HW1

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0.1 Titanic dataset

0.1.0.1 Import packages and read data

```
#install.packages("titanic")
library(titanic)
library(dplyr)
library(ggplot2)
library(GGally)


data(titanic_train)
head(titanic_train)
```

```
  PassengerId Survived Pclass
1           1        0      3
2           2        1      1
3           3        1      3
4           4        1      1
5           5        0      3
6           6        0      3
                                                 Name    Sex Age SibSp Parch
1                             Braund, Mr. Owen Harris   male  22     1     0
2 Cumings, Mrs. John Bradley (Florence Briggs Thayer) female  38     1     0
3                              Heikkinen, Miss. Laina female  26     0     0
```

```
4        Futrelle, Mrs. Jacques Heath (Lily May Peel) female  35     1     0
5                             Allen, Mr. William Henry   male  35     0     0
6                                    Moran, Mr. James   male  NA     0     0
            Ticket    Fare Cabin Embarked
1        A/5 21171  7.2500              S
2         PC 17599 71.2833   C85        C
3 STON/O2. 3101282  7.9250              S
4           113803 53.1000  C123        S
5           373450  8.0500              S
6           330877  8.4583              Q
```

0.1.0.2 Variables describtion

```
summary(titanic_train)
```

```
  PassengerId       Survived          Pclass          Name
Min.   :  1.0   Min.   :0.0000   Min.   :1.000   Length:891
1st Qu.:223.5   1st Qu.:0.0000   1st Qu.:2.000   Class :character
Median :446.0   Median :0.0000   Median :3.000   Mode  :character
Mean   :446.0   Mean   :0.3838   Mean   :2.309
3rd Qu.:668.5   3rd Qu.:1.0000   3rd Qu.:3.000
Max.   :891.0   Max.   :1.0000   Max.   :3.000

    Sex                 Age            SibSp           Parch
Length:891         Min.   : 0.42   Min.   :0.000   Min.   :0.0000
Class :character   1st Qu.:20.12   1st Qu.:0.000   1st Qu.:0.0000
Mode  :character   Median :28.00   Median :0.000   Median :0.0000
                   Mean   :29.70   Mean   :0.523   Mean   :0.3816
                   3rd Qu.:38.00   3rd Qu.:1.000   3rd Qu.:0.0000
                   Max.   :80.00   Max.   :8.000   Max.   :6.0000
                   NA's   :177
   Ticket               Fare           Cabin             Embarked
Length:891         Min.   :  0.00   Length:891         Length:891
```

```
 Class :character   1st Qu.:  7.91   Class :character   Class :character
 Mode  :character   Median : 14.45   Mode  :character   Mode  :character
                    Mean   : 32.20
                    3rd Qu.: 31.00
                    Max.   :512.33
```

0.1.0.3

- Survival: Survival status (0 = No 38%, 1 = Yes 62%)
- Pclass: Ticket class (Ordinal variable: 1 = 1st, 2 = 2nd, 3 = 3rd)
- Sex: Gender (Nominal variable: male = Male 65%, female = Female 35%)
- Age: Age (Continuous variable: 0.42 - 80, 177 missing values)
- SibSp: Number of siblings or spouses aboard the ship (Ordinal variable: 0 - 8)
- Parch: Number of parents or children aboard the ship (Ordinal variable: 0 - 6)
- Ticket: Ticket number
- Fare: Ticket price (Continuous variable: 0 - 512, no missing values)
- Cabin: Cabin number
- Embarked: Port of embarkation (C = Cherbourg 19%, Q = Queenstown 9%, S = Southampton 72%, 2 missing values)

