NULL  
## $ axis.title.y.right :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : NULL  
## ..$ vjust : num 0  
## ..$ angle : num -90  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 0points 0points 0points 2.75points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ axis.text :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : chr "grey30"  
## ..$ size : 'rel' num 0.8  
## ..$ hjust : NULL  
## ..$ vjust : NULL  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : NULL  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ axis.text.x :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : num 1  
## ..$ vjust : num 1  
## ..$ angle : num 45  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 2.2points 0points 0points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi FALSE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ axis.text.x.top :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : NULL  
## ..$ vjust : num 0  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 0points 0points 2.2points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ axis.text.x.bottom : NULL  
## $ axis.text.y :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : num 1  
## ..$ vjust : NULL  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 0points 2.2points 0points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ axis.text.y.left : NULL  
## $ axis.text.y.right :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : num 0  
## ..$ vjust : NULL  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 0points 0points 0points 2.2points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ axis.ticks : list()  
## ..- attr(\*, "class")= chr [1:2] "element\_blank" "element"  
## $ axis.ticks.x : NULL  
## $ axis.ticks.x.top : NULL  
## $ axis.ticks.x.bottom : NULL  
## $ axis.ticks.y : NULL  
## $ axis.ticks.y.left : NULL  
## $ axis.ticks.y.right : NULL  
## $ axis.ticks.length : 'simpleUnit' num 2.75points  
## ..- attr(\*, "unit")= int 8  
## $ axis.ticks.length.x : NULL  
## $ axis.ticks.length.x.top : NULL  
## $ axis.ticks.length.x.bottom: NULL  
## $ axis.ticks.length.y : NULL  
## $ axis.ticks.length.y.left : NULL  
## $ axis.ticks.length.y.right : NULL  
## $ axis.line : list()  
## ..- attr(\*, "class")= chr [1:2] "element\_blank" "element"  
## $ axis.line.x : NULL  
## $ axis.line.x.top : NULL  
## $ axis.line.x.bottom : NULL  
## $ axis.line.y : NULL  
## $ axis.line.y.left : NULL  
## $ axis.line.y.right : NULL  
## $ legend.background : list()  
## ..- attr(\*, "class")= chr [1:2] "element\_blank" "element"  
## $ legend.margin : 'margin' num [1:4] 5.5points 5.5points 5.5points 5.5points  
## ..- attr(\*, "unit")= int 8  
## $ legend.spacing : 'simpleUnit' num 11points  
## ..- attr(\*, "unit")= int 8  
## $ legend.spacing.x : NULL  
## $ legend.spacing.y : NULL  
## $ legend.key : list()  
## ..- attr(\*, "class")= chr [1:2] "element\_blank" "element"  
## $ legend.key.size : 'simpleUnit' num 1.2lines  
## ..- attr(\*, "unit")= int 3  
## $ legend.key.height : NULL  
## $ legend.key.width : NULL  
## $ legend.text :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : 'rel' num 0.8  
## ..$ hjust : NULL  
## ..$ vjust : NULL  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : NULL  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ legend.text.align : NULL  
## $ legend.title :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : num 0  
## ..$ vjust : NULL  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : NULL  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ legend.title.align : NULL  
## $ legend.position : chr "right"  
## $ legend.direction : NULL  
## $ legend.justification : chr "center"  
## $ legend.box : NULL  
## $ legend.box.just : NULL  
## $ legend.box.margin : 'margin' num [1:4] 0cm 0cm 0cm 0cm  
## ..- attr(\*, "unit")= int 1  
## $ legend.box.background : list()  
## ..- attr(\*, "class")= chr [1:2] "element\_blank" "element"  
## $ legend.box.spacing : 'simpleUnit' num 11points  
## ..- attr(\*, "unit")= int 8  
## $ panel.background : list()  
## ..- attr(\*, "class")= chr [1:2] "element\_blank" "element"  
## $ panel.border : list()  
## ..- attr(\*, "class")= chr [1:2] "element\_blank" "element"  
## $ panel.spacing : 'simpleUnit' num 5.5points  
## ..- attr(\*, "unit")= int 8  
## $ panel.spacing.x : NULL  
## $ panel.spacing.y : NULL  
## $ panel.grid :List of 6  
## ..$ colour : chr "grey92"  
## ..$ linewidth : NULL  
## ..$ linetype : NULL  
## ..$ lineend : NULL  
## ..$ arrow : logi FALSE  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_line" "element"  
## $ panel.grid.major : NULL  
## $ panel.grid.minor :List of 6  
## ..$ colour : NULL  
## ..$ linewidth : 'rel' num 0.5  
## ..$ linetype : NULL  
## ..$ lineend : NULL  
## ..$ arrow : logi FALSE  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_line" "element"  
## $ panel.grid.major.x : NULL  
## $ panel.grid.major.y : NULL  
## $ panel.grid.minor.x : NULL  
## $ panel.grid.minor.y : NULL  
## $ panel.ontop : logi FALSE  
## $ plot.background : list()  
## ..- attr(\*, "class")= chr [1:2] "element\_blank" "element"  
## $ plot.title :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : 'rel' num 1.2  
## ..$ hjust : num 0  
## ..$ vjust : num 1  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 0points 0points 5.5points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ plot.title.position : chr "panel"  
## $ plot.subtitle :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : num 0  
## ..$ vjust : num 1  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 0points 0points 5.5points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ plot.caption :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : 'rel' num 0.8  
## ..$ hjust : num 1  
## ..$ vjust : num 1  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 5.5points 0points 0points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ plot.caption.position : chr "panel"  
## $ plot.tag :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : 'rel' num 1.2  
## ..$ hjust : num 0.5  
## ..$ vjust : num 0.5  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : NULL  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ plot.tag.position : chr "topleft"  
## $ plot.margin : 'margin' num [1:4] 5.5points 5.5points 5.5points 5.5points  
## ..- attr(\*, "unit")= int 8  
## $ strip.background : list()  
## ..- attr(\*, "class")= chr [1:2] "element\_blank" "element"  
## $ strip.background.x : NULL  
## $ strip.background.y : NULL  
## $ strip.clip : chr "inherit"  
## $ strip.placement : chr "inside"  
## $ strip.text :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : chr "grey10"  
## ..$ size : 'rel' num 0.8  
## ..$ hjust : NULL  
## ..$ vjust : NULL  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 4.4points 4.4points 4.4points 4.4points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ strip.text.x : NULL  
## $ strip.text.x.bottom : NULL  
## $ strip.text.x.top : NULL  
## $ strip.text.y :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : NULL  
## ..$ vjust : NULL  
## ..$ angle : num -90  
## ..$ lineheight : NULL  
## ..$ margin : NULL  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ strip.text.y.left :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : NULL  
## ..$ vjust : NULL  
## ..$ angle : num 90  
## ..$ lineheight : NULL  
## ..$ margin : NULL  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ strip.text.y.right : NULL  
## $ strip.switch.pad.grid : 'simpleUnit' num 2.75points  
## ..- attr(\*, "unit")= int 8  
## $ strip.switch.pad.wrap : 'simpleUnit' num 2.75points  
## ..- attr(\*, "unit")= int 8  
## - attr(\*, "class")= chr [1:2] "theme" "gg"  
## - attr(\*, "complete")= logi TRUE  
## - attr(\*, "validate")= logi TRUE

