Predict422-CharityProject Part 1

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Exercises 1. Read Data from CSV File (a) Read data from csv file

```
charityData = read.csv(file.choose(),na.strings=c("NA"," "))
```

(c)

```
charityData$DONR = as.factor(charityData$DONR)
charityData$HOME = as.factor(charityData$HOME)
charityData$HINC = as.factor(charityData$HINC)
```

Following variable converted to factors. GENDER and RFA_96 converted due to default setting stringsAsFactors = TRUE

```
str(charityData)
```

```
## 'data.frame':    70871 obs. of  20 variables:
##  $ ID      : int  1 3 4 6 8 12 14 15 16 17 ...
##  $ DONR    : Factor w/ 2 levels "0","1": 1 1 1 1 1 1 1 1 1 1 ...
##  $ DAMT    : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ AGE     : int  62 86 66 52 55 49 41 48 58 75 ...
##  $ HOME    : Factor w/ 2 levels "0","1": 2 NA 2 2 2 NA NA 1 2 2 ...
##  $ HINC    : Factor w/ 7 levels "1","2","3","4",..: 4 NA 6 4 2 NA NA 5 6 7 ...
##  $ GENDER  : Factor w/ 6 levels "A","C","F","J",..: 5 3 5 4 3 5 3 3 3 3 ...
##  $ MEDAGE  : int  45 38 44 32 42 39 40 43 47 49 ...
##  $ MEDPPH  : int  180 118 225 247 208 266 288 198 236 183 ...
##  $ MEDHVAL : int  313 1131 1518 857 440 580 678 1044 871 5913 ...
##  $ MEDINC  : int  195 323 728 501 236 202 171 562 322 810 ...
##  $ MEDEDUC : int  120 160 160 140 120 120 114 120 120 160 ...
##  $ NUMPROM : int  34 53 18 43 55 23 14 24 56 32 ...
##  $ NUMPRM12: int  14 13 13 14 12 11 8 12 13 12 ...
##  $ RAMNTALL: num  53 68 20 84 172 35 15 39 115 44 ...
##  $ NGIFTALL: int  6 8 2 7 16 3 1 5 6 5 ...
##  $ MAXRAMNT: num  12 15 15 15 15 20 15 10 25 12 ...
##  $ LASTGIFT: num  10 15 15 10 11 20 15 7 25 12 ...
##  $ TDON    : num  16 17 18 16 22 ...
##  $ RFA_96  : Factor w/ 69 levels "A1D","A1E","A1F",..: 17 8 43 18 56 2 23 12 4 12 ...
```

2.Data Quality Check

```
dim(charityData)      # dimensions of data
```

```
## [1] 70871    20
```

```r
names(charityData)    # variable names
```

```
##  [1] "ID"       "DONR"     "DAMT"     "AGE"      "HOME"     "HINC"
##  [7] "GENDER"   "MEDAGE"   "MEDPPH"   "MEDHVAL"  "MEDINC"   "MEDEDUC"
## [13] "NUMPROM"  "NUMPRM12" "RAMNTALL" "NGIFTALL" "MAXRAMNT" "LASTGIFT"
## [19] "TDON"     "RFA_96"
```

```r
#str(charityData)      # one form of summary of data
  # another form of summary
```

(b) We can see that HOME, HINC and GENDER columns contain some missing values.

```r
## Check for Missing Values
which(sapply(charityData,anyNA))
```

```
##   HOME   HINC GENDER
##      5      6      7
```

```r
# Missing values identified in HINC, GENDER, and RFA_96
# Get counts of missing values for each variable
table(charityData$HOME,useNA="ifany")
```

```
##
##     0     1  <NA>
## 15004 46972  8895
```

```r
table(charityData$HINC,useNA="ifany")
```

```
##
##     1     2     3     4     5     6     7  <NA>
##  7084 10616  7189 10983 13454  6770  6657  8118
```

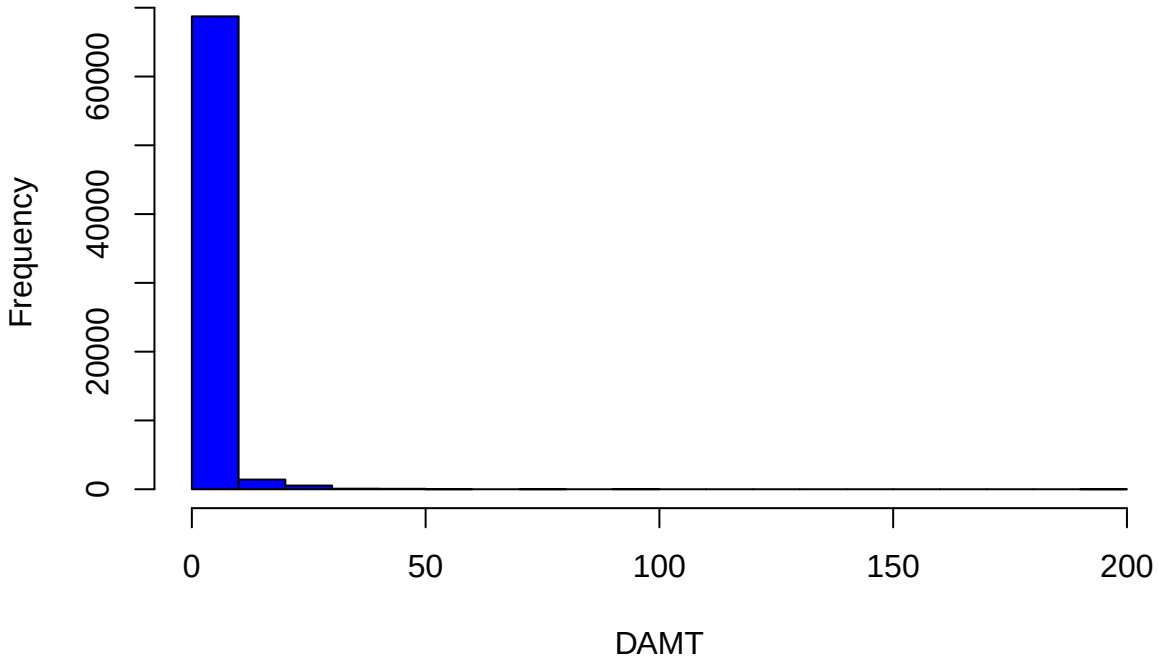
```r
table(charityData$GENDER,useNA="ifany")
```

```
##
##     A     C     F     J     M     U  <NA>
##     2     1 38183   290 30494   741  1160
```

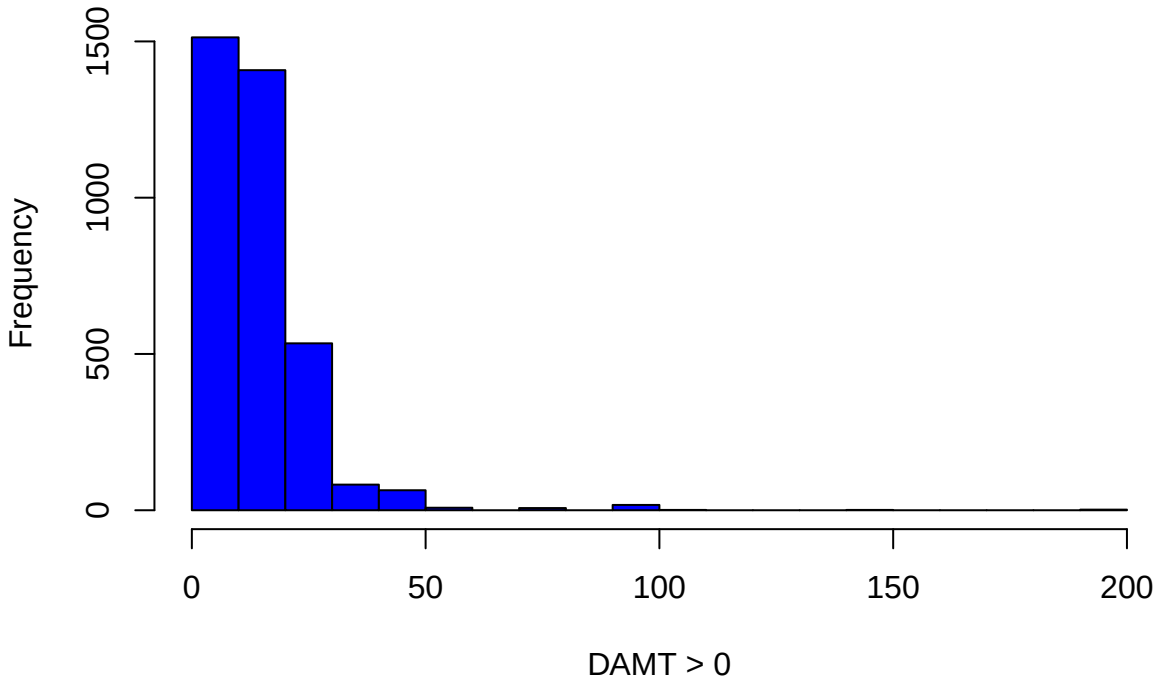
(c) Missing values could be a problem. Replacing the missing values with mean could be one solution.

3(a) Histogram of the response variable DAMT (first with 0s included, second with 0s dropped)

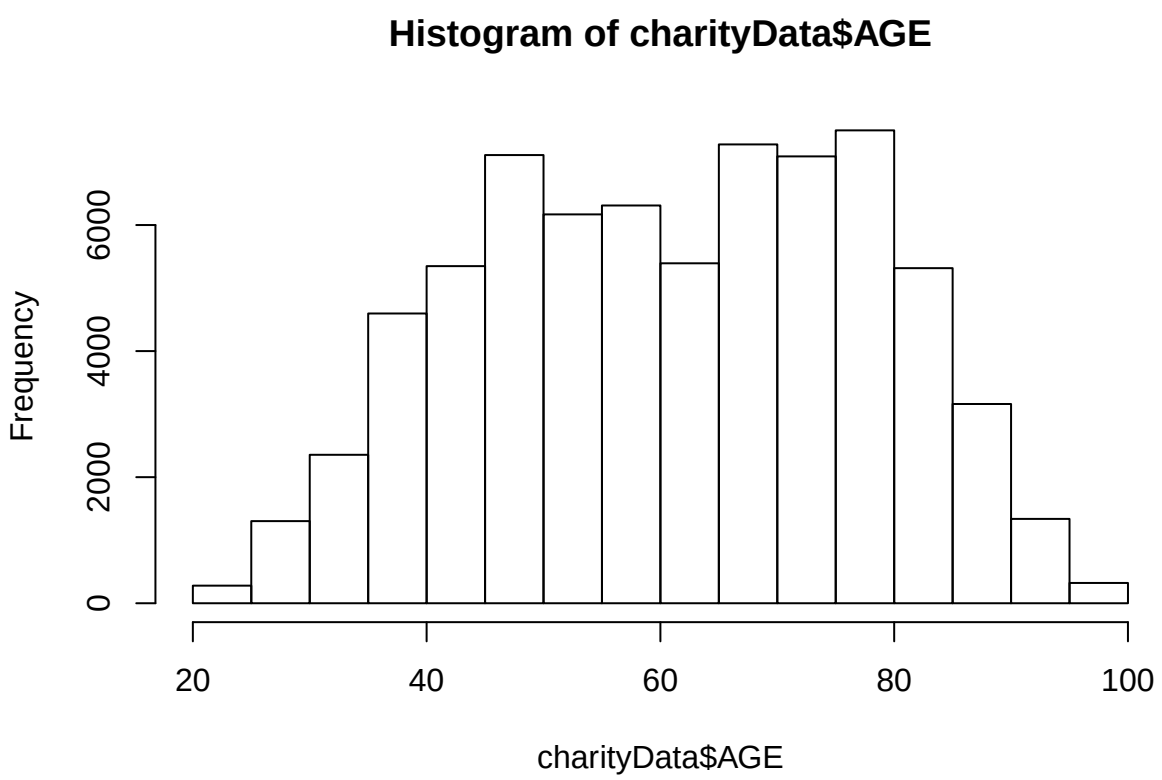
```r
hist(charityData$DAMT,col="blue",breaks=20,xlab="DAMT",main="")
```