0.1.0.4 Transformation

```
# Sex should be binary categorical variable
# Therefore transform it into factor
print(length(table(titanic_train$Sex)))
```

```
[1] 2
```

```
titanic_train$Sex = as.factor(titanic_train$Sex)

#Embarked is also categorical variable, transform it into factor
print(length(table(titanic_train$Embarked)))
```

```
[1] 4
```

```
titanic_train$Embarked = as.factor(titanic_train$Embarked)
titanic_train = titanic_train %>% mutate(Survived = as.factor(Survived),
                                         Sex = as.factor(Sex),
                                         #SibSp = as.factor(SibSp),
                                         #Parch = as.factor(Parch),
                                         Embarked = ifelse(Embarked=="",NA,Embarked) %>
                                         )


# Name, Ticket and Cabin variables are all charactors
head(titanic_train$Name,5)
```

```
[1] "Braund, Mr. Owen Harris"
[2] "Cumings, Mrs. John Bradley (Florence Briggs Thayer)"
[3] "Heikkinen, Miss. Laina"
[4] "Futrelle, Mrs. Jacques Heath (Lily May Peel)"
[5] "Allen, Mr. William Henry"
```

```
head(titanic_train$Ticket,5)
```

```
[1] "A/5 21171"        "PC 17599"         "STON/O2. 3101282" "113803"
[5] "373450"
```

```
head(titanic_train$Cabin,5)
```

```
[1] ""     "C85"  ""     "C123" ""
```

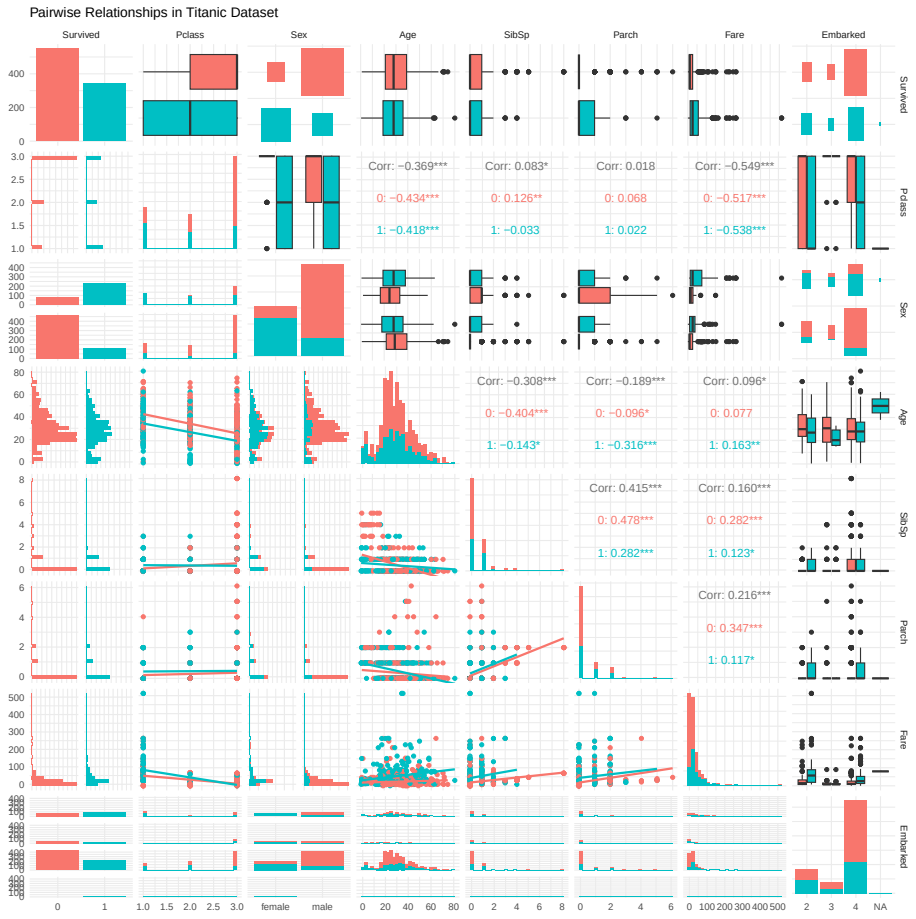
```
titanic_train = titanic_train %>% select(-c(PassengerId, Name, Ticket, Cabin))

summary(titanic_train)
```

```
 Survived     Pclass          Sex           Age            SibSp
 0:549    Min.   :1.000   female:314   Min.   : 0.42   Min.   :0.000
 1:342    1st Qu.:2.000   male  :577   1st Qu.:20.12   1st Qu.:0.000
          Median :3.000                Median :28.00   Median :0.000
          Mean   :2.309                Mean   :29.70   Mean   :0.523
          3rd Qu.:3.000                3rd Qu.:38.00   3rd Qu.:1.000
          Max.   :3.000                Max.   :80.00   Max.   :8.000
                                       NA's   :177
     Parch             Fare        Embarked
 Min.   :0.0000   Min.   :  0.00   2   :168
 1st Qu.:0.0000   1st Qu.:  7.91   3   : 77
 Median :0.0000   Median : 14.45   4   :644
 Mean   :0.3816   Mean   : 32.20   NA's:  2
 3rd Qu.:0.0000   3rd Qu.: 31.00
 Max.   :6.0000   Max.   :512.33
```