# Show the plot  
print(bar\_graph\_month)



ggsave('for each month crash data.png', plot =bar\_graph\_month)

## Saving 8 x 5 in image

### 3) Visualizing crash data for each month but separated by years

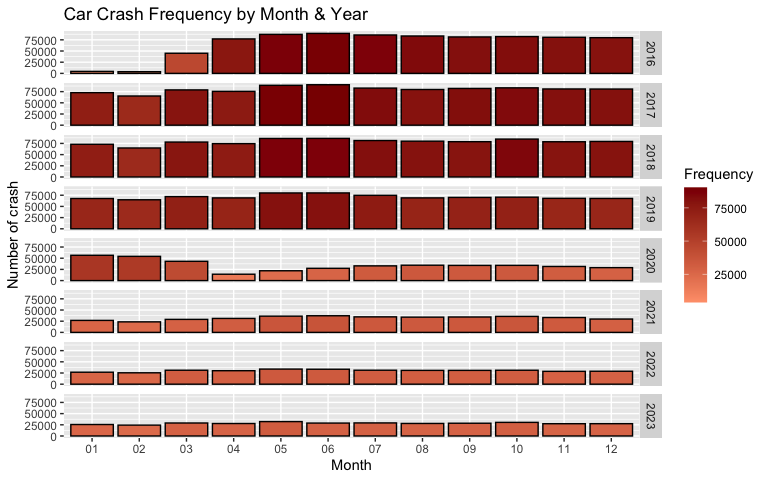
# Aggregate crash numbers by collision ID, month and year  
  
crash\_counts\_month\_year <- aggregate(collision\_id ~ month + year , data = crash\_data\_selected, FUN = function(collision\_id) length(collision\_id))  
  