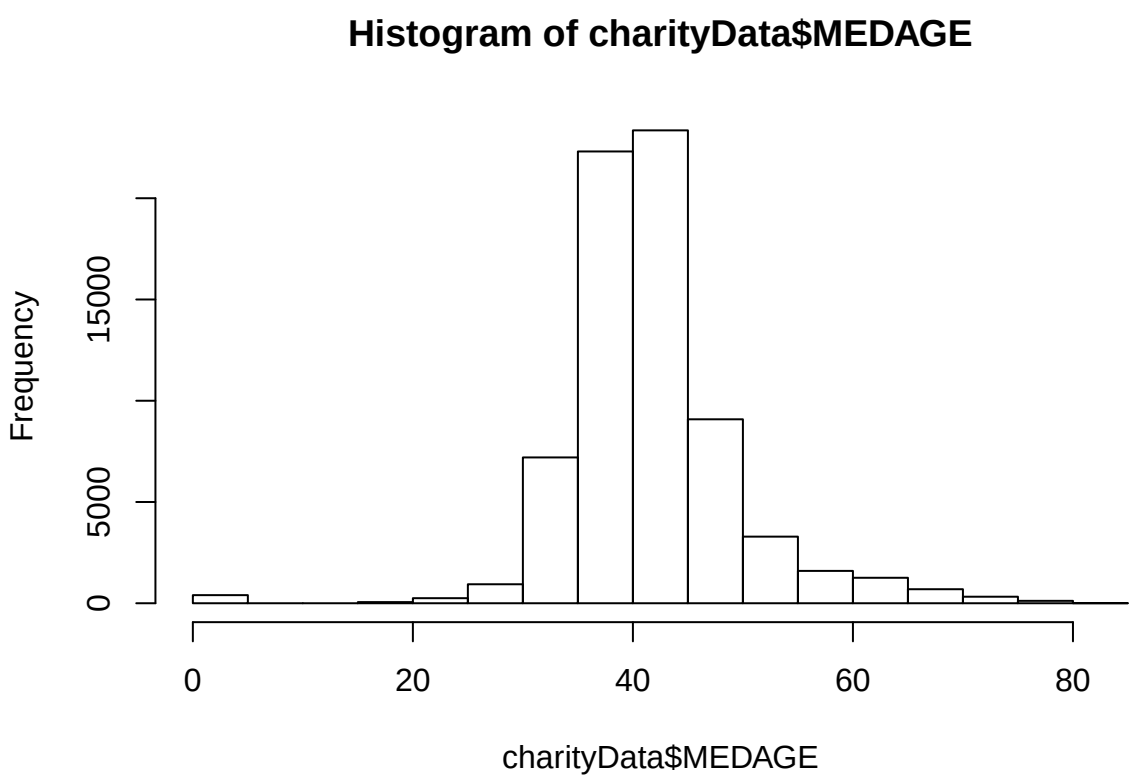

```
hist(charityData$DAMT[charityData$DAMT > 0],col="blue",breaks=20,xlab="DAMT > 0",main="")
```



