CITS4009 Project 1: 2021

Code

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Introduction

This is a project involving the study of a dataset from the US Department of Labor's "US Accident Injury Dataset", which was downloaded from Data.gov. The total number of records in the collection is 202814, and it spans 15 years (2000 to 2015). This data set includes information about the accidents/illness/injuries occurs in various mines.Nature, cause, reason, time & location of accident, employee experience, days lost as result of accident and various parameters are recorded in the data.

Exploratory study of data

In order to exploration of data, firstly required libraries and data set is loaded.

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```
#load libraries
library(dplyr)
library(ggplot2)
#load data set in R environment
us_data <- read.csv("us_data.csv")
```

Using R functions to explore the data

Hide

```
#structure of the data set
str(us_data)
```

```
'data.frame':   202814 obs. of  57 variables:
 $ MINE_ID           : int  100003 100003 100008 100011 100011 100011 100011 100011
100016 100021 ...
 $ CONTROLLER_ID     : chr  "41044" "41044" "M31753" "M11763" ...
 $ CONTROLLER_NAME   : chr  "Lhoist Group" "Lhoist Group" "Alan B  Cheney" "Imerys S
A" ...
 $ OPERATOR_ID       : chr  "L13586" "L13586" "L31753" "L17074" ...
 $ OPERATOR_NAME     : chr  "Lhoist North America " "Lhoist North America " "Cheney
Lime & Cement Company" "Imerys Pigments LLC" ...
 $ CONTRACTOR_ID     : chr  "" "" "" "" ...
 $ DOCUMENT_NO       : num  2.2e+11 2.2e+11 2.2e+11 2.2e+11 2.2e+11 ...
 $ SUBUNIT_CD        : int  3 30 30 30 30 30 30 30 3 3 ...
 $ SUBUNIT           : chr  "STRIP, QUARY, OPEN PIT" "MILL OPERATION/PREPARATION PLA
NT" "MILL OPERATION/PREPARATION PLANT" "MILL OPERATION/PREPARATION PLANT" ...
 $ ACCIDENT_DT       : chr  "14/03/2012" "8/01/2007" "4/07/2009" "26/05/2000" ...
 $ CAL_YR            : int  2012 2007 2009 2000 2005 2006 2008 2012 2000 2006 ...
 $ CAL_QTR           : int  1 1 3 2 1 1 4 2 3 1 ...
 $ FISCAL_YR         : int  2012 2007 2009 2000 2005 2006 2009 2012 2000 2006 ...
 $ FISCAL_QTR        : int  2 2 4 3 2 2 1 3 4 2 ...
 $ ACCIDENT_TIME     : int  945 1105 1000 1100 1430 1130 430 930 730 230 ...
 $ DEGREE_INJURY_CD  : chr  "5" "6" "3" "5" ...
 $ DEGREE_INJURY     : chr  "DAYS RESTRICTED ACTIVITY ONLY" "NO DYS AWY FRM WRK,NO R
STR ACT" "DAYS AWAY FROM WORK ONLY" "DAYS RESTRICTED ACTIVITY ONLY" ...
 $ FIPS_STATE_CD     : int  1 1 1 1 1 1 1 1 1 1 ...
 $ UG_LOCATION_CD    : chr  "?" "?" "?" "?" ...
 $ UG_LOCATION       : chr  "NO VALUE FOUND" "NO VALUE FOUND" "NO VALUE FOUND" "NO V
ALUE FOUND" ...
 $ UG_MINING_METHOD_CD: chr  "?" "?" "?" "?" ...
 $ UG_MINING_METHOD  : chr  "NO VALUE FOUND" "NO VALUE FOUND" "NO VALUE FOUND" "NO V
ALUE FOUND" ...
 $ MINING_EQUIP_CD   : chr  "24" "28" "?" "?" ...
 $ MINING_EQUIP      : chr  "Front-end loader, Tractor-shovel, Payloader, Highlift,
Skip loader" "Hand tools (not powered)" "NO VALUE FOUND" "NO VALUE FOUND" ...
 $ EQUIP_MFR_CD      : chr  "119" "121" "?" "?" ...
 $ EQUIP_MFR_NAME    : chr  "Not on this list" "Not Reported" "NO VALUE FOUND" "NO V
ALUE FOUND" ...
 $ EQUIP_MODEL_NO    : chr  "22321" "" "" "?" ...
 $ SHIFT_BEGIN_TIME  : int  600 700 600 700 700 700 2300 700 700 1800 ...
 $ CLASSIFICATION_CD : chr  "12" "10" "18" "9" ...
 $ CLASSIFICATION    : chr  "POWERED HAULAGE" "HANDTOOLS (NONPOWERED)" "SLIP OR FALL
OF PERSON" "HANDLING OF MATERIALS" ...
 $ ACCIDENT_TYPE_CD  : chr  "21" "8" "30" "27" ...
 $ ACCIDENT_TYPE     : chr  "CGHT I, U, B, MVNG & STTN OBJS" "STRUCK BY, NEC" "OVER-
EXERTION, NEC" "OVER-EXERTION IN LIFTING OBJS" ...
 $ NO_INJURIES       : int  1 1 1 1 1 1 1 1 1 1 ...
 $ TOT_EXPER         : num  4.35 0.02 10 NA 0.87 ...
 $ MINE_EXPER        : num  4.35 0.02 2.15 0.23 0.87 ...
 $ JOB_EXPER         : num  0.67 0.02 2.15 0.23 0.38 ...
 $ OCCUPATION_CD     : chr  "374" "374" "374" "374" ...
 $ OCCUPATION        : chr  "Warehouseman, Bagger, Palletizer/Stacker, Store keeper,
Packager, Fabricator, Cleaning plant operator" "Warehouseman, Bagger, Palletizer/Stac
ker, Store keeper, Packager, Fabricator, Cleaning plant operator" "Warehouseman, Bagg
er, Palletizer/Stacker, Store keeper, Packager, Fabricator, Cleaning plant operator"
"Warehouseman, Bagger, Palletizer/Stacker, Store keeper, Packager, Fabricator, Cleani
ng plant operator" ...
```

```
 $ ACTIVITY_CD        : chr  "28" "30" "13" "28" ...
 $ ACTIVITY           : chr  "HANDLING SUPPLIES/MATERIALS" "HAND TOOLS (NOT POWERED)"
"CLIMB SCAFFOLDS/LADDERS/PLATFORMS" "HANDLING SUPPLIES/MATERIALS" ...
 $ INJURY_SOURCE_CD   : chr  "76" "46" "117" "4" ...
 $ INJURY_SOURCE      : chr  "SURFACE MINING MACHINES" "AXE,HAMMER,SLEDGE" "GROUND"
"BAGS" ...
 $ NATURE_INJURY_CD   : chr  "160" "180" "330" "330" ...
 $ NATURE_INJURY      : chr  "CONTUSN,BRUISE,INTAC SKIN" "CUT,LACER,PUNCT-OPN WOUND"
"SPRAIN,STRAIN RUPT DISC" "SPRAIN,STRAIN RUPT DISC" ...
 $ INJ_BODY_PART_CD   : chr  "700" "100" "520" "420" ...
 $ INJ_BODY_PART      : chr  "MULTIPLE PARTS (MORE THAN ONE MAJOR)" "HEAD,NEC" "ANKL
E" "BACK (MUSCLES/SPINE/S-CORD/TAILBONE)" ...
 $ SCHEDULE_CHARGE    : int  0 0 0 NA 0 0 0 0 NA 0 ...
 $ DAYS_RESTRICT      : int  8 0 0 5 5 3 0 21 10 19 ...
 $ DAYS_LOST          : int  0 0 9 NA 0 0 0 0 NA 13 ...
 $ TRANS_TERM         : chr  "N" "N" "N" "N" ...
 $ RETURN_TO_WORK_DT  : chr  "03/26/2012" "1/09/2007" "07/14/2009" "6/01/2000" ...
 $ IMMED_NOTIFY_CD    : chr  "? " "? " "? " "13" ...
 $ IMMED_NOTIFY       : chr  "NO VALUE FOUND" "NO VALUE FOUND" "NO VALUE FOUND" "NOT
MARKED" ...
 $ INVEST_BEGIN_DT    : chr  "" "" "" "" ...
 $ NARRATIVE          : chr  "Employee was cleaning up at the Primary Crusher with th
e Dingo skid steer. The employee slipped and fell while "| __truncated__ "Handle of s
ledgehammer broke and head of hammer hit employee in the forehead." "EMPLOYEE WAS CLI
MBING DOWN A LADDER AND WHEN HE STEPPED TO THE GROUND HE SLIPPED AND SPRAINED HIS LEF
T ANKLE." "HE PULLED A BACK MUSCLE WHILE STACKING BAGS OF MATERIAL." ...
 $ CLOSED_DOC_NO      : num  NA NA 3.2e+11 3.2e+11 NA ...
 $ COAL_METAL_IND     : chr  "M" "M" "M" "M" ...
```

Data set contain 57 attributes with 202814 instances. 13 integer, 5 numeric and 39 character variables.

Hide