# Rename the column  
names(crash\_counts\_month\_year)[3] <- "frequency"  
  
head(crash\_counts\_month\_year)

## month year frequency  
## 1 01 2016 4449  
## 2 02 2016 3784  
## 3 03 2016 44989  
## 4 04 2016 77017  
## 5 05 2016 87184  
## 6 06 2016 89379

# Create a bar plot using crash by month & year  
bar\_graph\_month\_year <- ggplot(data = crash\_counts\_month\_year, aes(x = month, y = frequency, fill = frequency)) +  
 facet\_grid(year ~ .) +  
 geom\_bar(stat = "identity", color = "black") + # Create bars with specified colors  
 labs(title = "Car Crash Frequency by Month & Year", x = "Month", y = "Number of crash") + # Add title and axis labels  
 scale\_fill\_gradient(low = "lightsalmon", high = "darkred", name = "Frequency")  
 theme\_minimal() + # Use a minimal theme  
 theme(axis.text.x = element\_text(angle = 45, hjust = 1)) # Rotate x-axis labels for better readability

## List of 97  
## $ line :List of 6  
## ..$ colour : chr "black"  
## ..$ linewidth : num 0.5  
## ..$ linetype : num 1  
## ..$ lineend : chr "butt"  
## ..$ arrow : logi FALSE  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_line" "element"  
## $ rect :List of 5  
## ..$ fill : chr "white"  
## ..$ colour : chr "black"  
## ..$ linewidth : num 0.5  
## ..$ linetype : num 1  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_rect" "element"  
## $ text :List of 11  
## ..$ family : chr ""  
## ..$ face : chr "plain"  
## ..$ colour : chr "black"  
## ..$ size : num 11  
## ..$ hjust : num 0.5  
## ..$ vjust : num 0.5  
## ..$ angle : num 0  
## ..$ lineheight : num 0.9  
## ..$ margin : 'margin' num [1:4] 0points 0points 0points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : logi FALSE  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ title : NULL  
## $ aspect.ratio : NULL  
## $ axis.title : NULL  
## $ axis.title.x :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : NULL  
## ..$ vjust : num 1  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 2.75points 0points 0points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ axis.title.x.top :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : NULL  
## ..$ vjust : num 0  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 0points 0points 2.75points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ axis.title.x.bottom : NULL  
## $ axis.title.y :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : NULL  
## ..$ vjust : num 1  
## ..$ angle : num 90  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 0points 2.75points 0points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ axis.title.y.left : NULL  
## $ axis.title.y.right :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : NULL  
## ..$ vjust : num 0  
## ..$ angle : num -90  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 0points 0points 0points 2.75points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ axis.text :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : chr "grey30"  
## ..$ size : 'rel' num 0.8  
## ..$ hjust : NULL  
## ..$ vjust : NULL  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : NULL  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ axis.text.x :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : num 1  
## ..$ vjust : num 1  
## ..$ angle : num 45  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 2.2points 0points 0points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi FALSE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ axis.text.x.top :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : NULL  
## ..$ vjust : num 0  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 0points 0points 2.2points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ axis.text.x.bottom : NULL  
## $ axis.text.y :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : num 1  
## ..$ vjust : NULL  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 0points 2.2points 0points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ axis.text.y.left : NULL  
## $ axis.text.y.right :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : num 0  
## ..$ vjust : NULL  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 0points 0points 0points 2.2points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ axis.ticks : list()  
## ..- attr(\*, "class")= chr [1:2] "element\_blank" "element"  
## $ axis.ticks.x : NULL  
## $ axis.ticks.x.top : NULL  
## $ axis.ticks.x.bottom : NULL  
## $ axis.ticks.y : NULL  
## $ axis.ticks.y.left : NULL  
## $ axis.ticks.y.right : NULL  
## $ axis.ticks.length : 'simpleUnit' num 2.75points  
## ..- attr(\*, "unit")= int 8  
## $ axis.ticks.length.x : NULL  
## $ axis.ticks.length.x.top : NULL  
## $ axis.ticks.length.x.bottom: NULL  
## $ axis.ticks.length.y : NULL  
## $ axis.ticks.length.y.left : NULL  
## $ axis.ticks.length.y.right : NULL  
## $ axis.line : list()  
## ..- attr(\*, "class")= chr [1:2] "element\_blank" "element"  
## $ axis.line.x : NULL  
## $ axis.line.x.top : NULL  
## $ axis.line.x.bottom : NULL  
## $ axis.line.y : NULL  
## $ axis.line.y.left : NULL  
## $ axis.line.y.right : NULL  
## $ legend.background : list()  
## ..