Group_27

Stage 1: Exploratory Data Analysis (EDA)

1. Import data and packages

```
library(dplyr)
library(ggplot2)
library(janitor)
library(car)

# Import dataset
clean_data <- read.csv("C:\\Users\\2980157G\\Downloads\\cleaned_dataset27_1.1.csv")
```

2. Check data structure and summary statistics

```
# Check structure
str(clean_data)
```

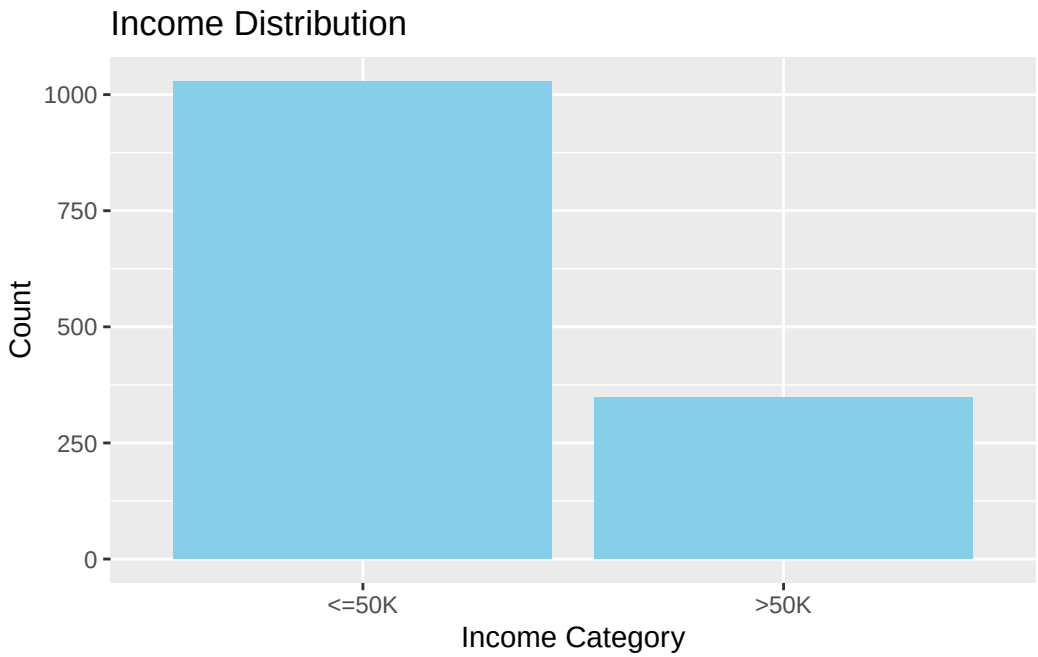
```
'data.frame':   1376 obs. of  8 variables:
 $ Age           : int  37 49 20 64 32 58 42 20 42 25 ...
 $ Education     : chr  "Bachelors" "College Education" "College Education" "Bachelors" ...
 $ Marital_Status: chr  "Married" "Divorced/Spouse Absent/Separated/Widowed" "Never-married"
 $ Occupation    : chr  "White-Collar" "Blue-Collar" "Service" "White-Collar" ...
 $ Sex           : chr  "Male" "Male" "Male" "Male" ...
 $ Hours_PW      : int  80 45 45 55 42 40 50 14 40 40 ...
 $ Nationality   : chr  "United-States" "United-States" "United-States" "United-States" ...
 $ Income        : chr  ">50K" "<=50K" "<=50K" ">50K" ...
```

```r
# Summary statistics
summary(clean_data)
```

```
      Age          Education         Marital_Status      Occupation
 Min.   :17.00   Length:1376        Length:1376        Length:1376
 1st Qu.:28.00   Class :character   Class :character   Class :character
 Median :38.00   Mode  :character   Mode  :character   Mode  :character
 Mean   :38.89
 3rd Qu.:47.00
 Max.   :90.00
     Sex                Hours_PW     Nationality           Income
 Length:1376        Min.   : 3.00   Length:1376        Length:1376
 Class :character   1st Qu.:40.00   Class :character   Class :character
 Mode  :character   Median :40.00   Mode  :character   Mode  :character
                    Mean   :41.18
                    3rd Qu.:45.00
                    Max.   :99.00
```