```
#summary of the data set
summary(us_data)
```

```
    MINE_ID        CONTROLLER_ID      CONTROLLER_NAME    OPERATOR_ID        OPERATOR_
NAME
 Min.   : 100003   Length:202814      Length:202814      Length:202814      Length:20
2814
 1st Qu.:1300095   Class :character   Class :character   Class :character   Class :ch
aracter
 Median :2602512   Mode  :character   Mode  :character   Mode  :character   Mode  :ch
aracter
 Mean   :2684336
 3rd Qu.:4400170
 Max.   :5500008

 CONTRACTOR_ID       DOCUMENT_NO          SUBUNIT_CD       SUBUNIT          ACCIDENT_
DT            CAL_YR
 Length:202814      Min.   :2.200e+11   Min.   : 1.000   Length:202814      Length:20
2814      Min.   :2000
 Class :character   1st Qu.:2.200e+11   1st Qu.: 1.000   Class :character   Class :ch
aracter   1st Qu.:2002
 Mode  :character   Median :2.201e+11   Median : 3.000   Mode  :character   Mode  :ch
aracter   Median :2006
                    Mean   :2.201e+11   Mean   : 9.362
Mean   :2006
                    3rd Qu.:2.201e+11   3rd Qu.:17.000
3rd Qu.:2010
                    Max.   :2.202e+11   Max.   :99.000
Max.   :2015

    CAL_QTR        FISCAL_YR      FISCAL_QTR    ACCIDENT_TIME  DEGREE_INJURY_CD   DEG
REE_INJURY
 Min.   :1.000   Min.   :2000   Min.   :1.000   Min.   :   1   Length:202814      Len
gth:202814
 1st Qu.:1.000   1st Qu.:2003   1st Qu.:2.000   1st Qu.: 845   Class :character   Cla
ss :character
 Median :2.000   Median :2006   Median :3.000   Median :1230   Mode  :character   Mod
e  :character
 Mean   :2.453   Mean   :2006   Mean   :2.574   Mean   :1886
 3rd Qu.:3.000   3rd Qu.:2010   3rd Qu.:4.000   3rd Qu.:1730
 Max.   :4.000   Max.   :2015   Max.   :4.000   Max.   :9999
                                                NA's   :1
 FIPS_STATE_CD   UG_LOCATION_CD     UG_LOCATION        UG_MINING_METHOD_CD UG_MINING_
METHOD
 Min.   : 1.00   Length:202814      Length:202814      Length:202814       Length:202
814
 1st Qu.:18.00   Class :character   Class :character   Class :character    Class :cha
racter
 Median :32.00   Mode  :character   Mode  :character   Mode  :character    Mode  :cha
racter
 Mean   :32.31
 3rd Qu.:49.00
 Max.   :78.00

 MINING_EQUIP_CD    MINING_EQUIP       EQUIP_MFR_CD       EQUIP_MFR_NAME     EQUIP_MO
DEL_NO
 Length:202814      Length:202814      Length:202814      Length:202814      Length:2
02814
```

```
 Class :character   Class :character   Class :character   Class :character   Class :c
haracter
 Mode  :character   Mode  :character   Mode  :character   Mode  :character   Mode  :c
haracter



 SHIFT_BEGIN_TIME CLASSIFICATION_CD  CLASSIFICATION     ACCIDENT_TYPE_CD   ACCIDENT_T
YPE
 Min.   :   1     Length:202814      Length:202814      Length:202814      Length:202
814
 1st Qu.: 630     Class :character   Class :character   Class :character   Class :cha
racter
 Median : 700     Mode  :character   Mode  :character   Mode  :character   Mode  :cha
racter
 Mean   :1384
 3rd Qu.:1545
 Max.   :9999
 NA's   :991
  NO_INJURIES        TOT_EXPER       MINE_EXPER      JOB_EXPER     OCCUPATION_CD
OCCUPATION
 Min.   : 0.0000   Min.   : 0.01   Min.   : 0.01   Min.   : 0.01   Length:202814
Length:202814
 1st Qu.: 1.0000   1st Qu.: 2.00   1st Qu.: 0.69   1st Qu.: 1.00   Class :character
Class :character
 Median : 1.0000   Median : 7.00   Median : 2.77   Median : 3.23   Mode  :character
Mode  :character
 Mean   : 0.9039   Mean   :11.32   Mean   : 6.63   Mean   : 6.98
 3rd Qu.: 1.0000   3rd Qu.:20.00   3rd Qu.: 8.77   3rd Qu.:10.00
 Max.   :36.0000   Max.   :65.00   Max.   :65.00   Max.   :65.00
                   NA's   :37400   NA's   :34325   NA's   :33746
 ACTIVITY_CD          ACTIVITY         INJURY_SOURCE_CD   INJURY_SOURCE      NATURE_I
NJURY_CD
 Length:202814      Length:202814      Length:202814      Length:202814      Length:2
02814
 Class :character   Class :character   Class :character   Class :character   Class :c
haracter
 Mode  :character   Mode  :character   Mode  :character   Mode  :character   Mode  :c
haracter



 NATURE_INJURY      INJ_BODY_PART_CD   INJ_BODY_PART      SCHEDULE_CHARGE   DAYS_REST
RICT
 Length:202814      Length:202814      Length:202814      Min.   :   0.00   Min.   :
0.00
 Class :character   Class :character   Class :character   1st Qu.:   0.00   1st Qu.:
0.00
 Mode  :character   Mode  :character   Mode  :character   Median :   0.00   Median :
0.00
                                                         Mean   :  71.93   Mean   :
7.98
                                                         3rd Qu.:   0.00   3rd Qu.:
4.00
```

```
                                                                Max.   :6000.00   Max.   :9
04.00
                                                                NA's   :65006     NA's   :5
4856
   DAYS_LOST        TRANS_TERM        RETURN_TO_WORK_DT  IMMED_NOTIFY_CD    IMMED_NOT
IFY
 Min.   :   0.00   Length:202814      Length:202814      Length:202814      Length:20
2814
 1st Qu.:   0.00   Class :character   Class :character   Class :character   Class :ch
aracter
 Median :   0.00   Mode  :character   Mode  :character   Mode  :character   Mode  :ch
aracter
 Mean   :  25.26
 3rd Qu.:  21.00
 Max.   :1247.00
 NA's   :39677
 INVEST_BEGIN_DT     NARRATIVE          CLOSED_DOC_NO       COAL_METAL_IND
 Length:202814      Length:202814      Min.   :3.200e+10   Length:202814
 Class :character   Class :character   1st Qu.:3.200e+11   Class :character
 Mode  :character   Mode  :character   Median :3.201e+11   Mode  :character
                                       Mean   :3.201e+11
                                       3rd Qu.:3.201e+11
                                       Max.   :3.202e+11
                                       NA's   :116621
```

First 5 rows of the data set to have glance of the data are bellow:

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```
head(us_data,5)
```

	MINE... <int>	CONTROLLE... <chr>	CONTROLLER_... <chr>	OPERATO... <chr>	OPERATOR_NAME <chr>
1	100003	41044	Lhoist Group	L13586	Lhoist North America
2	100003	41044	Lhoist Group	L13586	Lhoist North America
3	100008	M31753	Alan B Cheney	L31753	Cheney Lime & Cement Company
4	100011	M11763	Imerys S A	L17074	Imerys Pigments LLC
5	100011	M11763	Imerys S A	L17074	Imerys Pigments LLC

5 rows | 1-7 of 57 columns

Data cleaning

Dealing with NA values

Checking for missing values in each column of data set

Hide

```
sapply(us_data,function(x)sum(is.na(x)))
```

```
            MINE_ID       CONTROLLER_ID     CONTROLLER_NAME         OPERATOR_ID
OPERATOR_NAME
                  0                   0                   0                   0
0
      CONTRACTOR_ID         DOCUMENT_NO          SUBUNIT_CD             SUBUNIT
ACCIDENT_DT
                  0                   0                   0                   0
0
             CAL_YR             CAL_QTR          FISCAL_YR          FISCAL_QTR
ACCIDENT_TIME
                  0                   0                   0                   0
1
   DEGREE_INJURY_CD       DEGREE_INJURY       FIPS_STATE_CD      UG_LOCATION_CD
UG_LOCATION
                  0                   0                   0                   0
0
UG_MINING_METHOD_CD    UG_MINING_METHOD     MINING_EQUIP_CD        MINING_EQUIP
EQUIP_MFR_CD
                  0                   0                   0                   0
0
     EQUIP_MFR_NAME      EQUIP_MODEL_NO    SHIFT_BEGIN_TIME   CLASSIFICATION_CD
CLASSIFICATION
                  0                  48                 991                   0
0
   ACCIDENT_TYPE_CD       ACCIDENT_TYPE         NO_INJURIES           TOT_EXPER
MINE_EXPER
                  0                   0                   0               37400
34325
          JOB_EXPER       OCCUPATION_CD          OCCUPATION         ACTIVITY_CD
ACTIVITY
              33746                   0                   0                   0
0
   INJURY_SOURCE_CD       INJURY_SOURCE    NATURE_INJURY_CD       NATURE_INJURY    IN
J_BODY_PART_CD
                  0                   0                   0                   0
0
      INJ_BODY_PART     SCHEDULE_CHARGE       DAYS_RESTRICT           DAYS_LOST
TRANS_TERM
                  0               65006               54856               39677
0
  RETURN_TO_WORK_DT     IMMED_NOTIFY_CD        IMMED_NOTIFY     INVEST_BEGIN_DT
NARRATIVE
                  0                   0                   0                   0
0
      CLOSED_DOC_NO      COAL_METAL_IND
             116621                   0
```

Variables **EQUIP_MODEL_NO, SHIFT_BEGIN_TIME ,TOT_EXPER, MINE_EXPER, JOB_EXPER, SCHEDULE_CHARGE, DAYS_RESTRICT, DAYS_LOST, CLOSED_DOC_NO** have missing values.