- attr(\*, "class")= chr [1:2] "element\_blank" "element"  
## $ legend.margin : 'margin' num [1:4] 5.5points 5.5points 5.5points 5.5points  
## ..- attr(\*, "unit")= int 8  
## $ legend.spacing : 'simpleUnit' num 11points  
## ..- attr(\*, "unit")= int 8  
## $ legend.spacing.x : NULL  
## $ legend.spacing.y : NULL  
## $ legend.key : list()  
## ..- attr(\*, "class")= chr [1:2] "element\_blank" "element"  
## $ legend.key.size : 'simpleUnit' num 1.2lines  
## ..- attr(\*, "unit")= int 3  
## $ legend.key.height : NULL  
## $ legend.key.width : NULL  
## $ legend.text :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : 'rel' num 0.8  
## ..$ hjust : NULL  
## ..$ vjust : NULL  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : NULL  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ legend.text.align : NULL  
## $ legend.title :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : num 0  
## ..$ vjust : NULL  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : NULL  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ legend.title.align : NULL  
## $ legend.position : chr "right"  
## $ legend.direction : NULL  
## $ legend.justification : chr "center"  
## $ legend.box : NULL  
## $ legend.box.just : NULL  
## $ legend.box.margin : 'margin' num [1:4] 0cm 0cm 0cm 0cm  
## ..- attr(\*, "unit")= int 1  
## $ legend.box.background : list()  
## ..- attr(\*, "class")= chr [1:2] "element\_blank" "element"  
## $ legend.box.spacing : 'simpleUnit' num 11points  
## ..- attr(\*, "unit")= int 8  
## $ panel.background : list()  
## ..- attr(\*, "class")= chr [1:2] "element\_blank" "element"  
## $ panel.border : list()  
## ..- attr(\*, "class")= chr [1:2] "element\_blank" "element"  
## $ panel.spacing : 'simpleUnit' num 5.5points  
## ..- attr(\*, "unit")= int 8  
## $ panel.spacing.x : NULL  
## $ panel.spacing.y : NULL  
## $ panel.grid :List of 6  
## ..$ colour : chr "grey92"  
## ..$ linewidth : NULL  
## ..$ linetype : NULL  
## ..$ lineend : NULL  
## ..$ arrow : logi FALSE  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_line" "element"  
## $ panel.grid.major : NULL  
## $ panel.grid.minor :List of 6  
## ..$ colour : NULL  
## ..$ linewidth : 'rel' num 0.5  
## ..$ linetype : NULL  
## ..$ lineend : NULL  
## ..$ arrow : logi FALSE  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_line" "element"  
## $ panel.grid.major.x : NULL  
## $ panel.grid.major.y : NULL  
## $ panel.grid.minor.x : NULL  
## $ panel.grid.minor.y : NULL  
## $ panel.ontop : logi FALSE  
## $ plot.background : list()  
## ..- attr(\*, "class")= chr [1:2] "element\_blank" "element"  
## $ plot.title :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : 'rel' num 1.2  
## ..$ hjust : num 0  
## ..$ vjust : num 1  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 0points 0points 5.5points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ plot.title.position : chr "panel"  
## $ plot.subtitle :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : num 0  
## ..$ vjust : num 1  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 0points 0points 5.5points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ plot.caption :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : 'rel' num 0.8  
## ..$ hjust : num 1  
## ..$ vjust : num 1  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 5.5points 0points 0points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ plot.caption.position : chr "panel"  
## $ plot.tag :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : 'rel' num 1.2  
## ..$ hjust : num 0.5  
## ..$ vjust : num 0.5  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : NULL  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ plot.tag.position : chr "topleft"  
## $ plot.margin : 'margin' num [1:4] 5.5points 5.5points 5.5points 5.5points  
## ..- attr(\*, "unit")= int 8  
## $ strip.background : list()  
## ..- attr(\*, "class")= chr [1:2] "element\_blank" "element"  
## $ strip.background.x : NULL  
## $ strip.background.y : NULL  
## $ strip.clip : chr "inherit"  
## $ strip.placement : chr "inside"  
## $ strip.text :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : chr "grey10"  
## ..$ size : 'rel' num 0.8  
## ..$ hjust : NULL  
## ..$ vjust : NULL  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 4.4points 4.4points 4.4points 4.4points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ strip.text.x : NULL  
## $ strip.text.x.bottom : NULL  
## $ strip.text.x.top : NULL  
## $ strip.text.y :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : NULL  
## ..$ vjust : NULL  
## ..$ angle : num -90  
## ..$ lineheight : NULL  
## ..$ margin : NULL  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ strip.text.y.left :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : NULL  
## ..$ vjust : NULL  
## ..$ angle : num 90  
## ..$ lineheight : NULL  
## ..$ margin : NULL  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ strip.text.y.right : NULL  
## $ strip.switch.pad.grid : 'simpleUnit' num 2.75points  
## ..- attr(\*, "unit")= int 8  
## $ strip.switch.pad.wrap : 'simpleUnit' num 2.75points  
## ..- attr(\*, "unit")= int 8  
## - attr(\*, "class")= chr [1:2] "theme" "gg"  
## - attr(\*, "complete")= logi TRUE  
## - attr(\*, "validate")= logi TRUE