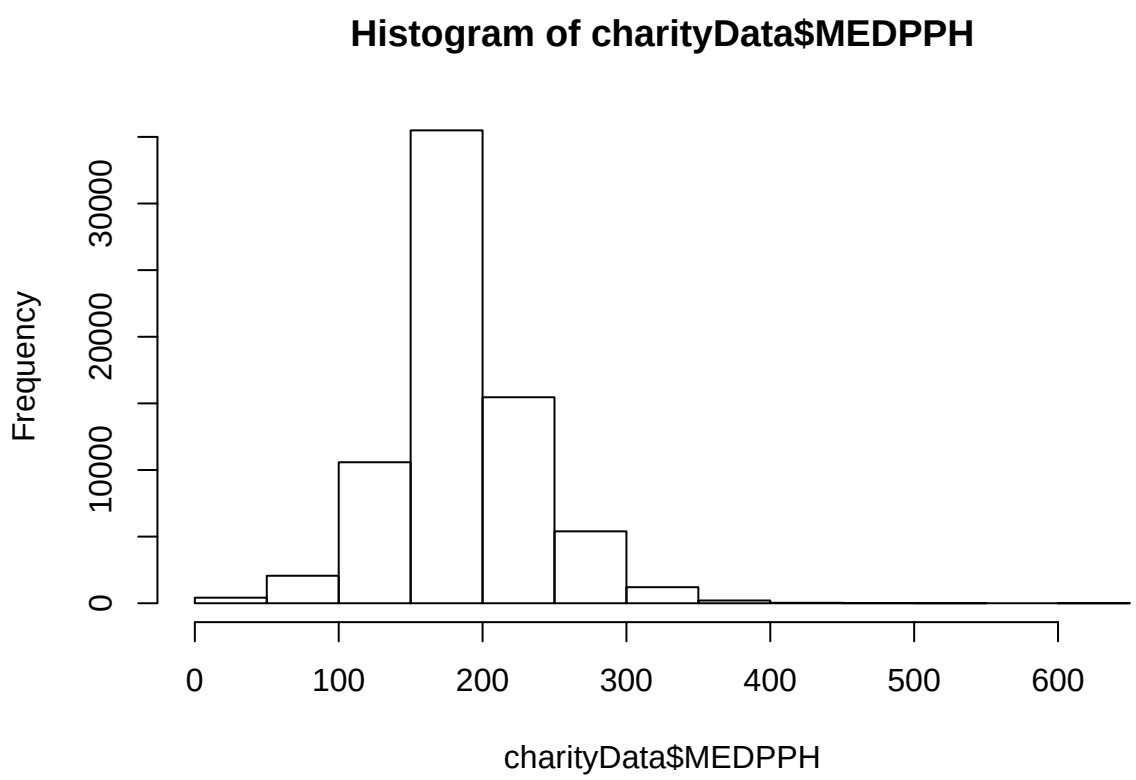

```
hist(charityData$AGE)
```



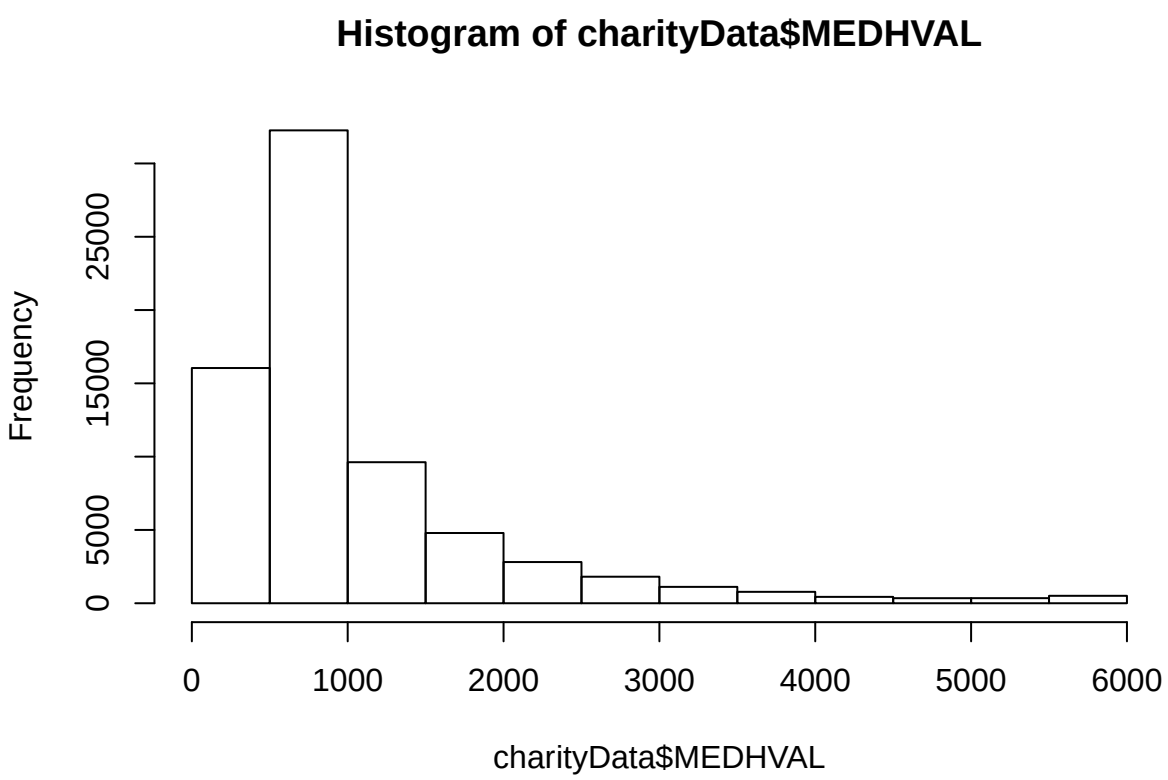

```
hist(charityData$MEDAGE)
```



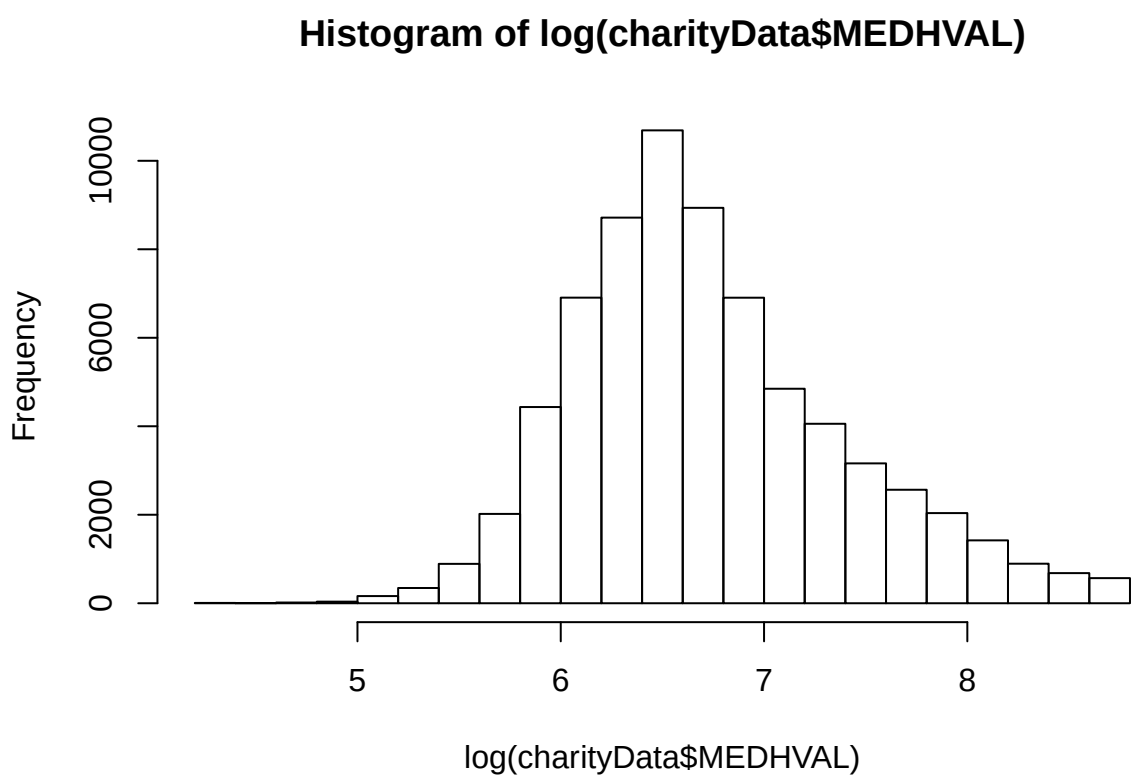

```
hist(charityData$MEDPPH)
```



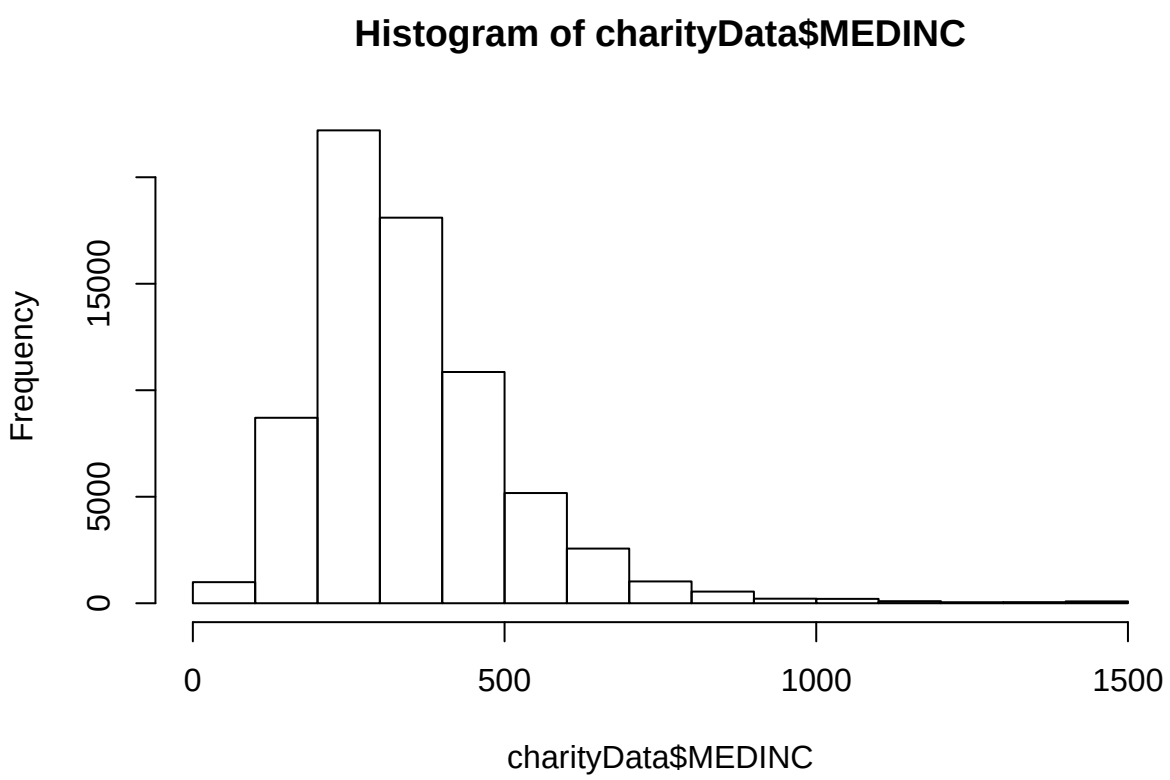

```
hist(charityData$MEDHVAL)
```



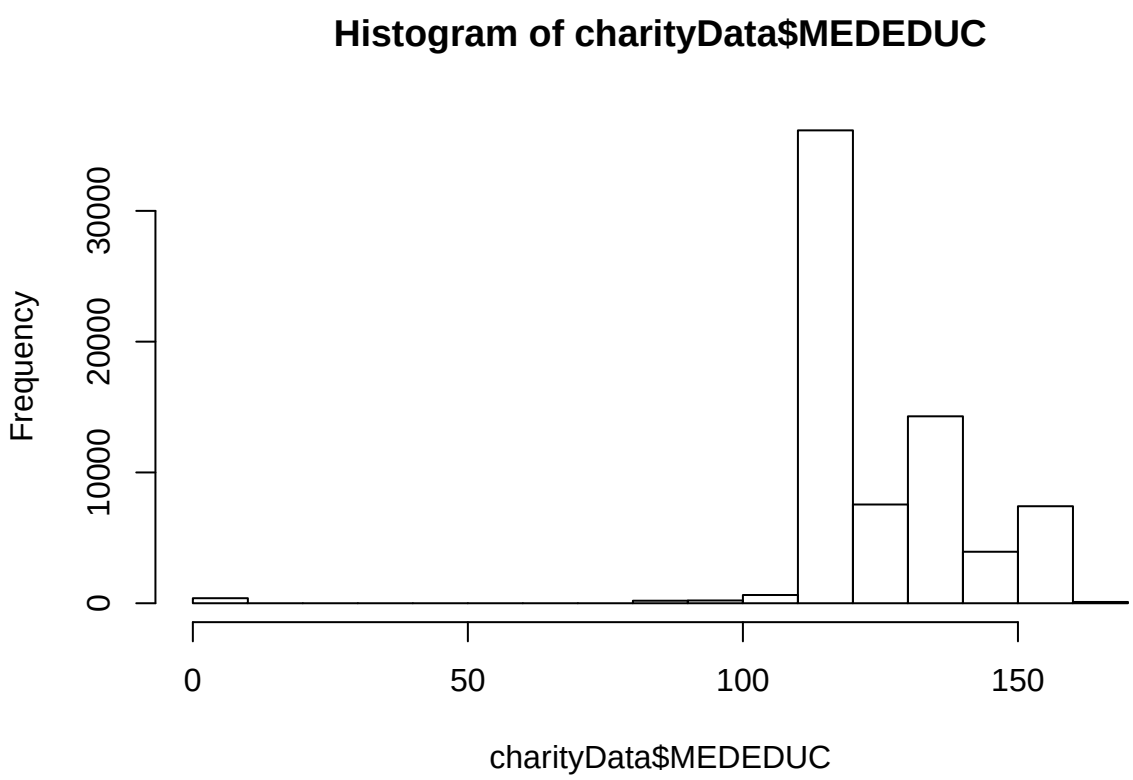

```
hist(log(charityData$MEDHVAL))
```



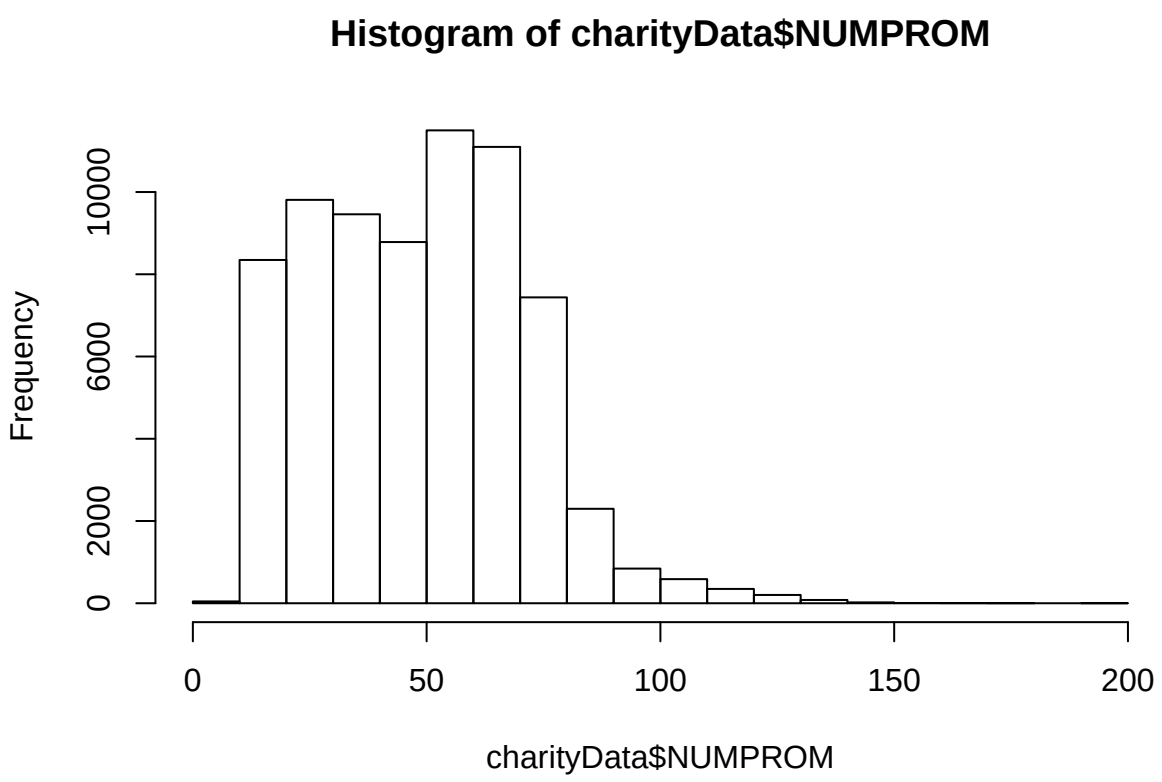

```
hist(charityData$MEDINC)
```