Dealing with Anamolies

checking for outliers in the data.

Hide

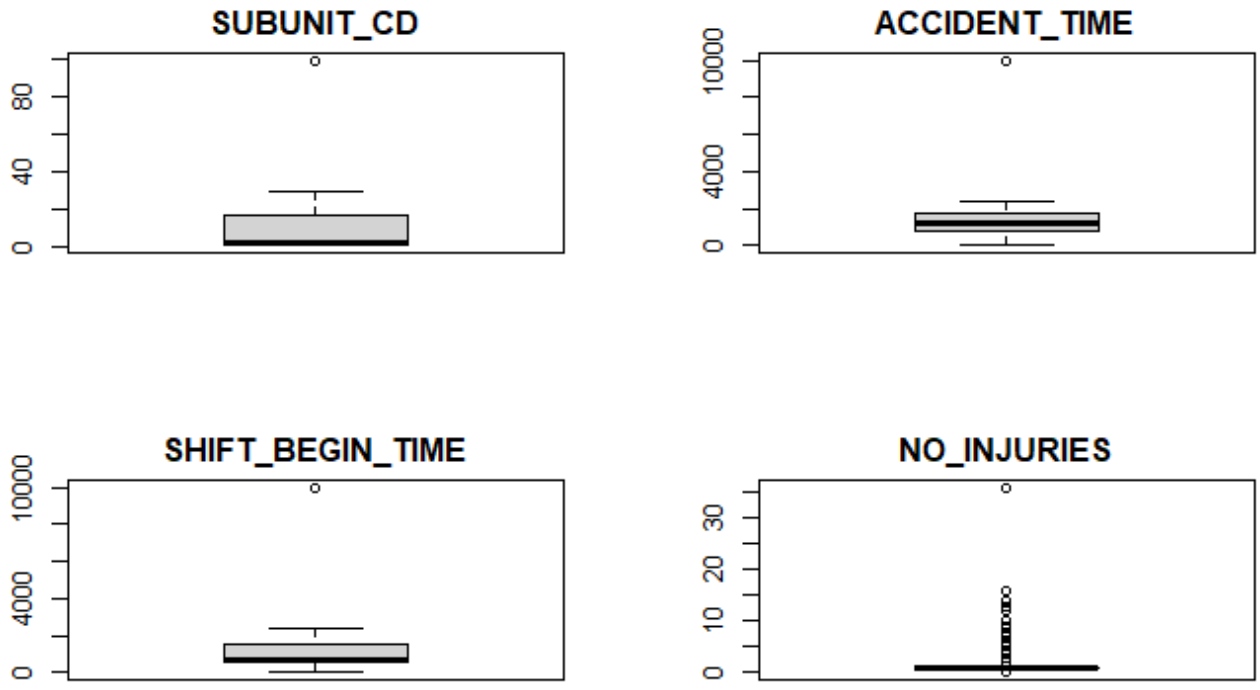
```
par(mfrow = c(2, 2))
boxplot(us_data$SUBUNIT_CD, main= "SUBUNIT_CD")
boxplot(us_data$ACCIDENT_TIME, main= "ACCIDENT_TIME")
```

Hide

```
boxplot(us_data$SHIFT_BEGIN_TIME, main= "SHIFT_BEGIN_TIME")
boxplot(us_data$NO_INJURIES, main= "NO_INJURIES")
```

Hide

```
par(mfrow = c(2, 2))
```



Hide

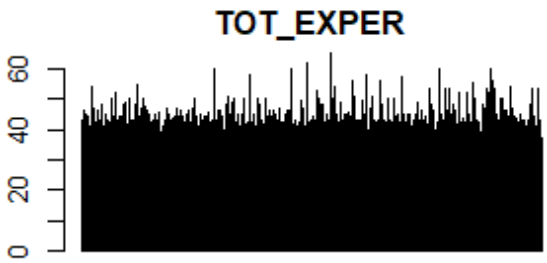
```
barplot(us_data$TOT_EXPER, main= "TOT_EXPER")
barplot(us_data$MINE_EXPER, main= "MINE_EXPER")
```

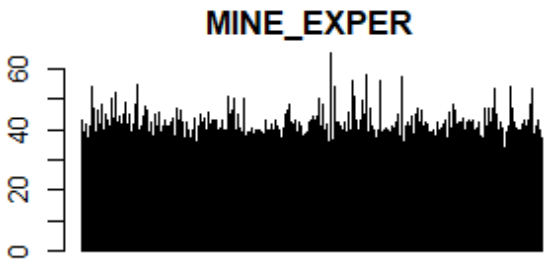
Hide

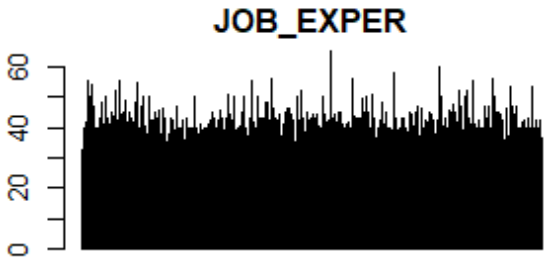
```
barplot(us_data$JOB_EXPER, main= "JOB_EXPER")
boxplot(us_data$SCHEDULE_CHARGE, main= "SCHEDULE_CHARGE")
```

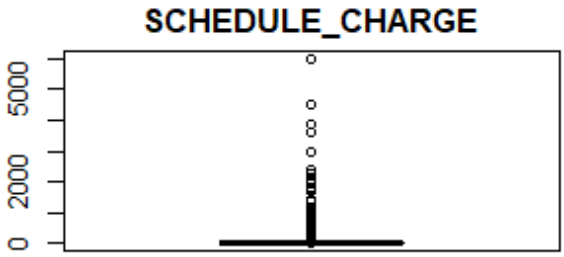
Hide

```
par(mfrow = c(2, 2))
```







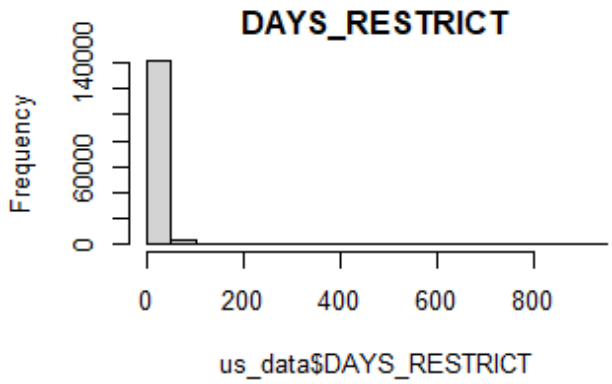


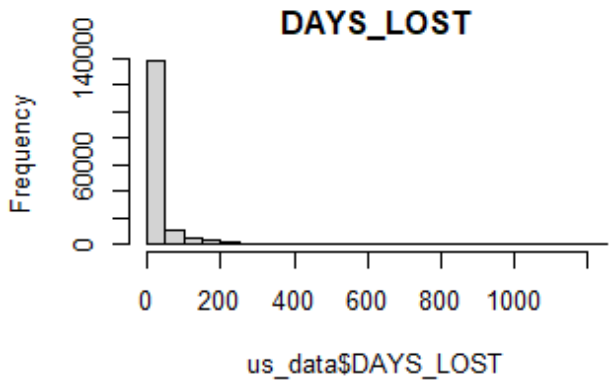
Hide

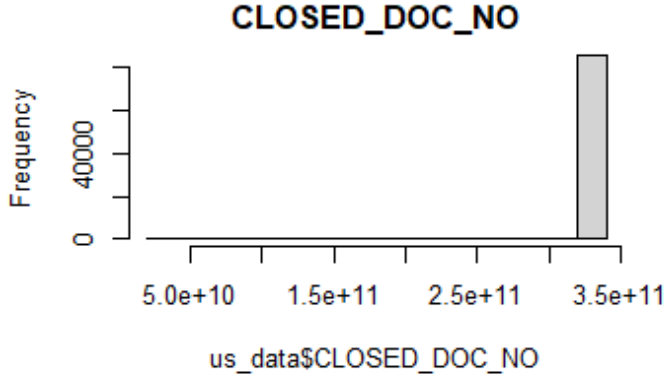
```
hist(us_data$DAYS_RESTRICT, main= "DAYS_RESTRICT")
hist(us_data$DAYS_LOST, main= "DAYS_LOST")
```

Hide

```
hist(us_data$CLOSED_DOC_NO, main= "CLOSED_DOC_NO")
```







SUBUNIT_CD, ACCIDENT_TIME, SHIFT_BEGIN_TIME, NO_INJURIES, TOT_EXPER, MINE_EXPER, JOB_EXPER, SCHEDULE_CHARGE, DAYS_RESTRICT, DAYS_LOST and CLOSED_DOC_NO have outliers.