# Show the plot  
print(bar\_graph\_month\_year)



ggsave('crash data by month and year.png', plot = bar\_graph\_month\_year)

## Saving 8 x 5 in image

### 4) Visualizing crash data for time of the day

# Aggregate crash numbers by collision ID and crash\_time  
  
crash\_counts\_time <- aggregate(collision\_id ~ crash\_time , data = crash\_data\_selected, FUN = function(collision\_id) length(collision\_id))  
  
# Rename the column  
names(crash\_counts\_time)[2] <- "frequency"  
  
head(crash\_counts\_time, 20)

## crash\_time frequency  
## 1 0:00 76883  
## 2 0:01 3739  
## 3 0:02 1360  
## 4 0:03 1096  
## 5 0:04 1011  
## 6 0:05 7429  
## 7 0:06 992  
## 8 0:07 856  
## 9 0:08 995  
## 10 0:09 1001  
## 11 0:10 7108  
## 12 0:11 817  
## 13 0:12 1167  
## 14 0:13 896  
## 15 0:14 867  
## 16 0:15 8287  
## 17 0:16 886  
## 18 0:17 1033  
## 19 0:18 870  
## 20 0:19 919

library(scales)  
# Create a histogram plot using crash by time  
histogram\_crash\_time <- ggplot(data = crash\_counts\_time, aes(x = crash\_time, y = frequency, fill = frequency)) +  
 geom\_histogram(stat = "identity", color = "blue") + # Create bars with specified colors  
 labs(title = "Car Crash Frequency by Time of the Day", x = "Time of the Day", y = "Number of crash") + # Add title and axis labels  
 # scale\_fill\_gradient(low = "lightsalmon", high = "darkred", name = "Frequency") +  
 theme\_minimal() + # Use a minimal theme  
 theme(axis.text.x = element\_text(angle = 90, hjust = 1)) + # Rotate x-axis labels for better readability  
 scale\_x\_time(labels = time\_format("%H:%M"), breaks = breaks\_width("2 hour")) # Adjust the breaks

## Warning in geom\_histogram(stat = "identity", color = "blue"): Ignoring unknown  
## parameters: `binwidth`, `bins`, and `pad`

# Show the plot  
print(histogram\_crash\_time)

## Warning in structure(as.numeric(x), names = names(x)): NAs introduced by  
## coercion

## Warning in min(x): no non-missing arguments to min; returning Inf

## Warning in max(x): no non-missing arguments to max; returning -Inf

## Warning in min(diff(sort(x))): no non-missing arguments to min; returning Inf

## Warning: Removed 1440 rows containing missing values (`position\_stack()`).

A graph with blue lines

Description automatically generated

ggsave('crash data by time of the day.png', plot = histogram\_crash\_time)