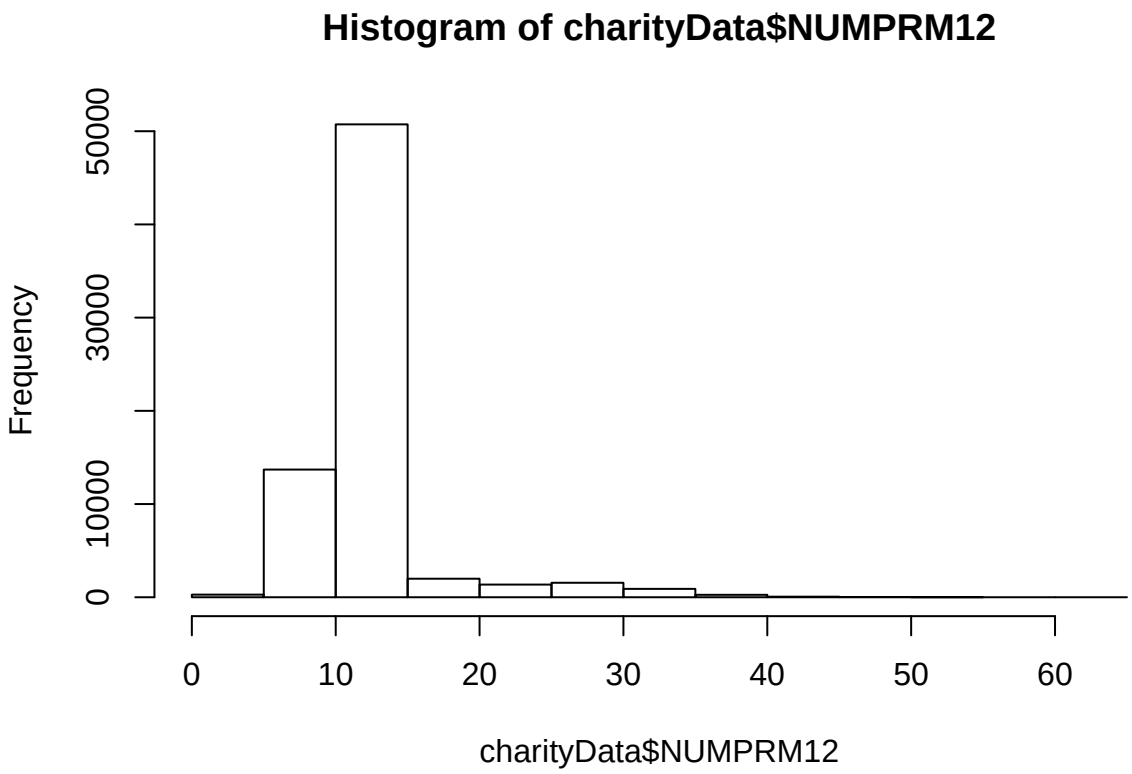

```
hist(charityData$MEDEDUC)
```



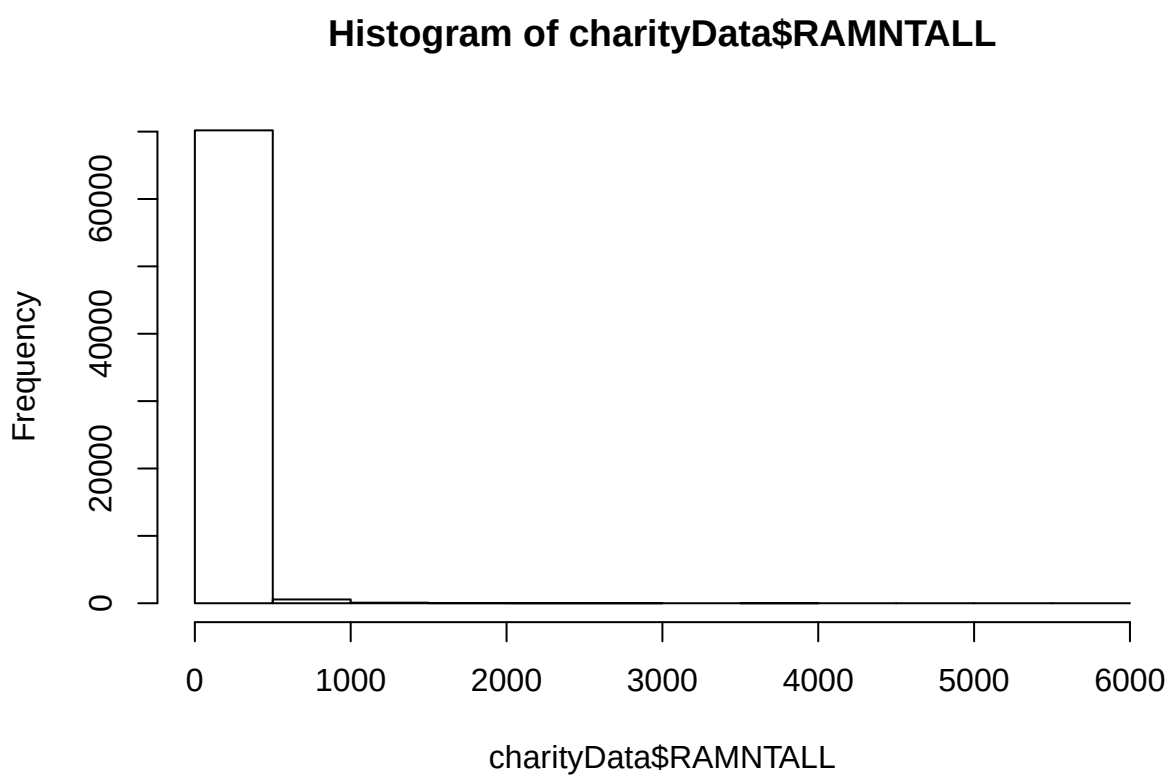

```
hist(charityData$NUMPROM)
```



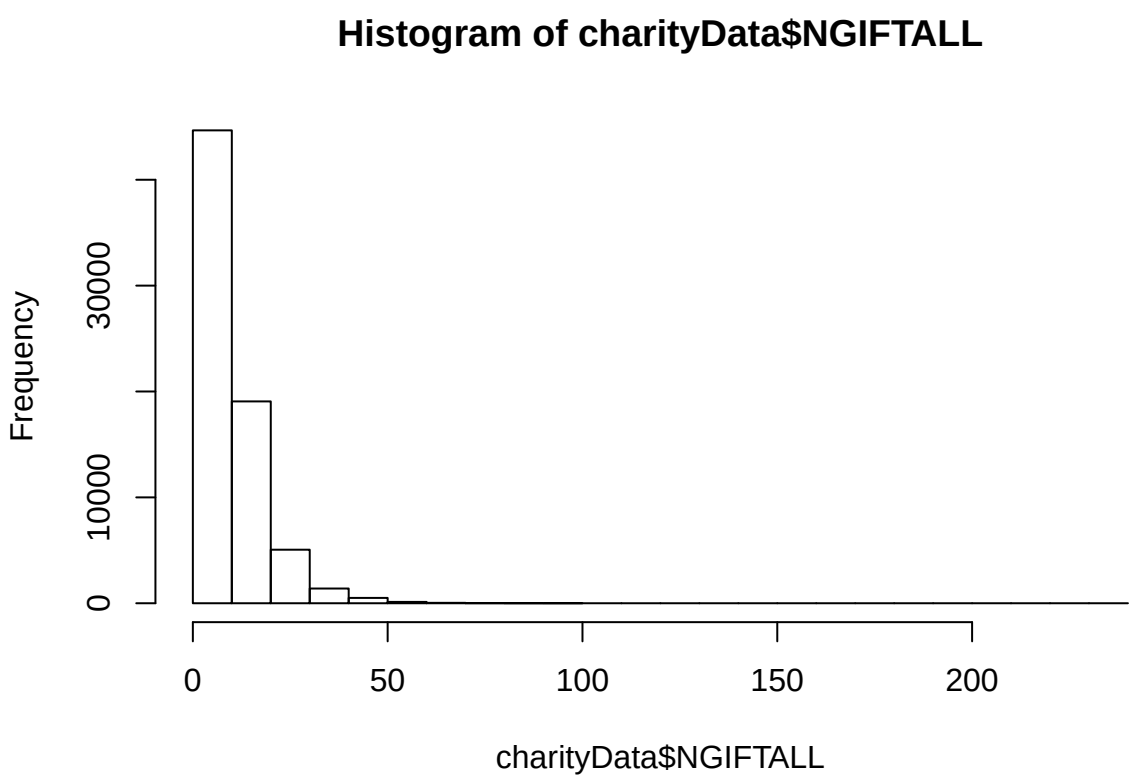

```
hist(charityData$NUMPRM12)
```



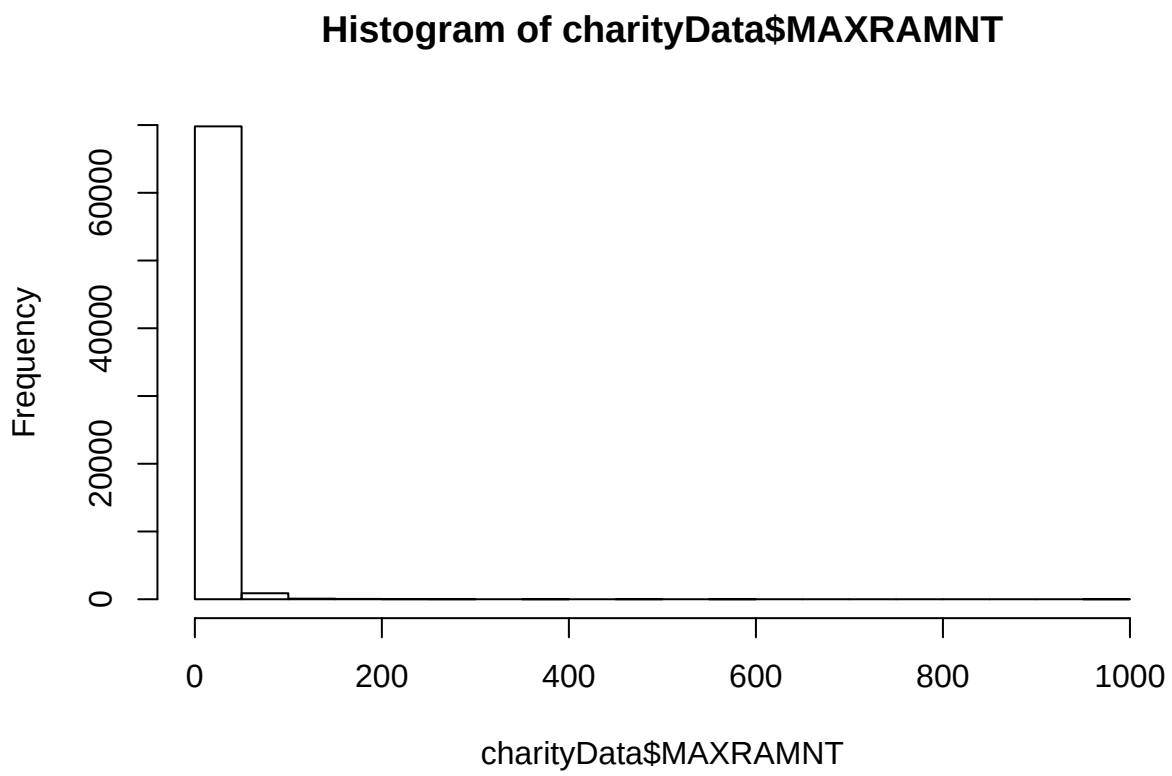

```
hist(charityData$RAMNTALL)
```



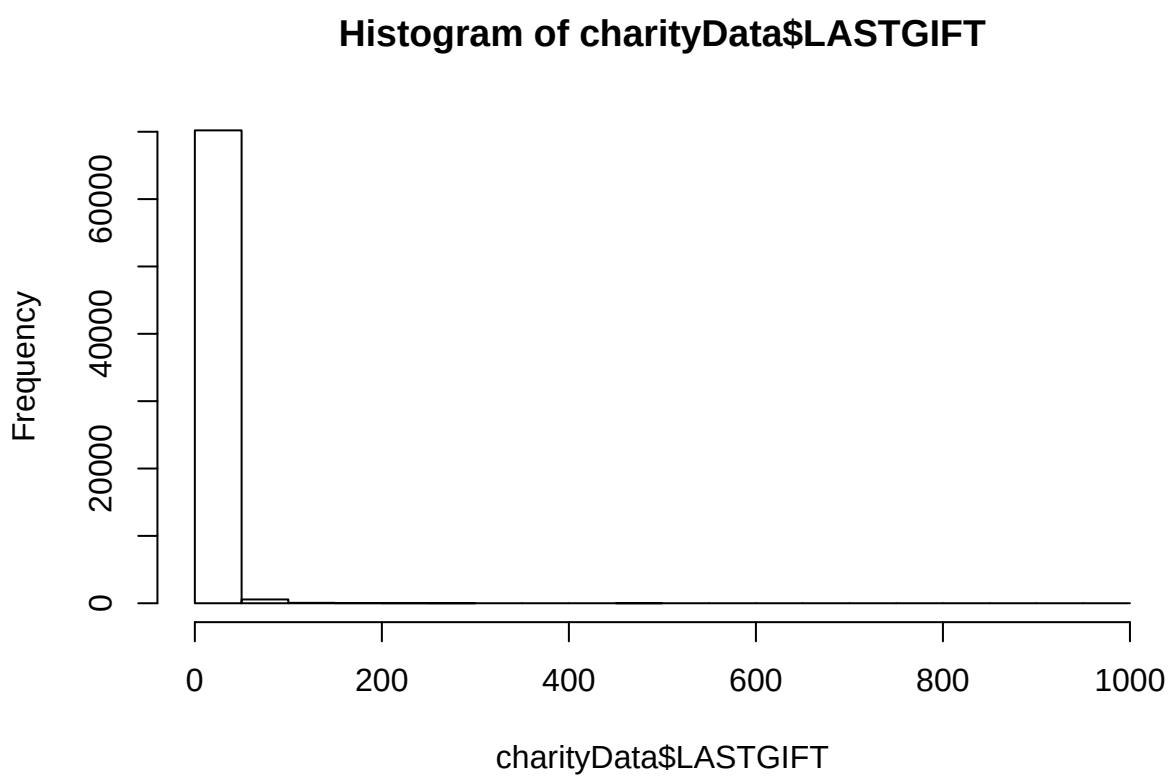

```
hist(charityData$NGIFTALL)
```



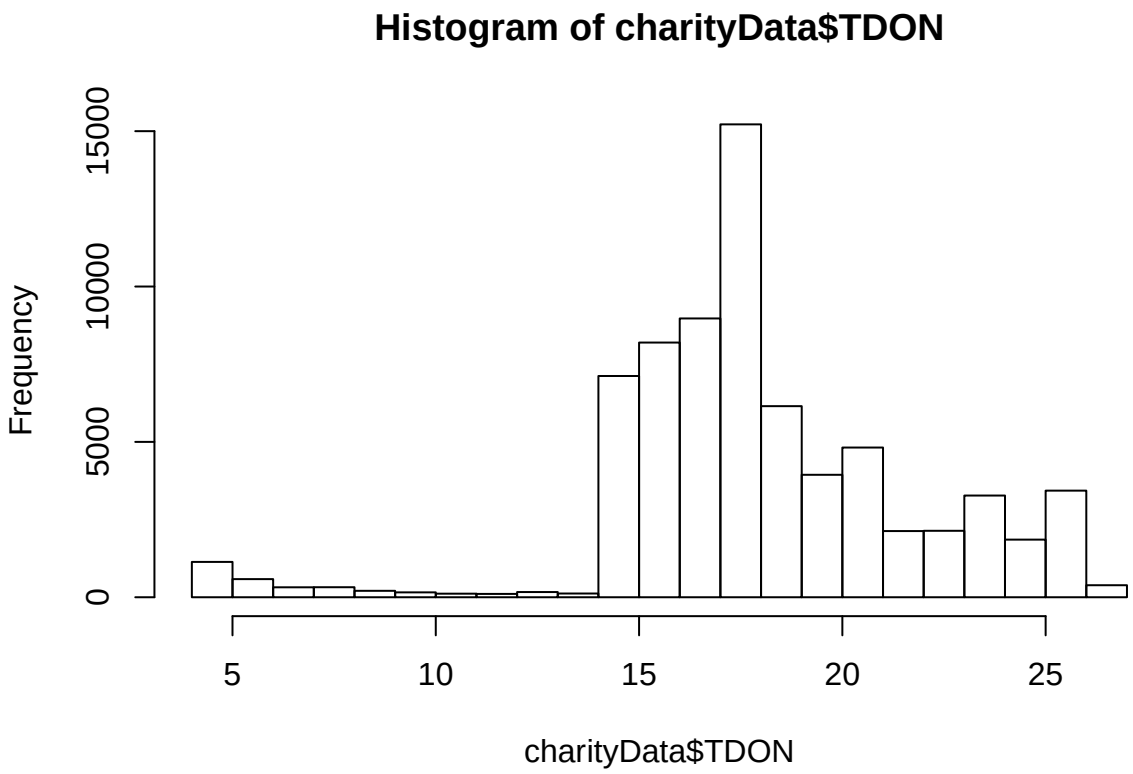

```
hist(charityData$MAXRAMNT)