0.1.0.5 Visuallization

```
ggpairs(
  titanic_train,
  title = "Pairwise Relationships in Titanic Dataset",
  lower = list(continuous = wrap("smooth", method = "lm", se = FALSE)), # 下三角加入回歸
  upper = list(continuous = wrap("cor", size = 4)), # 上三角顯示相關係數
  diag = list(continuous = "barDiag"), # 對角線繪製直方圖
  mapping = aes(color = Survived) # 顏色區分存活
) +
  theme_minimal()
```



a) Survival Analysis (Survived) More people did not survive (Survived = 0, shown in red). The survival rate seems to vary

significantly with Sex and Pclass.

b) Passenger Class (Pclass) First-class (Pclass = 1) passengers had a higher fare and survival rate. Third-class (Pclass = 3) passengers had the lowest survival rate.

c) Gender Influence (Sex) Female passengers had a higher survival rate than males. Males had a lower chance of survival, as indicated by the red proportion in the Sex vs. Survived plots.

d) Age Distribution (Age) Young children had a higher survival rate. The majority of passengers were adults. There is a negative correlation between Age and Survival (older passengers had a lower chance of survival).

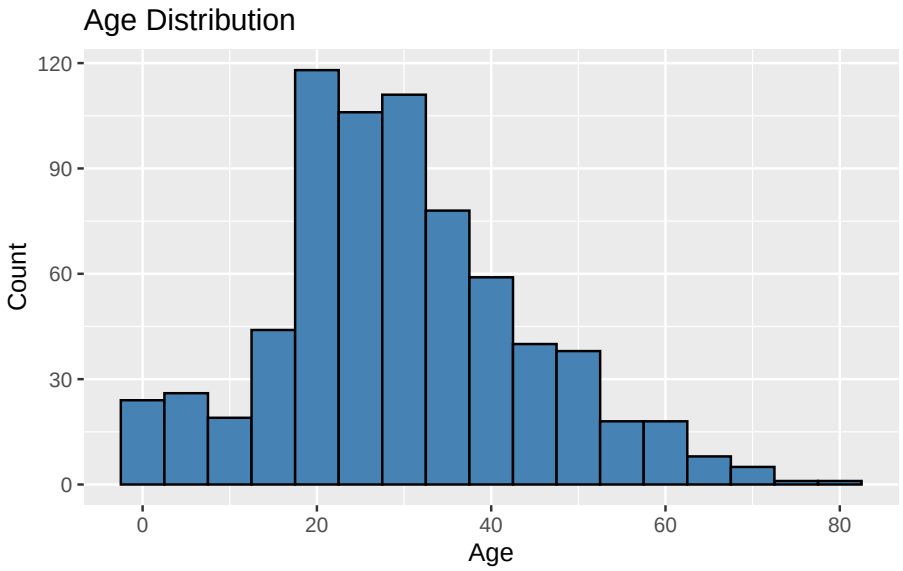
e) Family Members (SibSp and Parch) Having more siblings/spouses (SibSp) or parents/children (Parch) slightly increases survival probability, but very high numbers reduce survival chances. Large families had a lower survival rate compared to single passengers.

f) Fare and Survival (Fare) Higher Fare is positively correlated with survival (Corr = 0.538***), indicating that wealthier passengers had better chances. This aligns with the observation that first-class passengers survived more.