Hide

```
#replacing outliers with missing values
for (i in c(8,15,28,33,34,35,36,47,48,49,56)){
     qntile <- quantile(us_data[,i], probs=c(.25, .75),na.rm = TRUE)
     H <- 1.5 * IQR(us_data[,i], na.rm = T)
     us_data[,i][us_data[,i] < (qntile[1] - H)] <- NA
     us_data[,i][us_data[,i] > (qntile[2] + H)] <- NA
}
```

Hide

```
#replacing "?"
us_data$MINING_EQUIP_CD[us_data$MINING_EQUIP_CD == "?"] <- NA
us_data$EQUIP_MFR_CD[us_data$EQUIP_MFR_CD == "?"] <- NA
```

Hide

```
#removing NA values
us_data <- na.omit(us_data)
```

Data transformation

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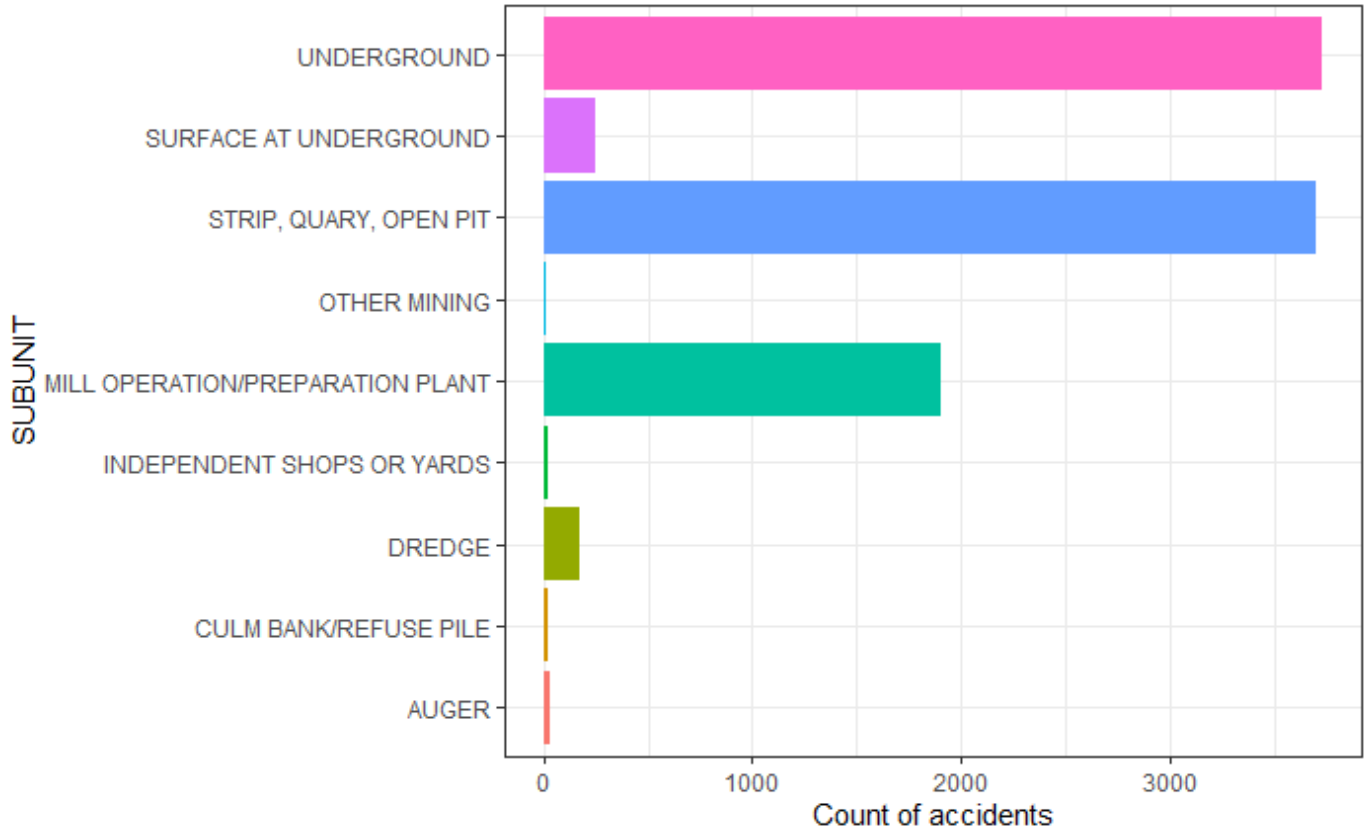
```
#transform character type variables to factor type
us_data[sapply(us_data, is.character)] <- lapply(us_data[sapply(us_data, is.characte
r)], as.factor)
```

Visualization

Hide

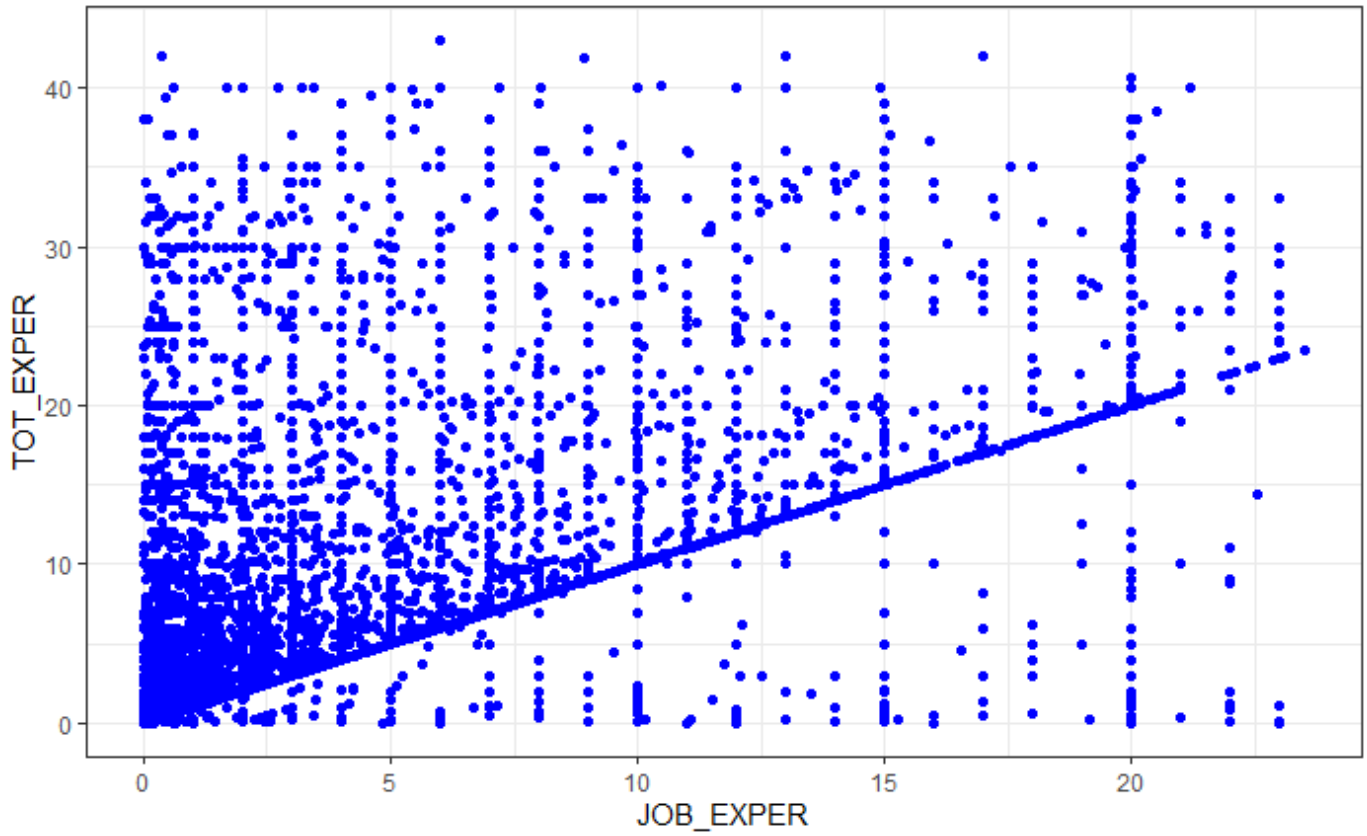
```
# location within a mine where the accident/injury/illness occurred
ggplot(data = us_data,aes(SUBUNIT,fill=SUBUNIT )) +geom_bar() + coord_flip() +theme_b
w() +
  theme(legend.position = "none") +ylab("Count of accidents")
```



underground,strip and open pit locations have more number of accidents as compare to other locations.