```




```
hist(charityData$LASTGIFT)
```



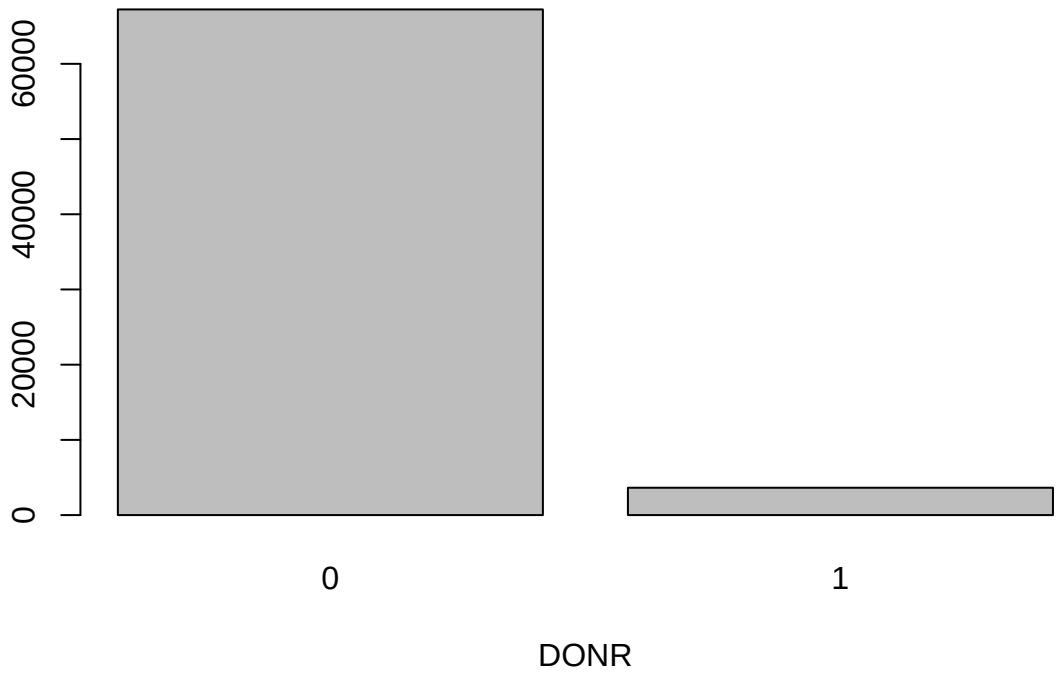

```
hist(charityData$TDON)
```




```
table(charityData$DONR)
```

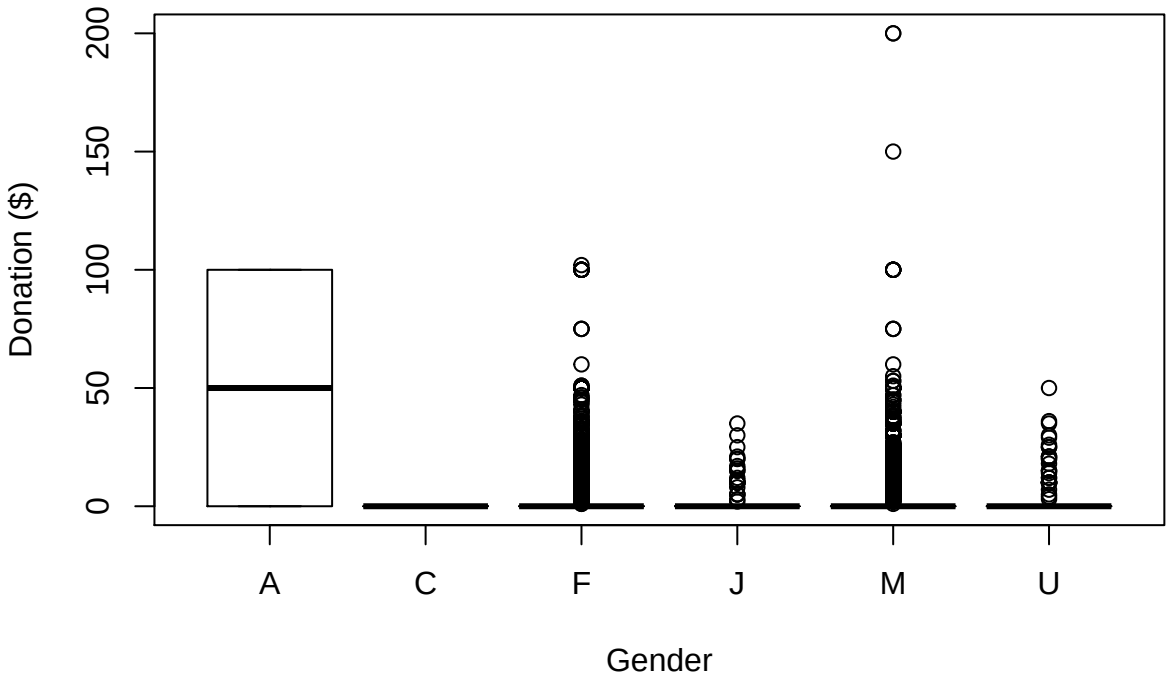
```
##
##     0     1
## 67234  3637
```

```
barplot(table(charityData$DONR),xlab="DONR")
```



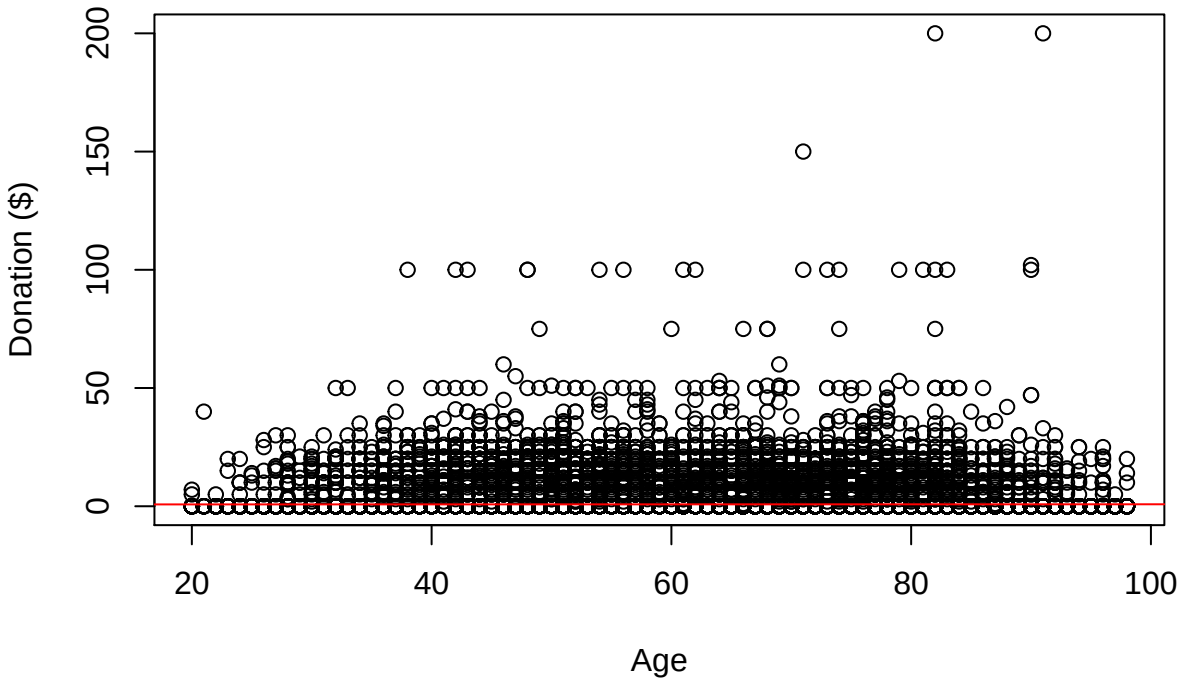
(b) Boxplot of DAMT amount by categories for GENDER

```
plot(charityData$GENDER,charityData$DAMT,xlab="Gender",ylab="Donation ($)")
```