3. Visualize the income distribution

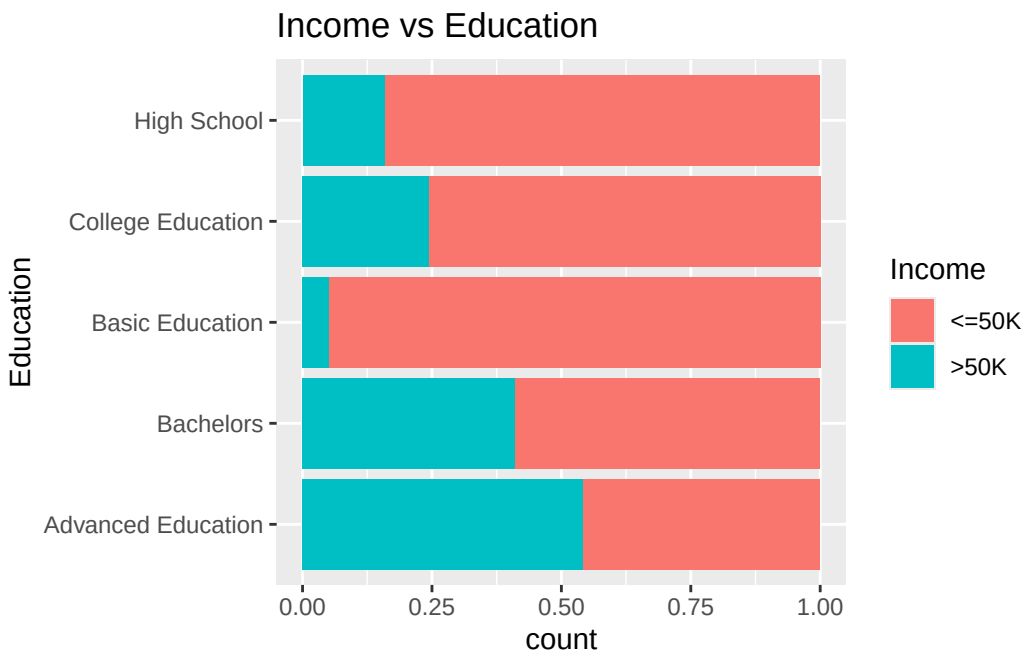
```r
# Bar plot for income distribution
ggplot(clean_data, aes(x = Income)) +
  geom_bar(fill = "skyblue") +
  labs(title = "Income Distribution", x = "Income Category", y = "Count")
```



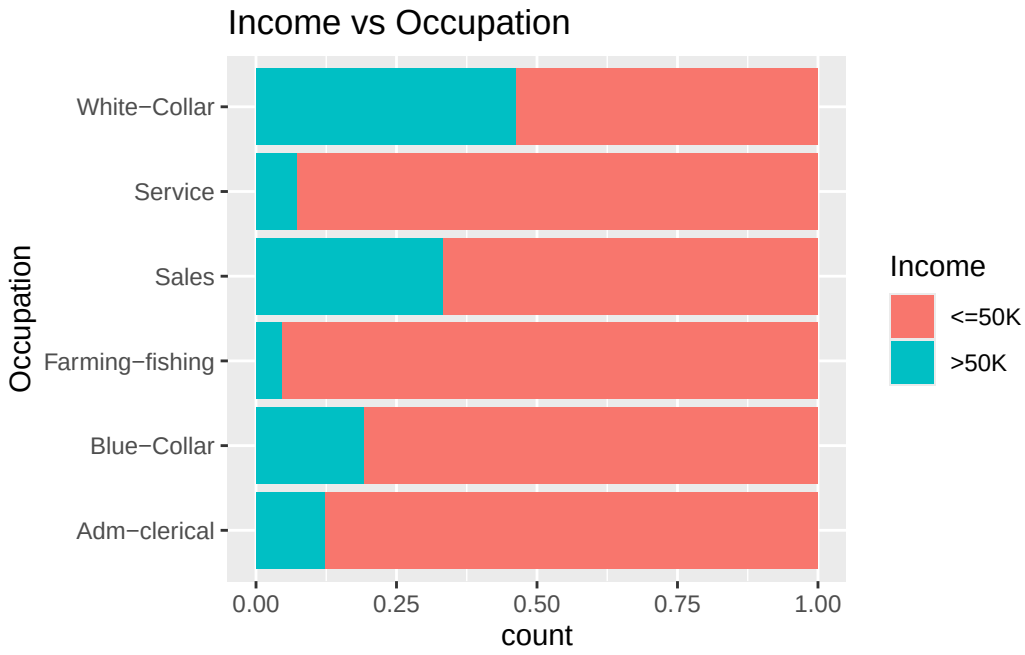
4. Explore categorical variables' relationship with income

```
# Stacked bar plots for categorical variables
categorical_vars <- c("Education", "Occupation", "Sex", "Marital_Status")

lapply(categorical_vars, function(var) {
  ggplot(clean_data, aes_string(x = var, fill = "Income")) +
    geom_bar(position = "fill") +
    coord_flip() +
    labs(title = paste("Income vs", var))
})
```