Hide

```
#Relation of total mining experience of person with Experience in the job title of th
e person
ggplot(data = us_data,aes(JOB_EXPER,TOT_EXPER)) + geom_point(col= "blue") +
  theme_bw()
```



Their is a quite vague relation between JOB_EXPER & TOT_EXPE, but most of the employees have more Experience in the job title with more total mining experience.

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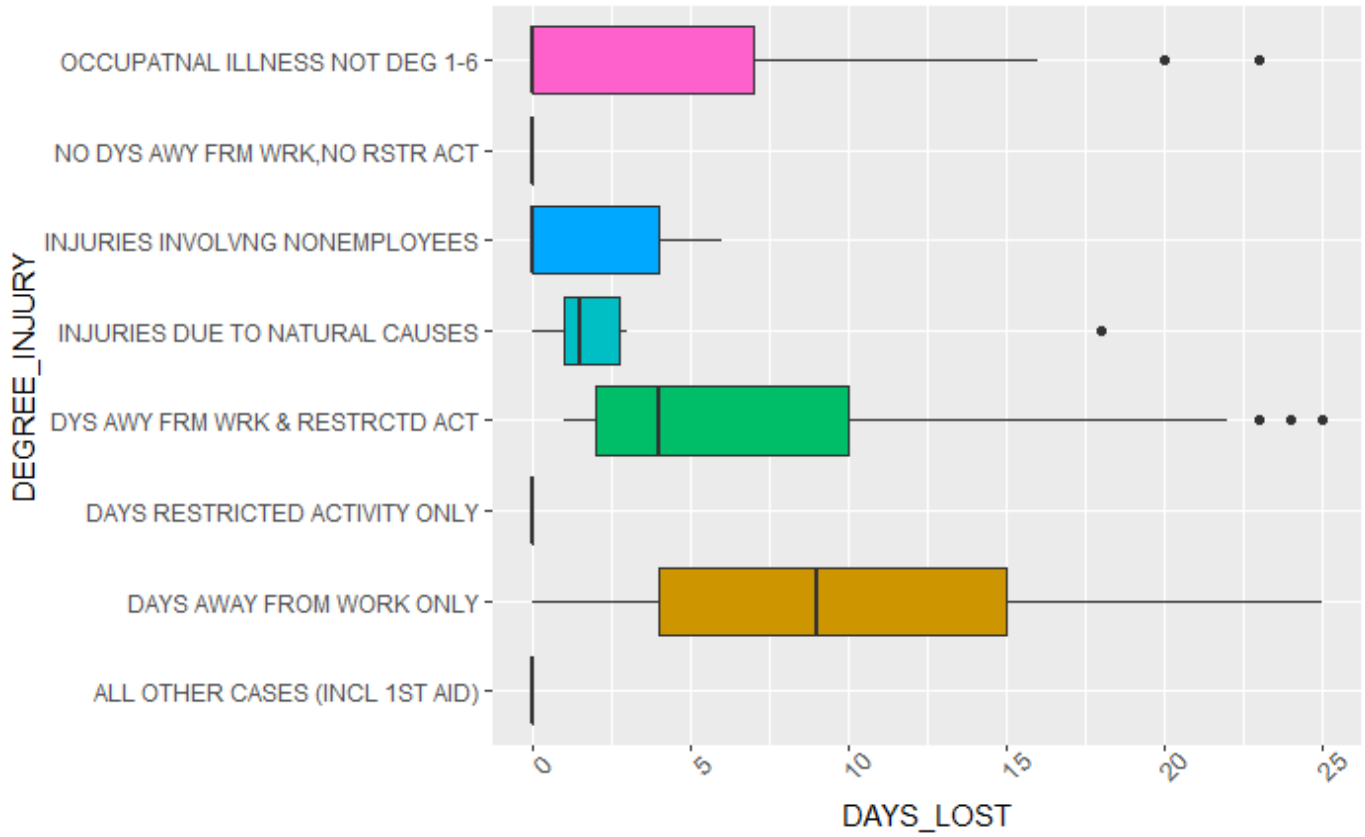
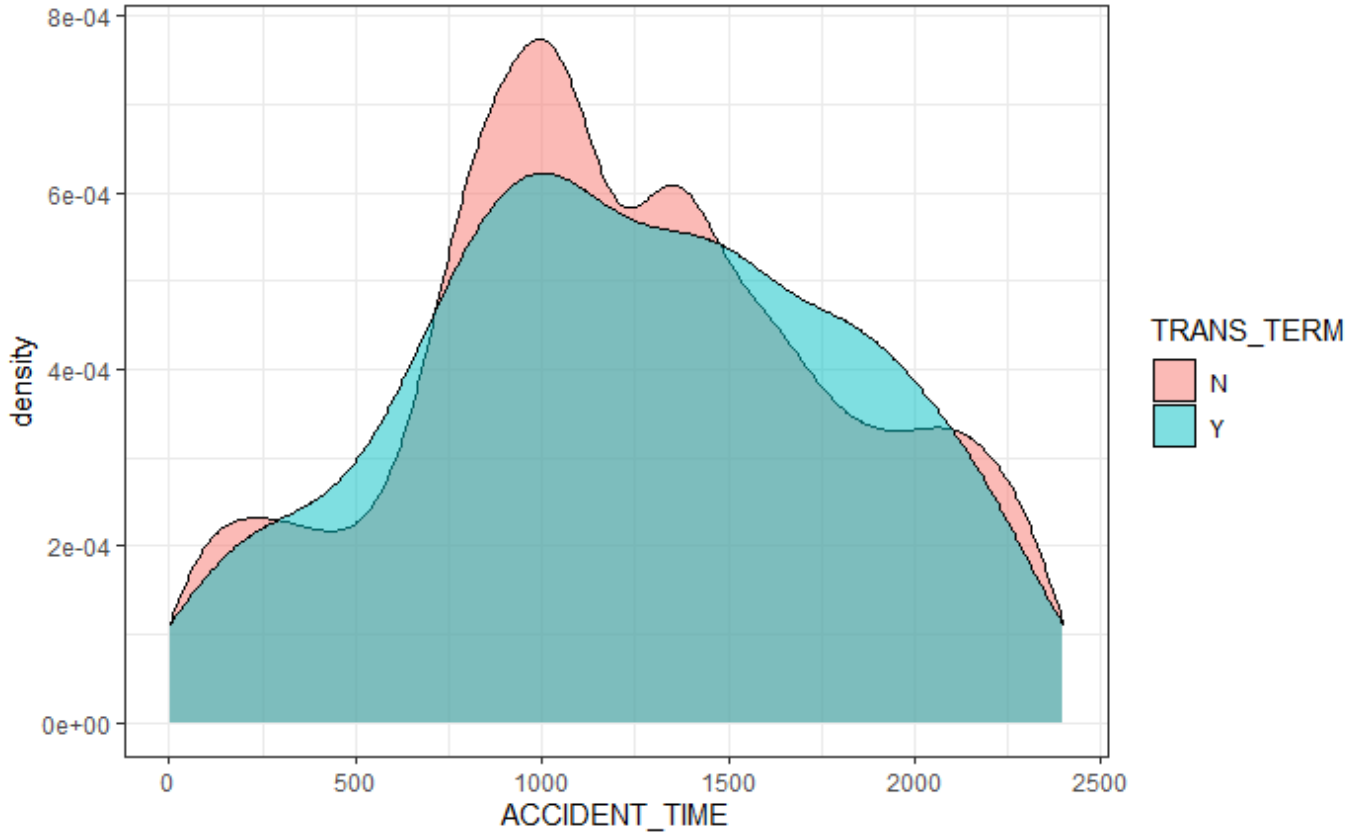
```
#Actual days lost from work due to the injury/illness
ggplot(data = us_data,aes(DEGREE_INJURY,DAYS_LOST,fill= DEGREE_INJURY)) + geom_boxplo
t() +
  theme(axis.text.x = element_text(angle=45), legend.position = "none") +
  ylim(0,25) +coord_flip()
```



Degree of injury named Days away from work only has more Days lost.