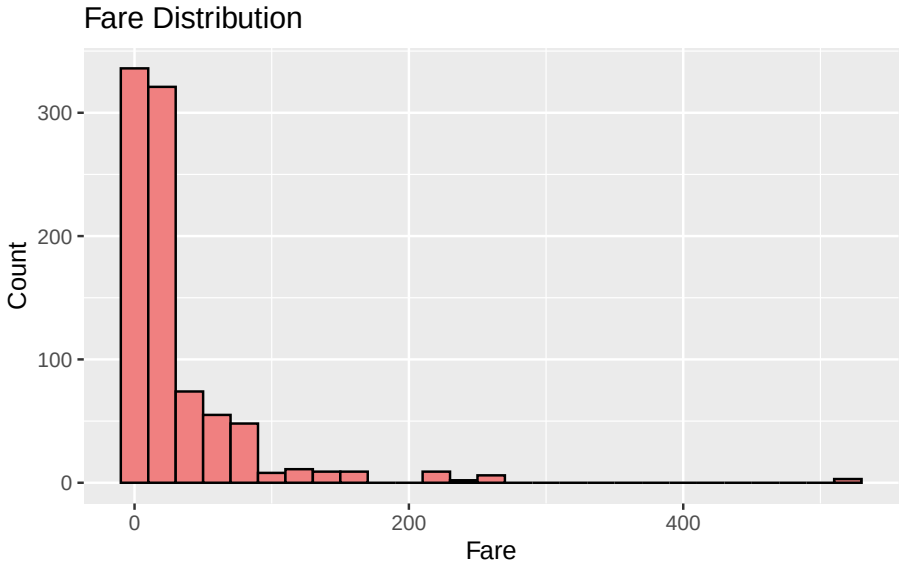
g) Embarkation Port (Embarked) Most passengers embarked from Southampton (S). Higher survival rates are observed among passengers from Cherbourg (C), likely due to a higher proportion of first-class passengers.

0.1.0.6 Appendix

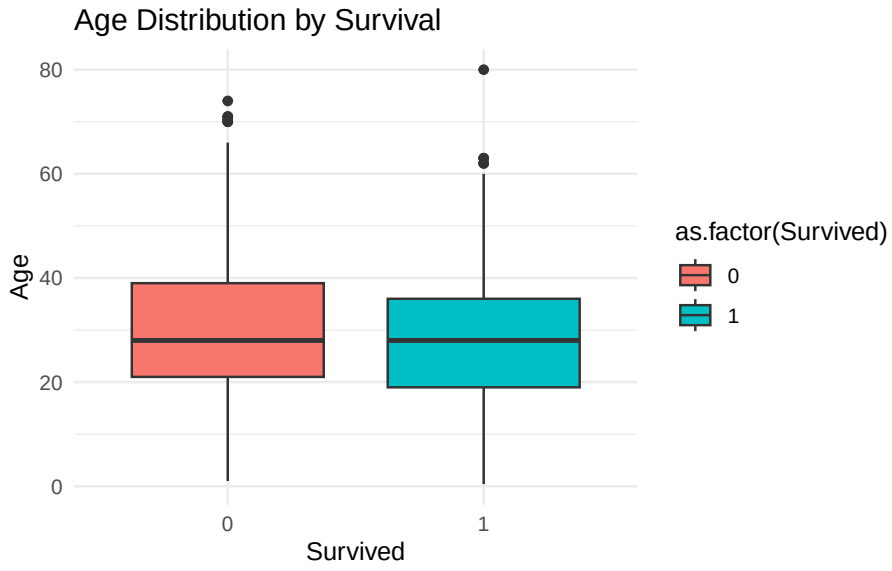
```
ggplot(titanic_train, aes(x = Age)) +
  geom_histogram(binwidth = 5, fill = "steelblue", color = "black") +
  labs(title = "Age Distribution", x = "Age", y = "Count")
```