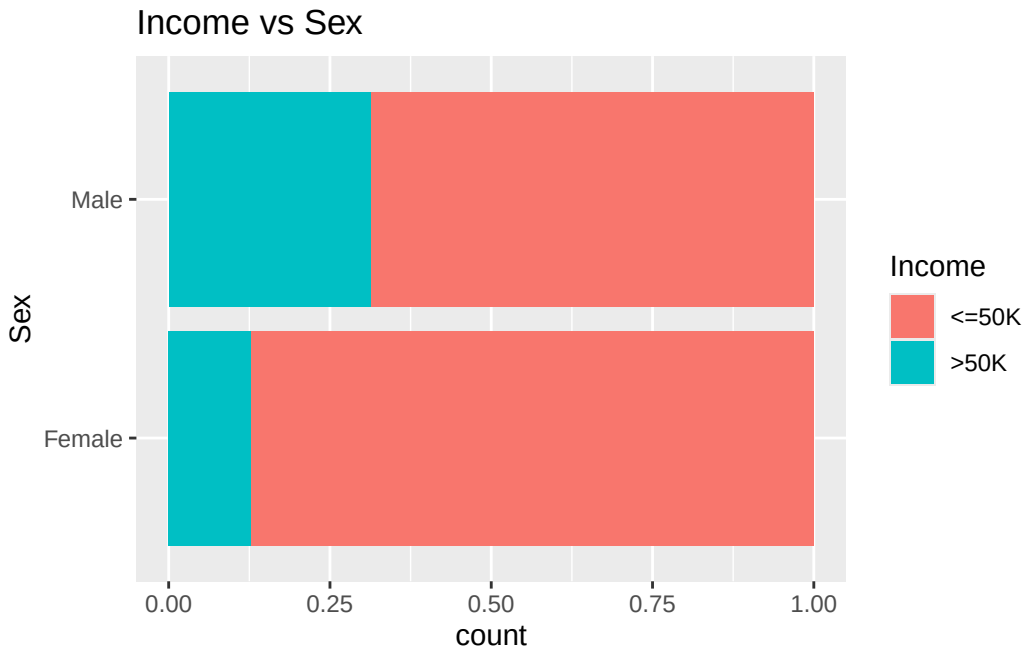
```
Warning: `aes_string()` was deprecated in ggplot2 3.0.0.
i Please use tidy evaluation idioms with `aes()`.
i See also `vignette("ggplot2-in-packages")` for more information.

[[1]]
```


Income vs Education
High School
College Education
Basic Education
Bachelors
Advanced Education
Education
0.00
0.25
0.50
0.75
1.00
count
Income
<=50K
>50K