Hide

```
#Distribution of accident time for employees who are terminated or not
ggplot(data = us_data,aes(ACCIDENT_TIME, fill= TRANS_TERM)) +
  geom_density(alpha= 0.5) +theme_bw()
```



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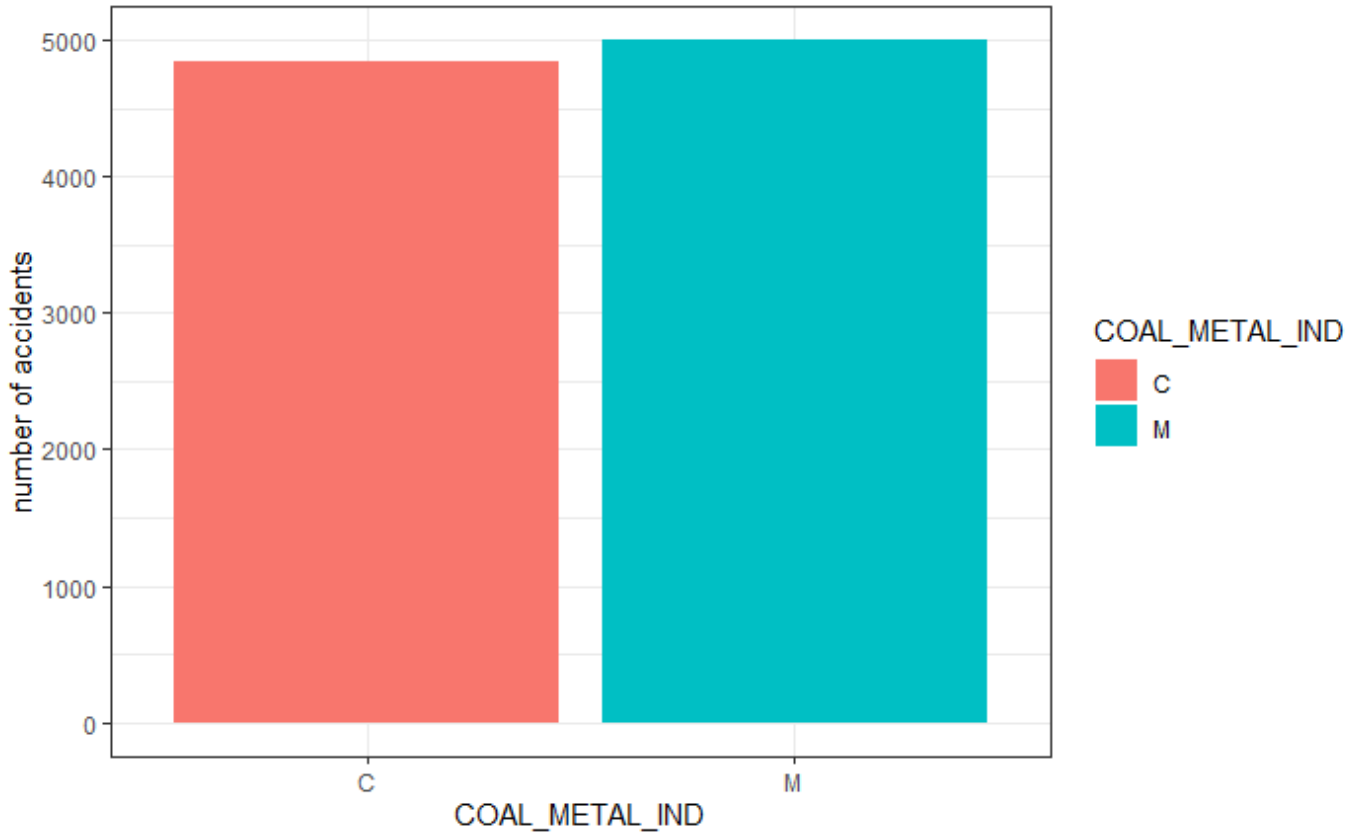
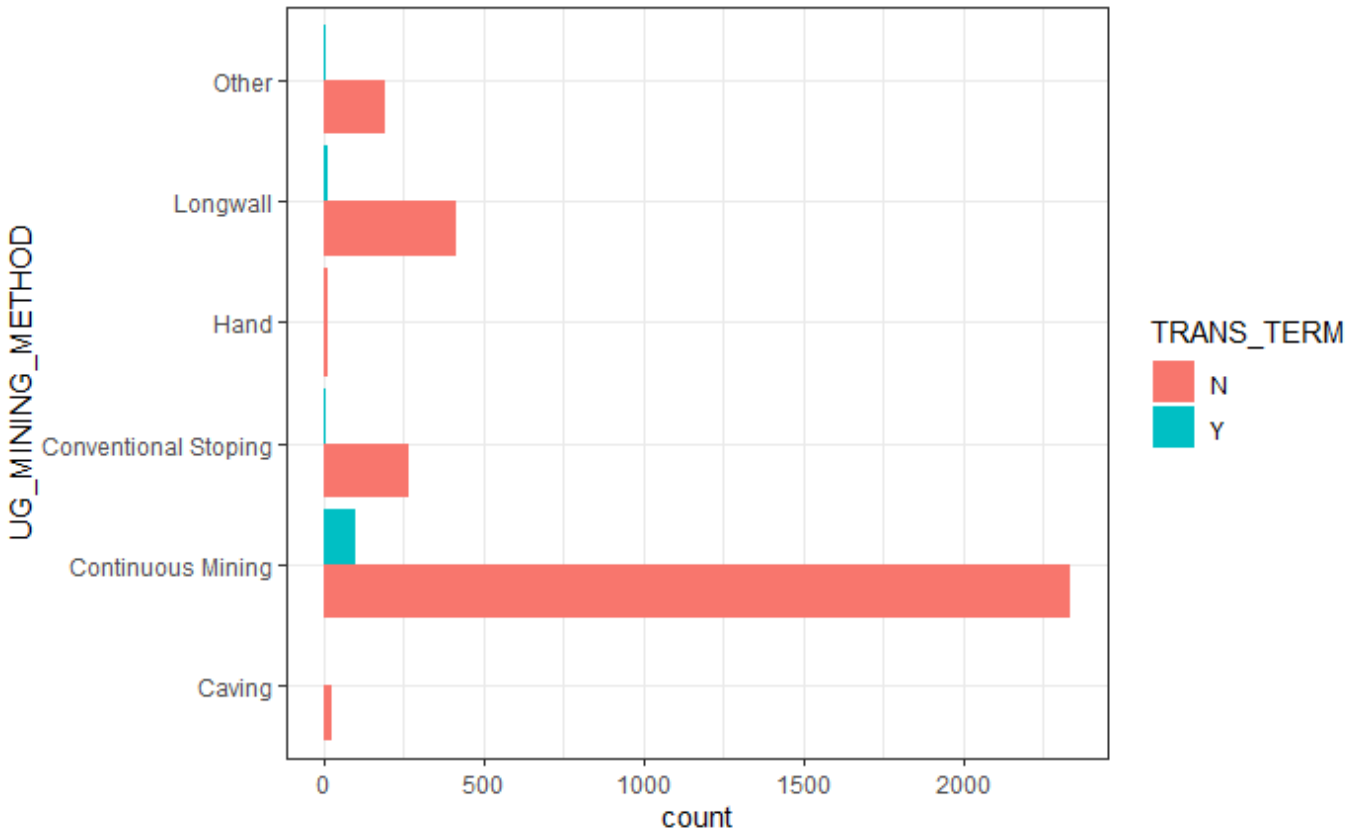
```
# Identifies if the accident occurred at a Coal or Metal/Non-Metal mine.
ggplot(data = us_data,aes(COAL_METAL_IND,fill= COAL_METAL_IND)) + geom_histogram(stat
="count")+
  theme_bw() + ylab("number of accidents")
```



Metal/Non-Metal mines have slightly more accidents as compare to coal mines.

Hide

```
#Minning method using which employees face accident and are permanently transferred o
r terminated
us_data %>% filter(UG_MINING_METHOD != "NO VALUE FOUND") %>%
  ggplot(aes(UG_MINING_METHOD,fill= TRANS_TERM)) +
  geom_histogram(stat="count",position = "dodge") + coord_flip()+
  theme_bw()
```