Plot DAMT against a quantitative predictor variable

```
plot(charityData$AGE,charityData$DAMT,xlab="Age",ylab="Donation ($)")
lm_age = lm(DAMT ~ AGE, data=charityData)
abline(lm_age,col="red")
```



Let's see which variable have the greates potential for the regression.

```
charity_damt<-subset(charityData,DAMT > 0,select=c(DAMT,AGE,MEDAGE,MEDPPH,MEDHVAL,MEDINC,MEDEDUC,NUMPROM
                                                   ,NUMPRM12,RAMNTALL,NGIFTALL,MAXRAMNT,LASTGIFT,TDON))
cor(charity_damt)
```

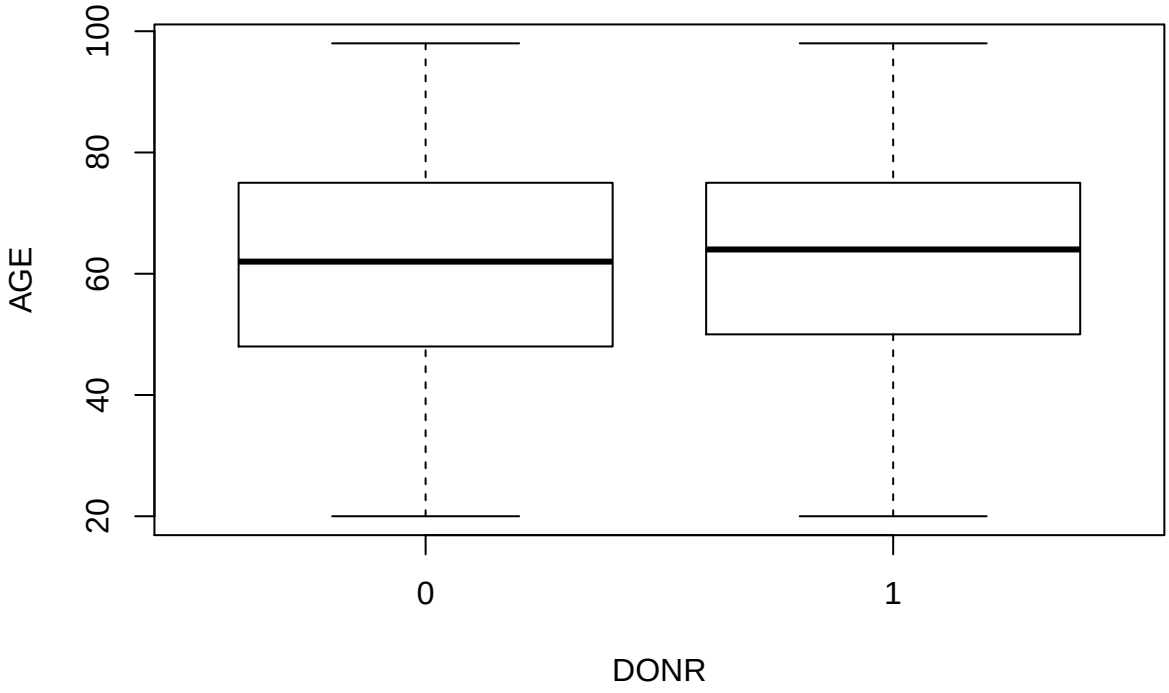
```
##                 DAMT         AGE      MEDAGE       MEDPPH      MEDHVAL
## DAMT      1.000000000 -0.03859743 -0.00706712  0.006517661  0.116305746
## AGE      -0.038597430  1.00000000  0.21497461 -0.181142567  0.013425465
## MEDAGE   -0.007067120  0.21497461  1.00000000 -0.260473255  0.071912722
## MEDPPH    0.006517661 -0.18114257 -0.26047325  1.000000000  0.048079707
## MEDHVAL   0.116305746  0.01342547  0.07191272  0.048079707  1.000000000
## MEDINC    0.116530060 -0.09127951  0.03426462  0.333221110  0.716263379
## MEDEDUC   0.098239525 -0.01074045  0.16332125  0.122422882  0.512371105
## NUMPROM  -0.059724189  0.23035661  0.02778282 -0.012745549 -0.024119575
## NUMPRM12  0.054758978  0.08488383  0.01944259 -0.022739982  0.043207453
## RAMNTALL  0.242751660  0.14025651  0.01156837 -0.021236409  0.025717589
## NGIFTALL -0.226396326  0.21498789  0.01523318 -0.020918100 -0.081961843
## MAXRAMNT  0.412984842  0.01636631  0.00722218 -0.009173518  0.077057583
## LASTGIFT  0.722788561 -0.03901145 -0.00296728  0.016783856  0.145406985
## TDON      0.108707853 -0.11618416 -0.03237160  0.040942543  0.003032744
##                MEDINC     MEDEDUC     NUMPROM    NUMPRM12    RAMNTALL
## DAMT      0.11653006  0.09823952 -0.05972419  0.05475898  0.24275166
## AGE      -0.09127951 -0.01074045  0.23035661  0.08488383  0.14025651
## MEDAGE    0.03426462  0.16332125  0.02778282  0.01944259  0.01156837
## MEDPPH    0.33322111  0.12242288 -0.01274555 -0.02273998 -0.02123641
```

```
## MEDHVAL   0.71626338  0.51237111 -0.02411958  0.04320745  0.02571759
## MEDINC    1.00000000  0.64654757 -0.02469300  0.03057805  0.01689872
## MEDEDUC   0.64654757  1.00000000 -0.02984508  0.01427124  0.01217791
## NUMPROM  -0.02469300 -0.02984508  1.00000000  0.52153590  0.66785709
## NUMPRM12  0.03057805  0.01427124  0.52153590  1.00000000  0.40913289
## RAMNTALL  0.01689872  0.01217791  0.66785709  0.40913289  1.00000000
## NGIFTALL -0.08754909 -0.08206455  0.78496064  0.30351573  0.63483633
## MAXRAMNT  0.06194634  0.04595540  0.11018119  0.17012424  0.47948167
## LASTGIFT  0.13025977  0.10734222 -0.02537302  0.09191341  0.31429272
## TDON      0.02254817  0.00251612 -0.25994471 -0.59919769 -0.20810152
##             NGIFTALL     MAXRAMNT    LASTGIFT         TDON
## DAMT     -0.22639633  0.412984842  0.72278856  0.108707853
## AGE       0.21498789  0.016366314 -0.03901145 -0.116184159
## MEDAGE    0.01523318  0.007222180 -0.00296728 -0.032371603
## MEDPPH   -0.02091810 -0.009173518  0.01678386  0.040942543
## MEDHVAL  -0.08196184  0.077057583  0.14540699  0.003032744
## MEDINC   -0.08754909  0.061946336  0.13025977  0.022548165
## MEDEDUC  -0.08206455  0.045955398  0.10734222  0.002516120
## NUMPROM   0.78496064  0.110181186 -0.02537302 -0.259944707
## NUMPRM12  0.30351573  0.170124239  0.09191341 -0.599197687
## RAMNTALL  0.63483633  0.479481665  0.31429272 -0.208101522
## NGIFTALL  1.00000000  0.014362033 -0.21244193 -0.241757439
## MAXRAMNT  0.01436203  1.000000000  0.53381124 -0.008665962
## LASTGIFT -0.21244193  0.533811240  1.00000000  0.100962876
## TDON     -0.24175744 -0.008665962  0.10096288  1.000000000
```

LASTGIFT and MAXRAMNT have the greatest potential for the regression problem.

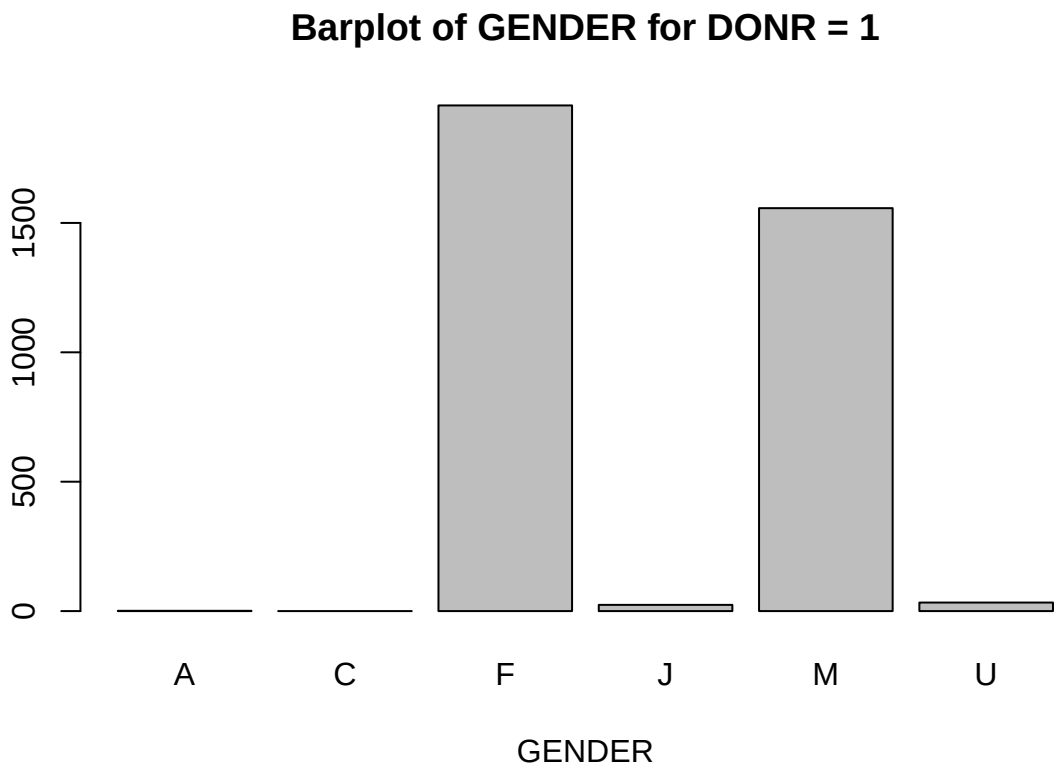
(c) Boxplot of AGE by DONR status

```
plot(charityData$DONR,charityData$AGE,xlab="DONR",ylab="AGE")
```