## Saving 8 x 5 in image

## Warning in structure(as.numeric(x), names = names(x)): NAs introduced by  
## coercion

## Warning in min(x): no non-missing arguments to min; returning Inf

## Warning in max(x): no non-missing arguments to max; returning -Inf

## Warning in min(diff(sort(x))): no non-missing arguments to min; returning Inf

## Warning: Removed 1440 rows containing missing values (`position\_stack()`).

### 5) Visualizing crash data by Gender

# Aggregate crash numbers by person\_sex  
  
crash\_counts\_person\_sex <- aggregate(collision\_id ~ person\_sex , data = crash\_data\_selected, FUN = function(collision\_id) length(collision\_id))  
  
# Rename the column  
names(crash\_counts\_person\_sex)[2] <- "frequency"  
  
crash\_counts\_person\_sex

## person\_sex frequency  
## 1 404804  
## 2 F 1418722  
## 3 M 2817374  
## 4 U 422507

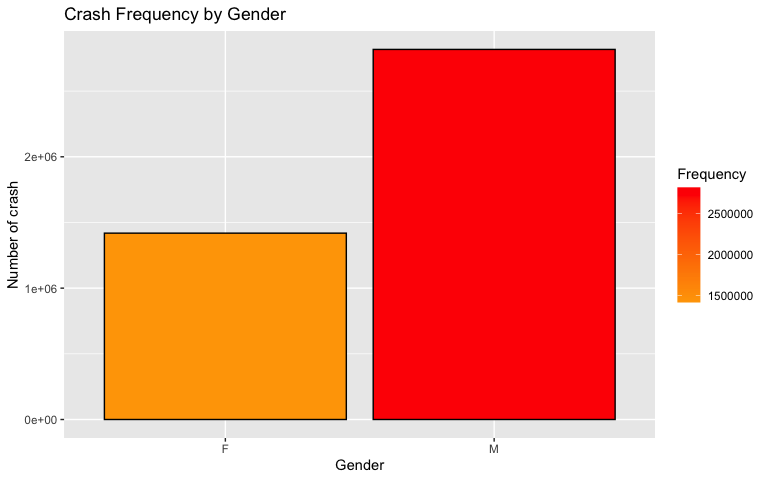
# we see there are a lot of missing data and unknown data, we will drop them  
crash\_counts\_person\_sex <- subset(crash\_counts\_person\_sex, person\_sex == 'F' | person\_sex == 'M')  
crash\_counts\_person\_sex

## person\_sex frequency  
## 2 F 1418722  
## 3 M 2817374

# Create a bar plot using crash by month & year  
bar\_graph\_gender <- ggplot(data = crash\_counts\_person\_sex, aes(x = person\_sex, y = frequency, fill = frequency)) +  
 geom\_bar(stat = "identity", color = "black") + # Create bars with specified colors  
 labs(title = "Crash Frequency by Gender", x = "Gender", y = "Number of crash") + # Add title and axis labels  
 scale\_fill\_gradient(low = "orange", high = "red", name = "Frequency")  
 theme\_minimal() + # Use a minimal theme  
 theme(axis.text.x = element\_text(angle = 45, hjust = 1)) # Rotate x-axis labels for better readability