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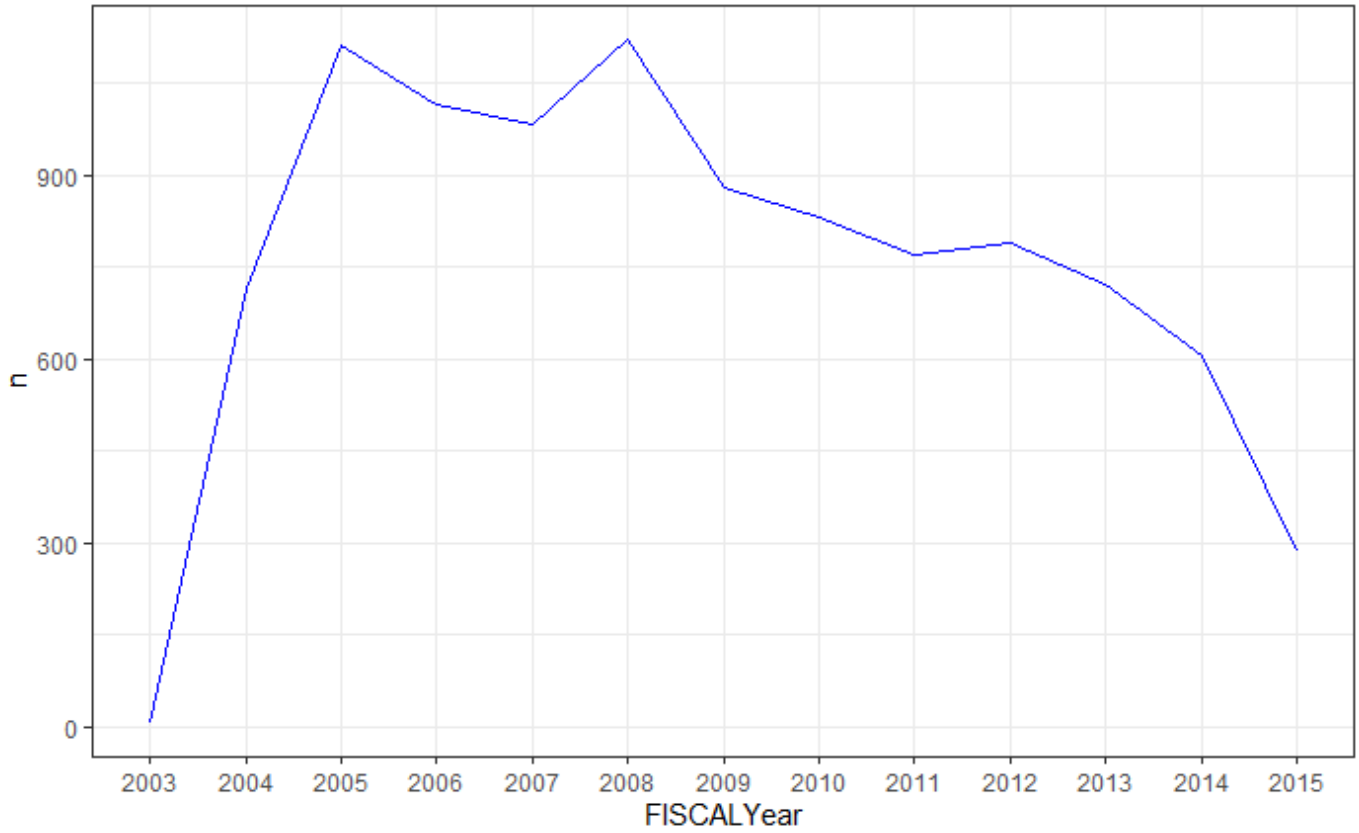
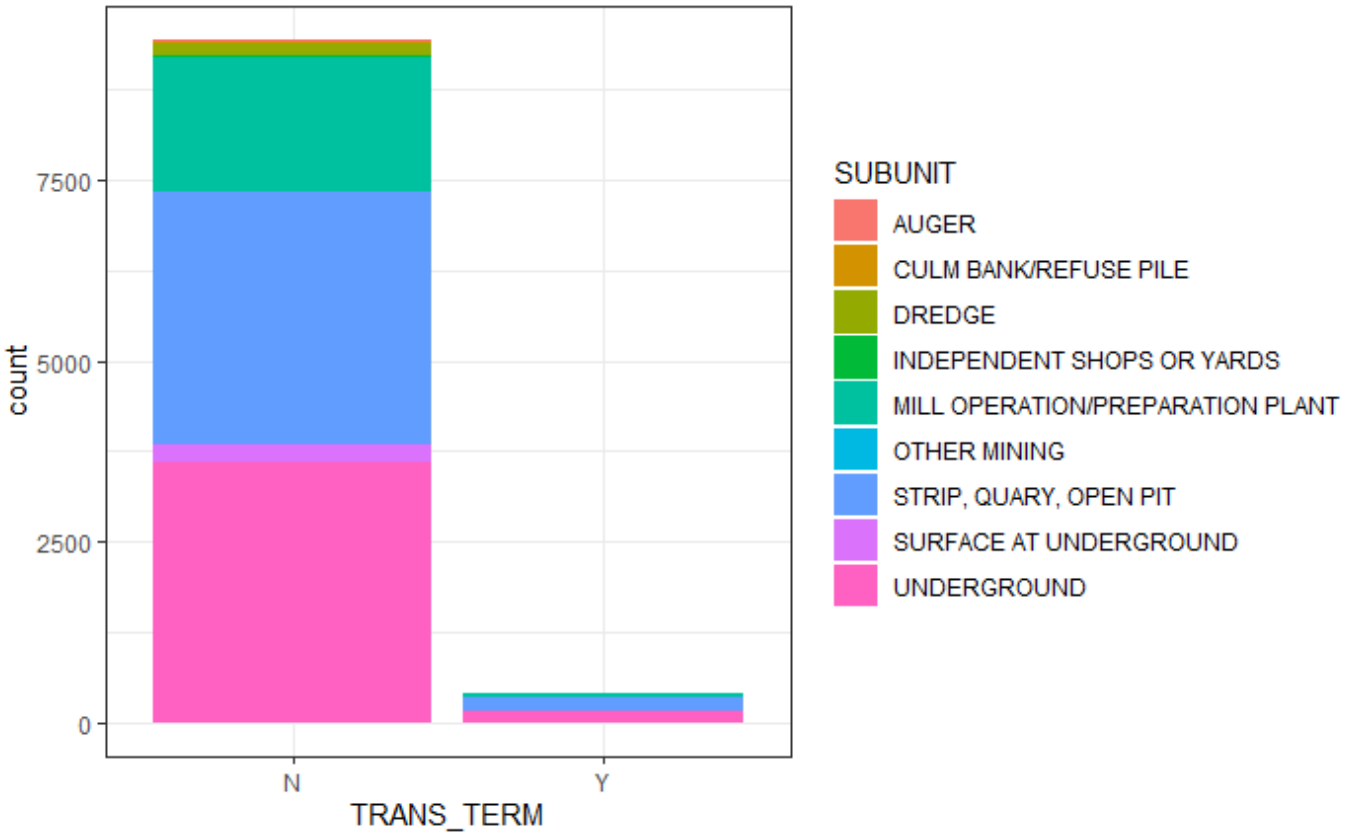
```
#number of accidents/illness in each year
us_data  %>% group_by(FISCAL_YR) %>% count() %>%
  ggplot(aes(as.factor(FISCAL_YR),n)) + geom_line(col= "blue",group=1) +
  theme_bw() + xlab("FISCALYear")
```



2005 and 2008 have more cases of accidents and illness as compare to other years.

Hide

```
#number of employees transferred/terminated,  working in sub units who faced accident
s
ggplot(data = us_data,aes(TRANS_TERM,fill=SUBUNIT)) +geom_bar()+
  theme_bw()
```



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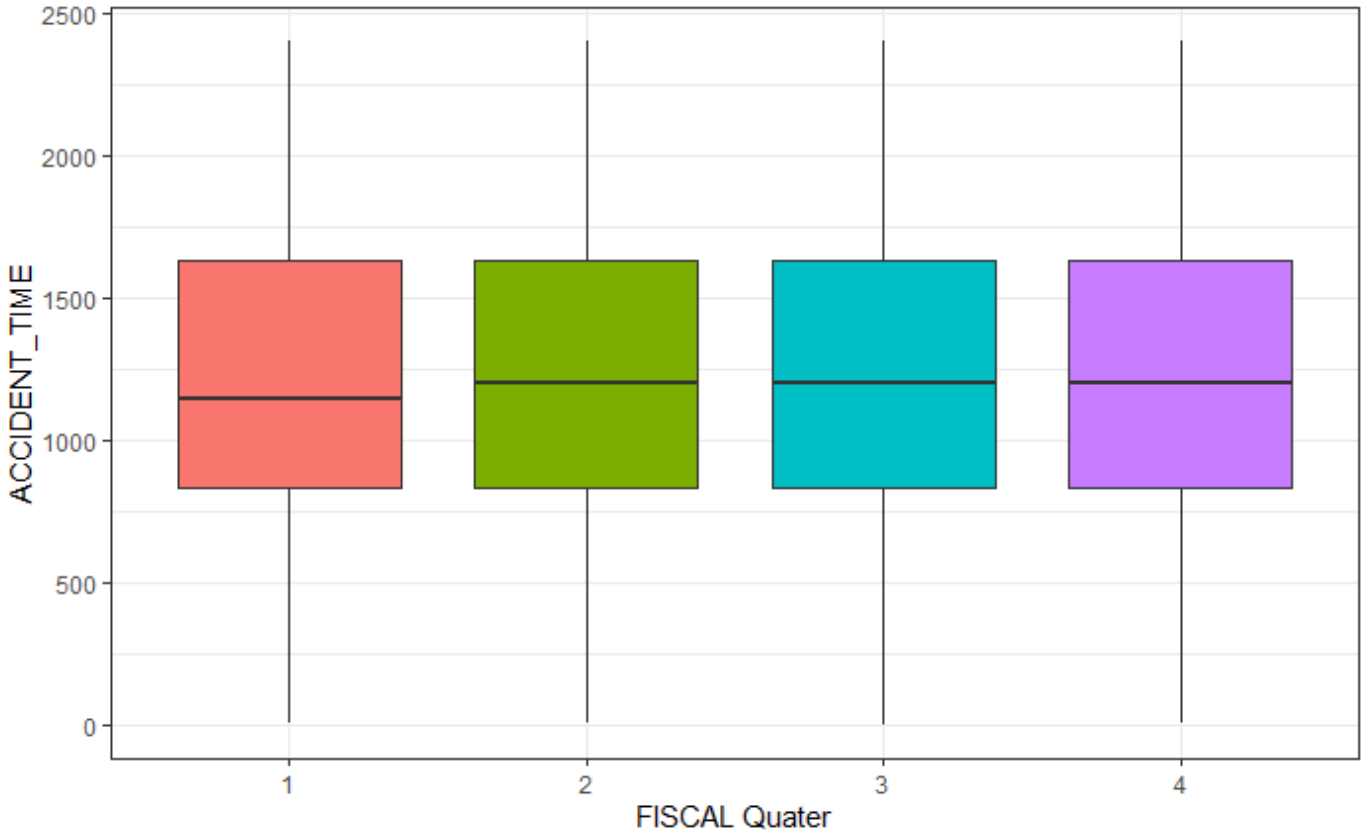
```
ggplot(data = us_data ,aes(as.factor(FISCAL_QTR),ACCIDENT_TIME,fill=as.factor(FISCAL_
QTR))) +
  geom_boxplot() + theme_bw() + theme( legend.position = "none") + xlab("FISCAL Quate
r")
```