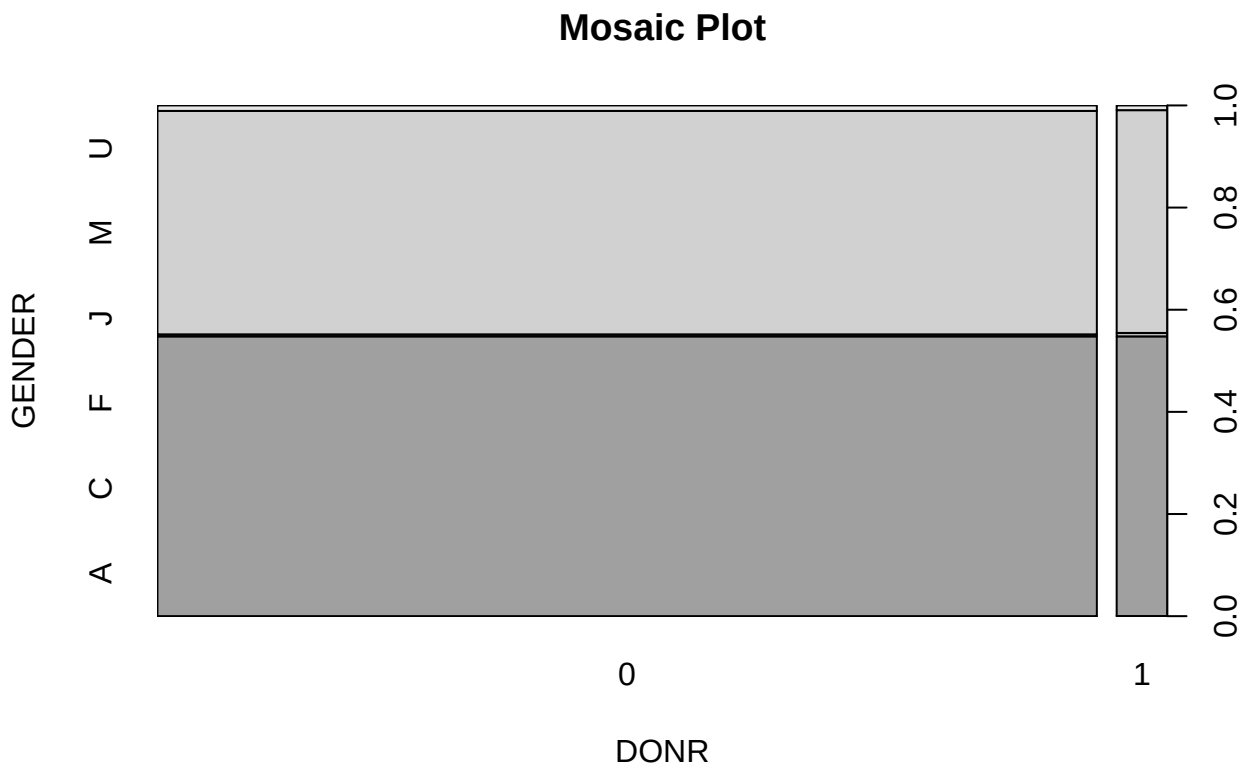
Wrong" Way. There are more females than males in the dataset as a whole.

```
barplot(table(charityData$GENDER[charityData$DONR == 1]),xlab="GENDER",main="Barplot of GENDER for DONR
```

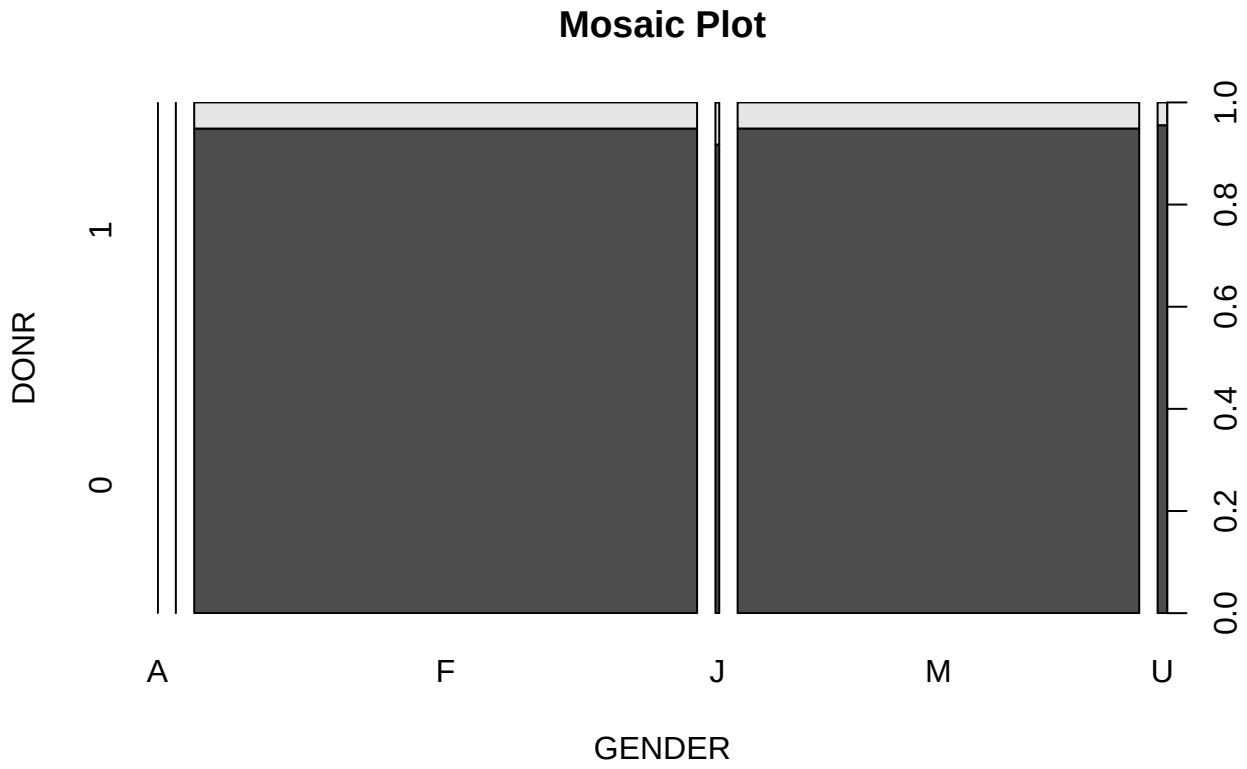


Right Way # A mosaic plot is obtained when we plot one factor variable against another. The # mosaic plot represents the counts as proportions to the whole. A deviation in # overall proportion of females donating compared to males donating is meaningful # whereas the absolute count of females donating compared to males donating was not.

```
plot(charityData$DONR,charityData$GENDER,xlab="DONR",ylab="GENDER",main="Mosaic Plot")
```




```
# Or
plot(charityData$GENDER,charityData$DONR,xlab="GENDER",ylab="DONR",main="Mosaic Plot")
```



These graphs show that M/F doesn't show any difference in DONR status.

```
charityData = separateRFA(charityData,"RFA_96")
# Check the results
table(charityData$RFA_96,charityData$RFA_96_R)
```

```
##
##           A     F     L     N     S
##   A1D    69     0     0     0     0
##   A1E  4102     0     0     0     0
##   A1F 17247     0     0     0     0
##   A1G  7246     0     0     0     0
##   A2C     1     0     0     0     0
##   A2D    60     0     0     0     0
##   A2E  1457     0     0     0     0
##   A2F  4839     0     0     0     0
##   A2G  2094     0     0     0     0
##   A3C     1     0     0     0     0
##   A3D   379     0     0     0     0
##   A3E  2913     0     0     0     0
##   A3F  1524     0     0     0     0
##   A3G   641     0     0     0     0
##   A4C     3     0     0     0     0
##   A4D  1296     0     0     0     0
##   A4E  1281     0     0     0     0
##   A4F   670     0     0     0     0
```

```
##   A4G   306     0     0     0     0
##   F1C     0    15     0     0     0
##   F1D     0    46     0     0     0
##   F1E     0    54     0     0     0
##   F1F     0  3935     0     0     0
##   F1G     0  1433     0     0     0
##   L1F     0     0   149     0     0
##   L1G     0     0    54     0     0
##   L2F     0     0    71     0     0
##   L2G     0     0    34     0     0
##   L3E     0     0    19     0     0
##   L3F     0     0    20     0     0
##   L3G     0     0     8     0     0
##   L4E     0     0    11     0     0
##   L4F     0     0     8     0     0
##   L4G     0     0     9     0     0
##   N1C     0     0     0     1     0
##   N1D     0     0     0    23     0
##   N1E     0     0     0    28     0
##   N1F     0     0     0  1026     0
##   N1G     0     0     0   438     0
##   N2C     0     0     0     7     0
##   N2D     0     0     0    38     0
##   N2E     0     0     0   100     0
##   N2F     0     0     0  1013     0
##   N2G     0     0     0   366     0
##   N3D     0     0     0    12     0
##   N3E     0     0     0   549     0
##   N3F     0     0     0   180     0
##   N3G     0     0     0    63     0
##   N4D     0     0     0    22     0
##   N4E     0     0     0   120     0
##   N4F     0     0     0    40     0
##   N4G     0     0     0    15     0
##   S2B     0     0     0     0     2
##   S2C     0     0     0     0     2
##   S2D     0     0     0     0   157
##   S2E     0     0     0     0  2688
##   S2F     0     0     0     0  2055
##   S2G     0     0     0     0   893
##   S3C     0     0     0     0     2
##   S3D     0     0     0     0  1539
##   S3E     0     0     0     0  1757
##   S3F     0     0     0     0   856
##   S3G     0     0     0     0   402
##   S4B     0     0     0     0     2
##   S4C     0     0     0     0     7
##   S4D     0     0     0     0  2027
##   S4E     0     0     0     0  1386
##   S4F     0     0     0     0   741
##   S4G     0     0     0     0   319
```

```
table(charityData$RFA_96,charityData$RFA_96_F)
```

```
##
##          1     2     3     4
##   A1D   69     0     0     0
##   A1E  4102     0     0     0
##   A1F 17247     0     0     0
##   A1G  7246     0     0     0
##   A2C     0     1     0     0
##   A2D     0    60     0     0
##   A2E     0  1457     0     0
##   A2F     0  4839     0     0
##   A2G     0  2094     0     0
##   A3C     0     0     1     0
##   A3D     0     0   379     0
##   A3E     0     0  2913     0
##   A3F     0     0  1524     0
##   A3G     0     0   641     0
##   A4C     0     0     0     3
##   A4D     0     0     0  1296
##   A4E     0     0     0  1281
##   A4F     0     0     0   670
##   A4G     0     0     0   306
##   F1C    15     0     0     0
##   F1D    46     0     0     0
##   F1E    54     0     0     0
##   F1F  3935     0     0     0
##   F1G  1433     0     0     0
##   L1F   149     0     0     0
##   L1G    54     0     0     0
##   L2F     0    71     0     0
##   L2G     0    34     0     0
##   L3E     0     0    19     0
##   L3F     0     0    20     0
##   L3G     0     0     8     0
##   L4E     0     0     0    11
##   L4F     0     0     0     8
##   L4G     0     0     0     9
##   N1C     1     0     0     0
##   N1D    23     0     0     0
##   N1E    28     0     0     0
##   N1F  1026     0     0     0
##   N1G   438     0     0     0
##   N2C     0     7     0     0
##   N2D     0    38     0     0
##   N2E     0   100     0     0
##   N2F     0  1013     0     0
##   N2G     0   366     0     0
##   N3D     0     0    12     0
##   N3E     0     0   549     0
##   N3F     0     0   180     0
##   N3G     0     0    63     0
##   N4D     0     0     0    22
##   N4E     0     0     0   120
##   N4F     0     0     0    40
##   N4G     0     0     0    15
```

```
##   S2B     0     2     0     0
##   S2C     0     2     0     0
##   S2D     0   157     0     0
##   S2E     0  2688     0     0
##   S2F     0  2055     0     0
##   S2G     0   893     0     0
##   S3C     0     0     2     0
##   S3D     0     0  1539     0
##   S3E     0     0  1757     0
##   S3F     0     0   856     0
##   S3G     0     0   402     0
##   S4B     0     0     0     2
##   S4C     0     0     0     7
##   S4D     0     0     0  2027
##   S4E     0     0     0  1386
##   S4F     0     0     0   741
##   S4G     0     0     0   319
```

```
table(charityData$RFA_96,charityData$RFA_96_A)
```

```
##
##          B     C     D     E     F     G
##   A1D    0     0    69     0     0     0
##   A1E    0     0     0  4102     0     0
##   A1F    0     0     0     0 17247     0
##   A1G    0     0     0     0     0  7246
##   A2C    0     1     0     0     0     0
##   A2D    0     0    60     0     0     0
##   A2E    0     0     0  1457     0     0
##   A2F    0     0     0     0  4839     0
##   A2G    0     0     0     0     0  2094
##   A3C    0     1     0     0     0     0
##   A3D    0     0   379     0     0     0
##   A3E    0     0     0  2913     0     0
##   A3F    0     0     0     0  1524     0
##   A3G    0     0     0     0     0   641
##   A4C    0     3     0     0     0     0
##   A4D    0     0  1296     0     0     0
##   A4E    0     0     0  1281     0     0
##   A4F    0     0     0     0   670     0
##   A4G    0     0     0     0     0   306
##   F1C    0    15     0     0     0     0
##   F1D    0     0    46     0     0     0
##   F1E    0     0     0    54     0     0
##   F1F    0     0     0     0  3935     0
##   F1G    0     0     0     0     0  1433
##   L1F    0     0     0     0   149     0
##   L1G    0     0     0     0     0    54
##   L2F    0     0     0     0    71     0
##   L2G    0     0     0     0     0    34
##   L3E    0     0     0    19     0     0
##   L3F    0     0     0     0    20     0
##   L3G    0     0     0     0     0     8
##   L4E    0     0     0    11     0     0
```

```
##   L4F     0     0     0     0     8     0
##   L4G     0     0     0     0     0     9
##   N1C     0     1     0     0     0     0
##   N1D     0     0    23     0     0     0
##   N1E     0     0     0    28     0     0
##   N1F     0     0     0     0  1026     0
##   N1G     0     0     0     0     0   438
##   N2C     0     7     0     0     0     0
##   N2D     0     0    38     0     0     0
##   N2E     0     0     0   100     0     0
##   N2F     0     0     0     0  1013     0
##   N2G     0     0     0     0     0   366
##   N3D     0     0    12     0     0     0
##   N3E     0     0     0   549     0     0
##   N3F     0     0     0     0   180     0
##   N3G     0     0     0     0     0    63
##   N4D     0     0    22     0     0     0
##   N4E     0     0     0   120     0     0
##   N4F     0     0     0     0    40     0
##   N4G     0     0     0     0     0    15
##   S2B     2     0     0     0     0     0
##   S2C     0     2     0     0     0     0
##   S2D     0     0   157     0     0     0
##   S2E     0     0     0  2688     0     0
##   S2F     0     0     0     0  2055     0
##   S2G     0     0     0     0     0   893
##   S3C     0     2     0     0     0     0
##   S3D     0     0  1539     0     0     0
##   S3E     0     0     0  1757     0     0
##   S3F     0     0     0     0   856     0
##   S3G     0     0     0     0     0   402
##   S4B     2     0     0     0     0     0
##   S4C     0     7     0     0     0     0
##   S4D     0     0  2027     0     0     0
##   S4E     0     0     0  1386     0     0
##   S4F     0     0     0     0   741     0
##   S4G     0     0     0     0     0   319
```