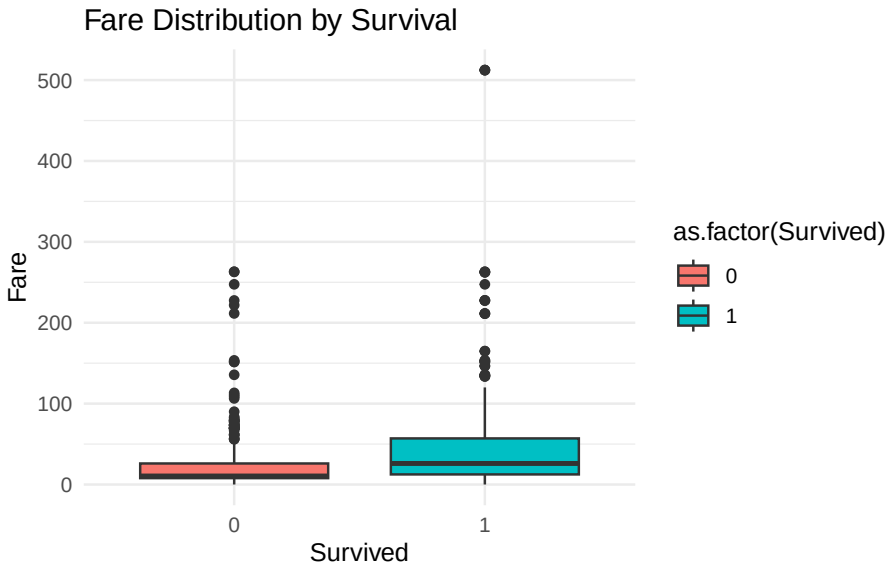

```
ggplot(titanic_train, aes(x = Fare, fill = as.factor(Survived))) +
  geom_histogram(binwidth = 20, fill = "lightcoral", color = "black") +
  labs(title = "Fare Distribution", x = "Fare", y = "Count")
```



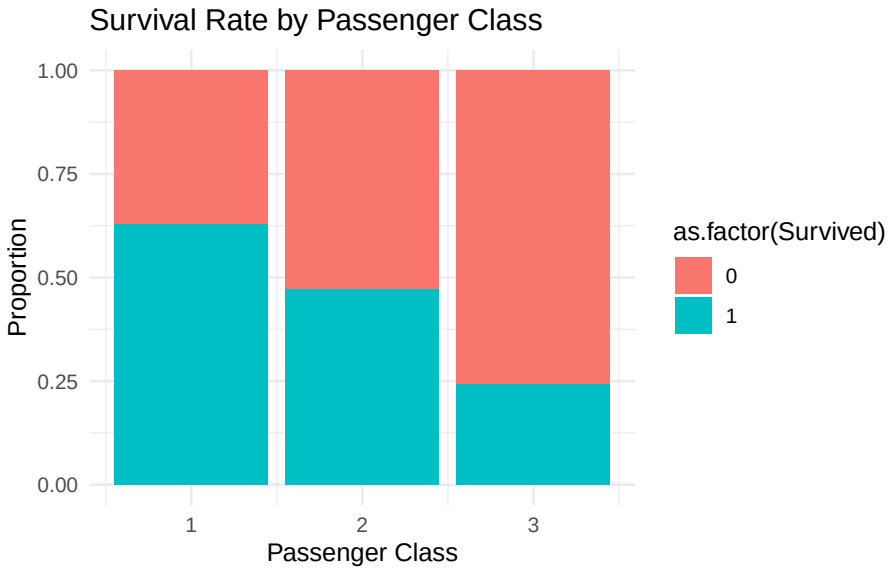
```r
ggplot(titanic_train, aes(x = as.factor(Survived), y = Age, fill = as.factor(Survived))) +
  geom_boxplot() +
  labs(title = "Age Distribution by Survival", x = "Survived", y = "Age") +
  theme_minimal()
```