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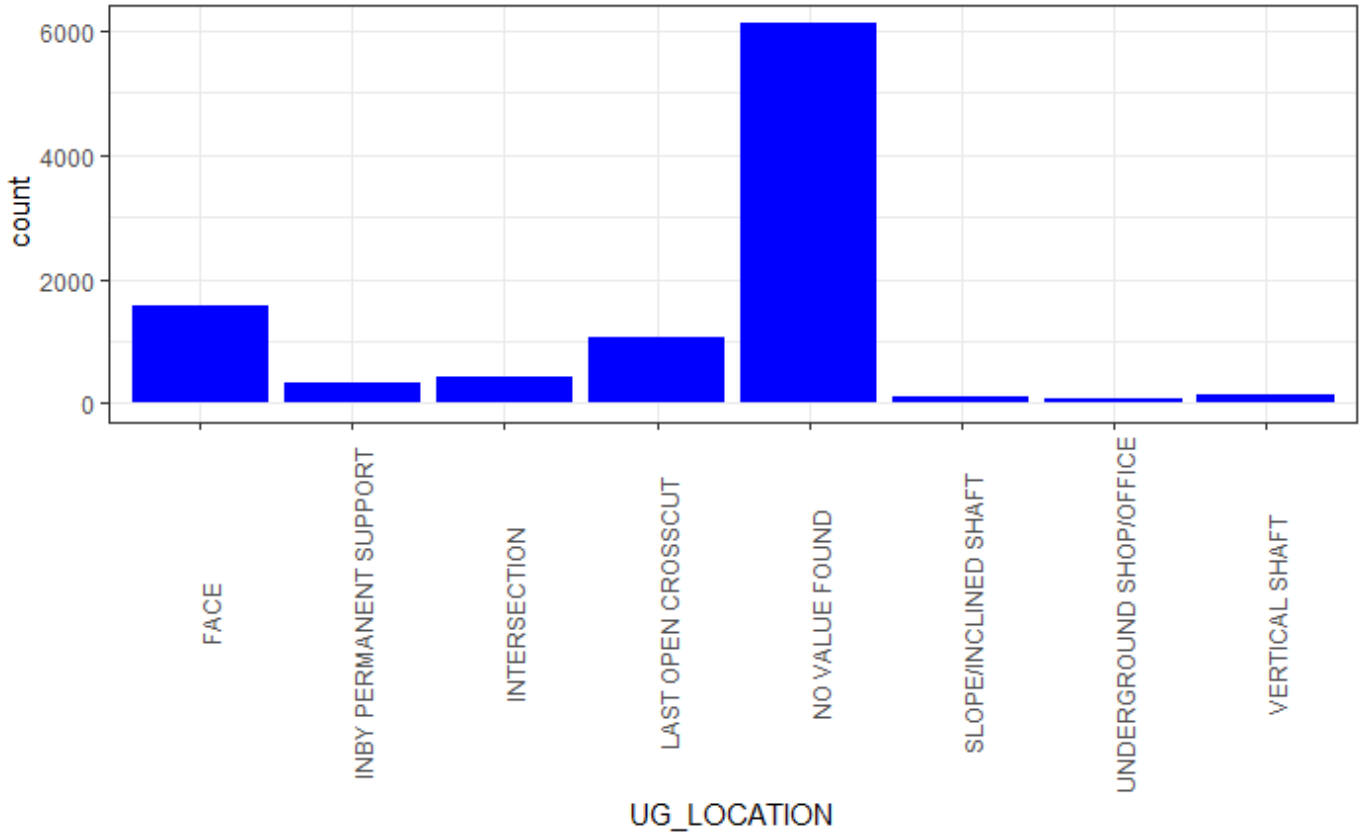
```
ggplot(data = us_data,aes(UG_LOCATION)) + geom_histogram(fill="blue",stat="count")  +
  theme_bw() +
  theme(axis.text.x = element_text(angle=90))
```



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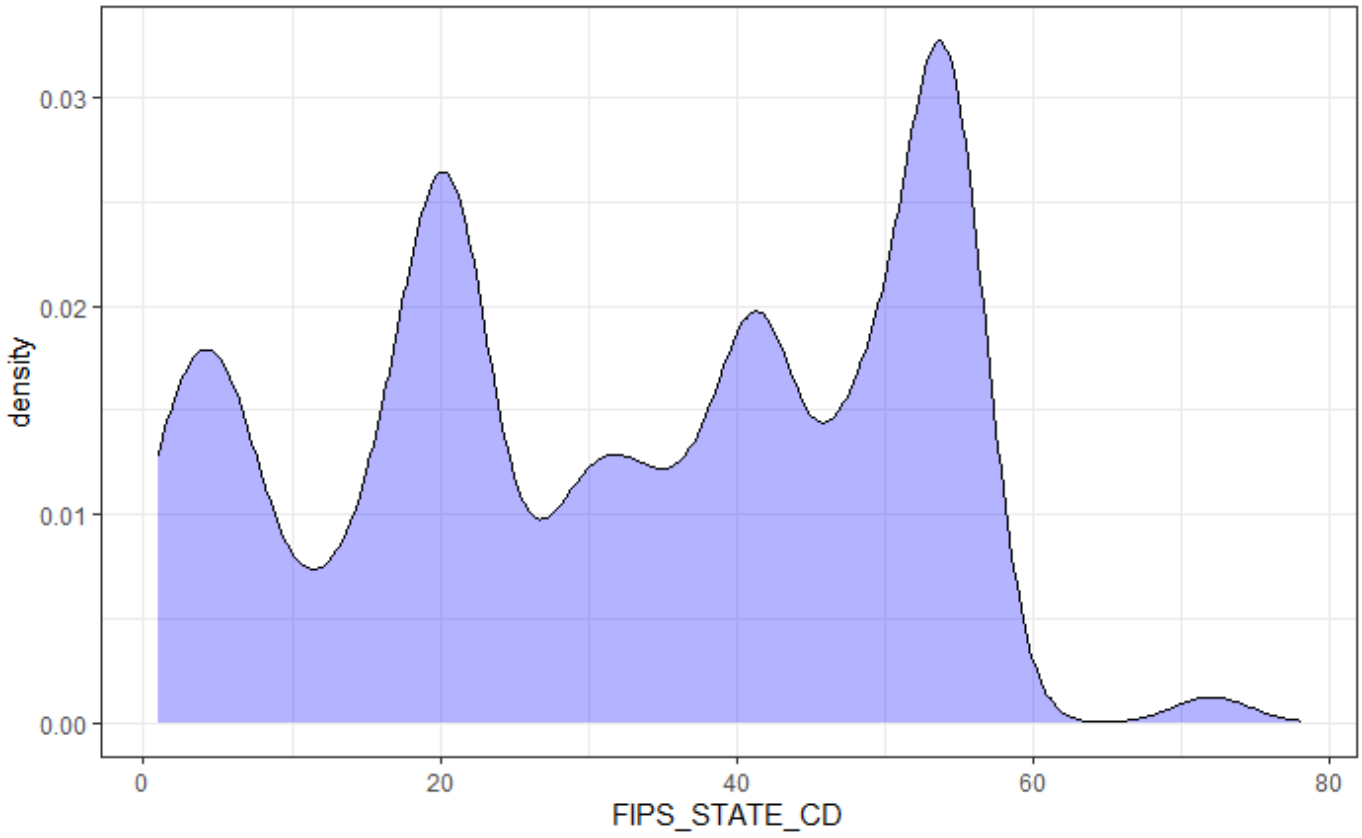
```
ggplot(us_data,aes(FIPS_STATE_CD)) + geom_density(fill= "blue",alpha=0.3) +theme_bw()
```



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```
ggplot(us_data,aes(TRANS_TERM,fill=TRANS_TERM)) + geom_bar()+
  scale_fill_manual(values=c("#56B4E9", "#E69F00")) +
   theme_bw() + theme( legend.position = "none")
```