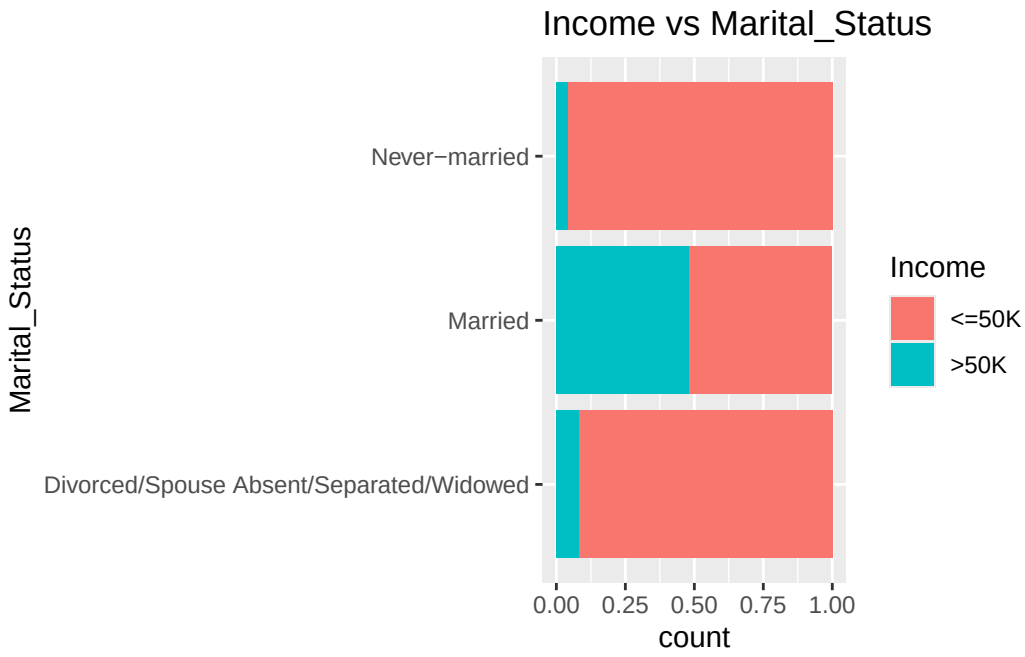
```
[[2]]
```


Income vs Occupation
White−Collar
Service
Sales
Farming−fishing
Blue−Collar
Adm−clerical
Occupation
0.00
0.25
0.50
0.75
1.00
count
Income
<=50K
>50K

```
[[3]]
```


Income vs Sex
Male
Female
Sex
0.00
0.25
0.50
0.75
1.00
count
Income
<=50K
>50K

```
[[4]]
```



5. Check category balance

```
# Check proportion of income categories
prop.table(table(clean_data$Income))
```

```
   <=50K     >50K
0.747093 0.252907
```

6. Establish Logistic Regression Model

```
# Convert Income to binary (0 = <=50K, 1 = >50K)
clean_data <- clean_data %>%
  mutate(Income = ifelse(Income == ">50K", 1, 0))


# Logistic regression model
model <- glm(Income ~ Age + Education + Marital_Status + Occupation + Sex + Hours_PW + Natio
             data = clean_data,
```

```
             family = binomial(link = "logit"))
summary(model)
```

```
Call:
glm(formula = Income ~ Age + Education + Marital_Status + Occupation +
    Sex + Hours_PW + Nationality, family = binomial(link = "logit"),
    data = clean_data)

Coefficients:
                             Estimate Std. Error z value Pr(>|z|)
(Intercept)                 -5.090717   0.714610  -7.124 1.05e-12 ***
Age                          0.025900   0.007460   3.472 0.000517 ***
EducationBachelors          -0.437211   0.302472  -1.445 0.148329
EducationBasic Education    -2.765322   0.630528  -4.386 1.16e-05 ***
EducationCollege Education  -0.692475   0.305703  -2.265 0.023501 *
EducationHigh School        -1.077803   0.316860  -3.402 0.000670 ***
Marital_StatusMarried        2.750066   0.274474  10.019  < 2e-16 ***
Marital_StatusNever-married -0.268038   0.355729  -0.753 0.451155
OccupationBlue-Collar       -0.040757   0.331201  -0.123 0.902062
OccupationFarming-fishing   -2.770325   0.864437  -3.205 0.001352 **
OccupationSales              0.594309   0.339475   1.751 0.080003 .
OccupationService           -0.390250   0.393379  -0.992 0.321175
OccupationWhite-Collar       1.204002   0.310606   3.876 0.000106 ***
SexMale                     -0.267497   0.233600  -1.145 0.252165
Hours_PW                     0.044293   0.007863   5.633 1.77e-08 ***
NationalityUnited-States    -0.105831   0.301564  -0.351 0.725633
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 1556.27  on 1375  degrees of freedom
Residual deviance:  966.68  on 1360  degrees of freedom
AIC: 998.68

Number of Fisher Scoring iterations: 6
```