## List of 97  
## $ line :List of 6  
## ..$ colour : chr "black"  
## ..$ linewidth : num 0.5  
## ..$ linetype : num 1  
## ..$ lineend : chr "butt"  
## ..$ arrow : logi FALSE  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_line" "element"  
## $ rect :List of 5  
## ..$ fill : chr "white"  
## ..$ colour : chr "black"  
## ..$ linewidth : num 0.5  
## ..$ linetype : num 1  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_rect" "element"  
## $ text :List of 11  
## ..$ family : chr ""  
## ..$ face : chr "plain"  
## ..$ colour : chr "black"  
## ..$ size : num 11  
## ..$ hjust : num 0.5  
## ..$ vjust : num 0.5  
## ..$ angle : num 0  
## ..$ lineheight : num 0.9  
## ..$ margin : 'margin' num [1:4] 0points 0points 0points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : logi FALSE  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ title : NULL  
## $ aspect.ratio : NULL  
## $ axis.title : NULL  
## $ axis.title.x :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : NULL  
## ..$ vjust : num 1  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 2.75points 0points 0points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ axis.title.x.top :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : NULL  
## ..$ vjust : num 0  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 0points 0points 2.75points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ axis.title.x.bottom : NULL  
## $ axis.title.y :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : NULL  
## ..$ vjust : num 1  
## ..$ angle : num 90  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 0points 2.75points 0points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ axis.title.y.left : NULL  
## $ axis.title.y.right :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : NULL  
## ..$ vjust : num 0  
## ..$ angle : num -90  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 0points 0points 0points 2.75points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ axis.text :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : chr "grey30"  
## ..$ size : 'rel' num 0.8  
## ..$ hjust : NULL  
## ..$ vjust : NULL  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : NULL  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ axis.text.x :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : num 1  
## ..$ vjust : num 1  
## ..$ angle : num 45  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 2.2points 0points 0points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi FALSE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ axis.text.x.top :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : NULL  
## ..$ vjust : num 0  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 0points 0points 2.2points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ axis.text.x.bottom : NULL  
## $ axis.text.y :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : num 1  
## ..$ vjust : NULL  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 0points 2.2points 0points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ axis.text.y.left : NULL  
## $ axis.text.y.right :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : num 0  
## ..$ vjust : NULL  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 0points 0points 0points 2.2points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ axis.ticks : list()  
## ..- attr(\*, "class")= chr [1:2] "element\_blank" "element"  
## $ axis.ticks.x : NULL  
## $ axis.ticks.x.top : NULL  
## $ axis.ticks.x.bottom : NULL  
## $ axis.ticks.y : NULL  
## $ axis.ticks.y.left : NULL  
## $ axis.ticks.y.right : NULL  
## $ axis.ticks.length : 'simpleUnit' num 2.75points  
## ..- attr(\*, "unit")= int 8  
## $ axis.ticks.length.x : NULL  
## $ axis.ticks.length.x.top : NULL  
## $ axis.ticks.length.x.bottom: NULL  
## $ axis.ticks.length.y : NULL  
## $ axis.ticks.length.y.left : NULL  
## $ axis.ticks.length.y.right : NULL  
## $ axis.line : list()  
## ..- attr(\*, "class")= chr [1:2] "element\_blank" "element"  
## $ axis.line.x : NULL  
## $ axis.line.x.top : NULL  
## $ axis.line.x.bottom : NULL  
## $ axis.line.y : NULL  
## $ axis.line.y.left : NULL  
## $ axis.line.y.right : NULL  
## $ legend.background : list()  
## ..- attr(\*, "class")= chr [1:2] "element\_blank" "element"  
## $ legend.margin : 'margin' num [1:4] 5.5points 5.5points 5.5points 5.5points  
## ..- attr(\*, "unit")= int 8  
## $ legend.spacing : 'simpleUnit' num 11points  
## ..- attr(\*, "unit")= int 8  
## $ legend.spacing.x : NULL  
## $ legend.spacing.y : NULL  
## $ legend.key : list()  
## ..- attr(\*, "class")= chr [1:2] "element\_blank" "element"  
## $ legend.key.size : 'simpleUnit' num 1.2lines  
## ..- attr(\*, "unit")= int 3  
## $ legend.key.height : NULL  
## $ legend.key.width : NULL  
## $ legend.text :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : 'rel' num 0.8  
## ..$ hjust : NULL  
## ..