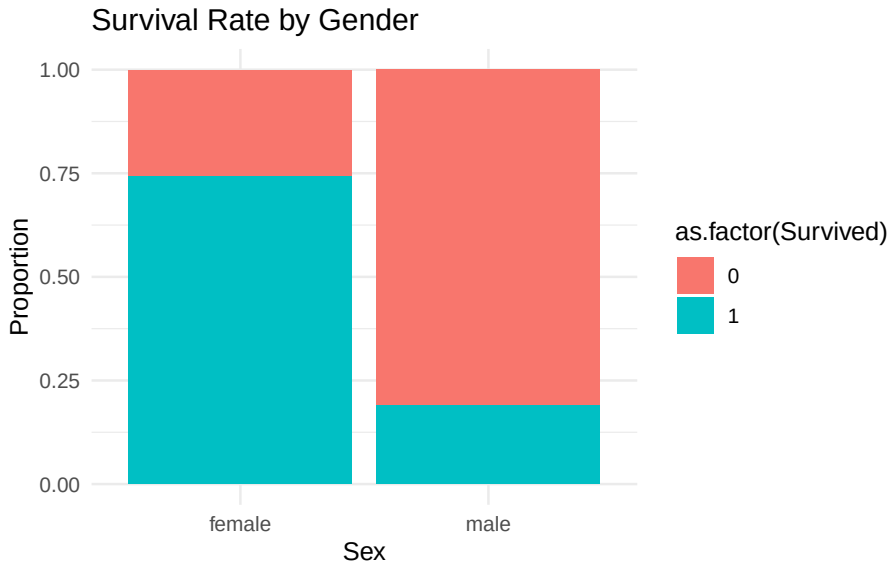

```r
ggplot(titanic_train, aes(x = as.factor(Survived), y = Fare, fill = as.factor(Survived))) +
  geom_boxplot() +
  labs(title = "Fare Distribution by Survival", x = "Survived", y = "Fare") +
  theme_minimal()
```




```
ggplot(titanic_train, aes(x = Pclass, fill = as.factor(Survived))) +
  geom_bar(position = "fill") +
  labels(title = "Survival Rate by Passenger Class", x = "Passenger Class", y = "Proporti
  theme_minimal()
```

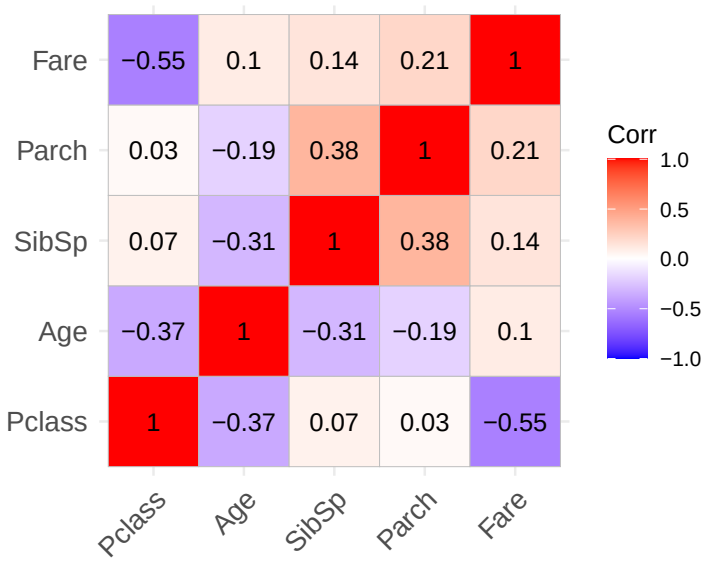


```r
ggplot(titanic_train, aes(x = Sex, fill = as.factor(Survived))) +
  geom_bar(position = "fill") +
  labs(title = "Survival Rate by Gender", x = "Sex", y = "Proportion") +
  theme_minimal()
```




```r
library(ggcorrplot)

cor_matrix <- cor(titanic_train[, sapply(titanic_train, is.numeric)], use = "complete.o
ggcorrplot(cor_matrix, lab = TRUE)
```


Fare
Parch
SibSp
Age
Pclass
−0.55
0.1
0.14
0.21
1
0.03
−0.19
0.38
1
0.21
0.07
−0.31
1
0.38
0.14
−0.37
1
−0.31
−0.19
0.1
1
−0.37
0.07
0.03
−0.55
Pclass
Age
SibSp
Parch
Fare
Corr
1.0
0.5
0.0
−0.5
−1.0