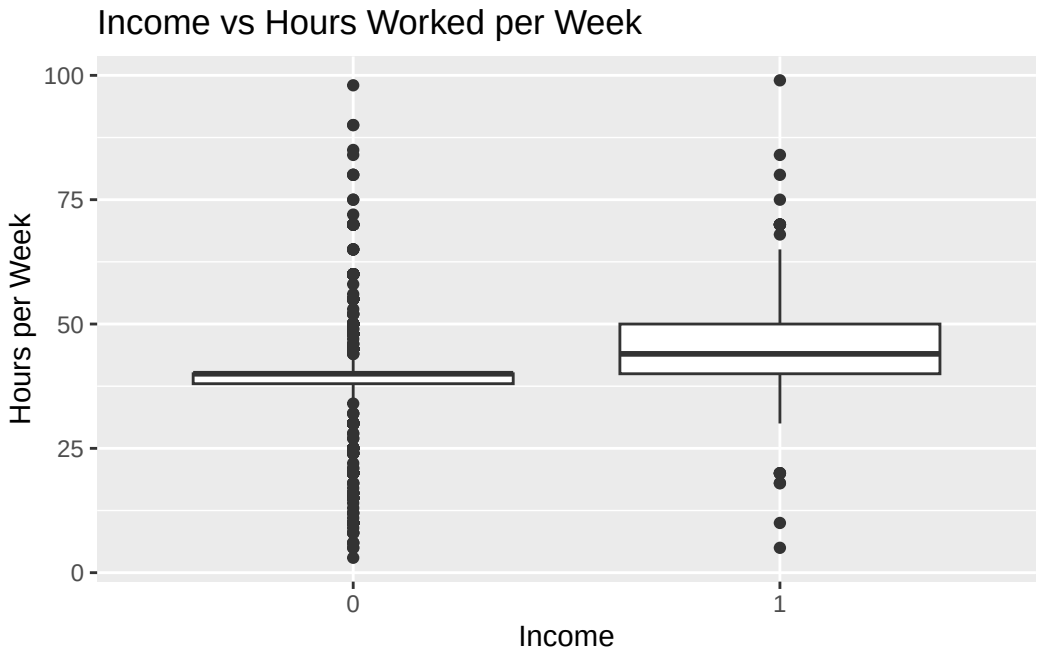
7. Check for multicollinearity

```
# Variance Inflation Factor (VIF) test
vif(model)
```

```
                  GVIF Df GVIF^(1/(2*Df))
Age           1.142520  1        1.068887
Education     1.620551  4        1.062204
Marital_Status 1.522199  2        1.110754
Occupation    1.834595  5        1.062561
Sex           1.464875  1        1.210320
Hours_PW      1.143694  1        1.069436
Nationality   1.064644  1        1.031816
```

8. Visualize numeric variables against income

```
# Box plot for Hours per Week
ggplot(clean_data, aes(x = as.factor(Income), y = Hours_PW)) +
  geom_boxplot() +
  labs(title = "Income vs Hours Worked per Week", x = "Income", y = "Hours per Week")
```



```r
# Box plot for Age
ggplot(clean_data, aes(x = as.factor(Income), y = Age)) +
  geom_boxplot() +
  labs(title = "Income vs Age", x = "Income", y = "Age")
```