$ vjust : NULL  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : NULL  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ legend.text.align : NULL  
## $ legend.title :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : num 0  
## ..$ vjust : NULL  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : NULL  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ legend.title.align : NULL  
## $ legend.position : chr "right"  
## $ legend.direction : NULL  
## $ legend.justification : chr "center"  
## $ legend.box : NULL  
## $ legend.box.just : NULL  
## $ legend.box.margin : 'margin' num [1:4] 0cm 0cm 0cm 0cm  
## ..- attr(\*, "unit")= int 1  
## $ legend.box.background : list()  
## ..- attr(\*, "class")= chr [1:2] "element\_blank" "element"  
## $ legend.box.spacing : 'simpleUnit' num 11points  
## ..- attr(\*, "unit")= int 8  
## $ panel.background : list()  
## ..- attr(\*, "class")= chr [1:2] "element\_blank" "element"  
## $ panel.border : list()  
## ..- attr(\*, "class")= chr [1:2] "element\_blank" "element"  
## $ panel.spacing : 'simpleUnit' num 5.5points  
## ..- attr(\*, "unit")= int 8  
## $ panel.spacing.x : NULL  
## $ panel.spacing.y : NULL  
## $ panel.grid :List of 6  
## ..$ colour : chr "grey92"  
## ..$ linewidth : NULL  
## ..$ linetype : NULL  
## ..$ lineend : NULL  
## ..$ arrow : logi FALSE  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_line" "element"  
## $ panel.grid.major : NULL  
## $ panel.grid.minor :List of 6  
## ..$ colour : NULL  
## ..$ linewidth : 'rel' num 0.5  
## ..$ linetype : NULL  
## ..$ lineend : NULL  
## ..$ arrow : logi FALSE  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_line" "element"  
## $ panel.grid.major.x : NULL  
## $ panel.grid.major.y : NULL  
## $ panel.grid.minor.x : NULL  
## $ panel.grid.minor.y : NULL  
## $ panel.ontop : logi FALSE  
## $ plot.background : list()  
## ..- attr(\*, "class")= chr [1:2] "element\_blank" "element"  
## $ plot.title :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : 'rel' num 1.2  
## ..$ hjust : num 0  
## ..$ vjust : num 1  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 0points 0points 5.5points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ plot.title.position : chr "panel"  
## $ plot.subtitle :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : num 0  
## ..$ vjust : num 1  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 0points 0points 5.5points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ plot.caption :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : 'rel' num 0.8  
## ..$ hjust : num 1  
## ..$ vjust : num 1  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 5.5points 0points 0points 0points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ plot.caption.position : chr "panel"  
## $ plot.tag :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : 'rel' num 1.2  
## ..$ hjust : num 0.5  
## ..$ vjust : num 0.5  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : NULL  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ plot.tag.position : chr "topleft"  
## $ plot.margin : 'margin' num [1:4] 5.5points 5.5points 5.5points 5.5points  
## ..- attr(\*, "unit")= int 8  
## $ strip.background : list()  
## ..- attr(\*, "class")= chr [1:2] "element\_blank" "element"  
## $ strip.background.x : NULL  
## $ strip.background.y : NULL  
## $ strip.clip : chr "inherit"  
## $ strip.placement : chr "inside"  
## $ strip.text :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : chr "grey10"  
## ..$ size : 'rel' num 0.8  
## ..$ hjust : NULL  
## ..$ vjust : NULL  
## ..$ angle : NULL  
## ..$ lineheight : NULL  
## ..$ margin : 'margin' num [1:4] 4.4points 4.4points 4.4points 4.4points  
## .. ..- attr(\*, "unit")= int 8  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ strip.text.x : NULL  
## $ strip.text.x.bottom : NULL  
## $ strip.text.x.top : NULL  
## $ strip.text.y :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : NULL  
## ..$ vjust : NULL  
## ..$ angle : num -90  
## ..$ lineheight : NULL  
## ..$ margin : NULL  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ strip.text.y.left :List of 11  
## ..$ family : NULL  
## ..$ face : NULL  
## ..$ colour : NULL  
## ..$ size : NULL  
## ..$ hjust : NULL  
## ..$ vjust : NULL  
## ..$ angle : num 90  
## ..$ lineheight : NULL  
## ..$ margin : NULL  
## ..$ debug : NULL  
## ..$ inherit.blank: logi TRUE  
## ..- attr(\*, "class")= chr [1:2] "element\_text" "element"  
## $ strip.text.y.right : NULL  
## $ strip.switch.pad.grid : 'simpleUnit' num 2.75points  
## ..- attr(\*, "unit")= int 8  
## $ strip.switch.pad.wrap : 'simpleUnit' num 2.75points  
## ..- attr(\*, "unit")= int 8  
## - attr(\*, "class")= chr [1:2] "theme" "gg"  
## - attr(\*, "complete")= logi TRUE  
## - attr(\*, "validate")= logi TRUE

# Show the plot  
print(bar\_graph\_gender)



ggsave('crash data by gender.png', plot = bar\_graph\_gender)

## Saving 8 x 5 in image