Excercise 4 First we will subset the charity data set and exclude all the categorical variables.Not sure how to handle mix of continous and categorical variables. We only include DAMT values greater than 0.

```
charity_sub<-subset(charityData,DAMT > 0,select=c(AGE,MEDAGE,MEDPPH,MEDHVAL,MEDINC,MEDEDUC,NUMPROM
                                                  ,NUMPRM12,RAMNTALL,NGIFTALL,MAXRAMNT,LASTGIFT,TDON))
```

Let's look at mean an variance of the variables. It

```
sapply(charity_sub,mean)
```

```
##        AGE     MEDAGE     MEDPPH    MEDHVAL     MEDINC    MEDEDUC
##   62.39126   42.52543  185.60682 1165.70003  360.15947  129.53148
##    NUMPROM   NUMPRM12   RAMNTALL   NGIFTALL   MAXRAMNT   LASTGIFT
##   51.87930   13.32279  115.18877   11.68985   18.27874   15.17563
##       TDON
##   17.70993
```

```
sapply(charity_sub, var)
```

```
##          AGE       MEDAGE       MEDPPH      MEDHVAL       MEDINC
## 2.481018e+02 6.539794e+01 2.354235e+03 1.055142e+06 3.049313e+04
##      MEDEDUC      NUMPROM     NUMPRM12     RAMNTALL     NGIFTALL
## 2.831281e+02 5.138163e+02 2.555749e+01 1.275299e+04 8.500444e+01
##     MAXRAMNT     LASTGIFT         TDON
## 4.474424e+02 1.268361e+02 1.759488e+01
```

We now perform principal component analysis using prcomp function.

```
pr.out<-prcomp(charity_sub,scale=TRUE)
pr.out$sdev
```

```
##  [1] 1.7468653 1.5615092 1.2753145 1.1910868 1.0645638 0.8807616 0.8437433
##  [8] 0.6911847 0.6813230 0.6053720 0.4460684 0.4425991 0.3752499
```

The center and scale varialbes correspond to meand and standard deviations of variable prior to PCA.

```
pr.out$center
```

```
##        AGE     MEDAGE     MEDPPH    MEDHVAL     MEDINC    MEDEDUC
##   62.39126   42.52543  185.60682 1165.70003  360.15947  129.53148
##    NUMPROM   NUMPRM12   RAMNTALL   NGIFTALL   MAXRAMNT   LASTGIFT
##   51.87930   13.32279  115.18877   11.68985   18.27874   15.17563
##       TDON
##   17.70993
```

```
pr.out$scale
```

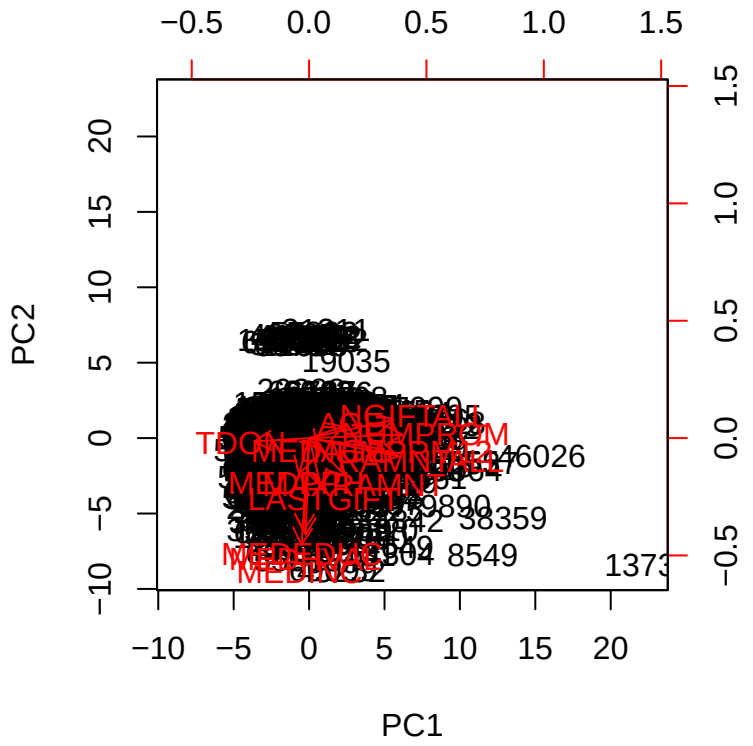
```
##         AGE      MEDAGE      MEDPPH     MEDHVAL      MEDINC     MEDEDUC
##   15.751248    8.086899   48.520463 1027.201029  174.622834   16.826410
##     NUMPROM    NUMPRM12    RAMNTALL    NGIFTALL    MAXRAMNT    LASTGIFT
##   22.667516    5.055442  112.929153    9.219785   21.152834   11.262151
##        TDON
##    4.194625
```

```
pr.out$rotation
```

```
##                  PC1         PC2         PC3         PC4          PC5
## AGE       0.17981397  0.06195935  0.14354868 -0.43790261  0.172836557
## MEDAGE    0.04359051 -0.05164401  0.13650338 -0.62358498  0.002226247
## MEDPPH   -0.05336775 -0.19045402  0.03538389  0.58273954  0.115523629
## MEDHVAL  -0.01830202 -0.51271462  0.17564772 -0.10455262  0.015440314
## MEDINC   -0.04045772 -0.56720783  0.19880445  0.08969708  0.059428940
## MEDEDUC  -0.03025628 -0.49317982  0.20952796 -0.11114998  0.039765987
## NUMPROM   0.49689818  0.01850947  0.11913819  0.08974645  0.238985165
## NUMPRM12  0.39873651 -0.05916862  0.07282530  0.08201776 -0.514500737
## RAMNTALL  0.47667400 -0.09692337 -0.23060492  0.03790078  0.208804271
## NGIFTALL  0.44893195  0.09744319  0.20099196  0.10929265  0.379334933
```

```
## MAXRAMNT  0.19153112 -0.19875009 -0.57204491 -0.08549752 -0.038346487
## LASTGIFT  0.06441568 -0.25851848 -0.59320900 -0.10335678 -0.097926038
## TDON     -0.29075986 -0.01810023 -0.23027194 -0.04807731  0.656541110
##                  PC6           PC7         PC8         PC9         PC10
## AGE      -0.834713823  0.1058180067 -0.01417260  0.05596316 -0.056250405
## MEDAGE    0.251390795 -0.6757429585  0.16258097 -0.19911380  0.033115988
## MEDPPH   -0.400603136 -0.6003448089  0.08590519 -0.11801232  0.019802428
## MEDHVAL   0.028966866  0.3999744560  0.26621732 -0.43806101  0.064052641
## MEDINC   -0.014974483  0.0144252802  0.06532814 -0.13843591 -0.008776728
## MEDEDUC   0.089713537 -0.0762350486 -0.46818726  0.62929252 -0.068664885
## NUMPROM   0.096426396  0.0089423619  0.22980430  0.14304286 -0.185288722
## NUMPRM12  0.008076649 -0.0230706235  0.30198933  0.14263393 -0.551102324
## RAMNTALL  0.114637318  0.0003830476 -0.09472328 -0.01854907  0.232188875
## NGIFTALL  0.146290047  0.0226111334 -0.10389267 -0.07347749  0.224312287
## MAXRAMNT -0.055944872 -0.0552792290 -0.49543516 -0.38339398 -0.345961164
## LASTGIFT -0.098843528 -0.0223449809  0.42750812  0.35466357  0.400833979
## TDON      0.116855254  0.0328931032  0.28223248  0.12999231 -0.513636142
##                 PC11        PC12         PC13
## AGE      -0.05991367  0.05515000  0.022758480
## MEDAGE    0.02797040  0.01226849 -0.001455955
## MEDPPH    0.24095252  0.07717345 -0.009310533
## MEDHVAL   0.50463386  0.10828806 -0.026359967
## MEDINC   -0.75722700 -0.16464540  0.033096933
## MEDEDUC   0.24972566  0.04128453  0.013028624
## NUMPROM   0.09566517 -0.48612483 -0.557617229
## NUMPRM12 -0.01997478  0.23172717  0.301358758
## RAMNTALL -0.16598410  0.69854752 -0.270710137
## NGIFTALL  0.06683942 -0.17951971  0.683821455
## MAXRAMNT  0.06345266 -0.25200189  0.044109949
## LASTGIFT  0.03762744 -0.21429823  0.173273045
## TDON     -0.01215741  0.17513972  0.151043619
```

```
biplot(pr.out,scale=0)
```



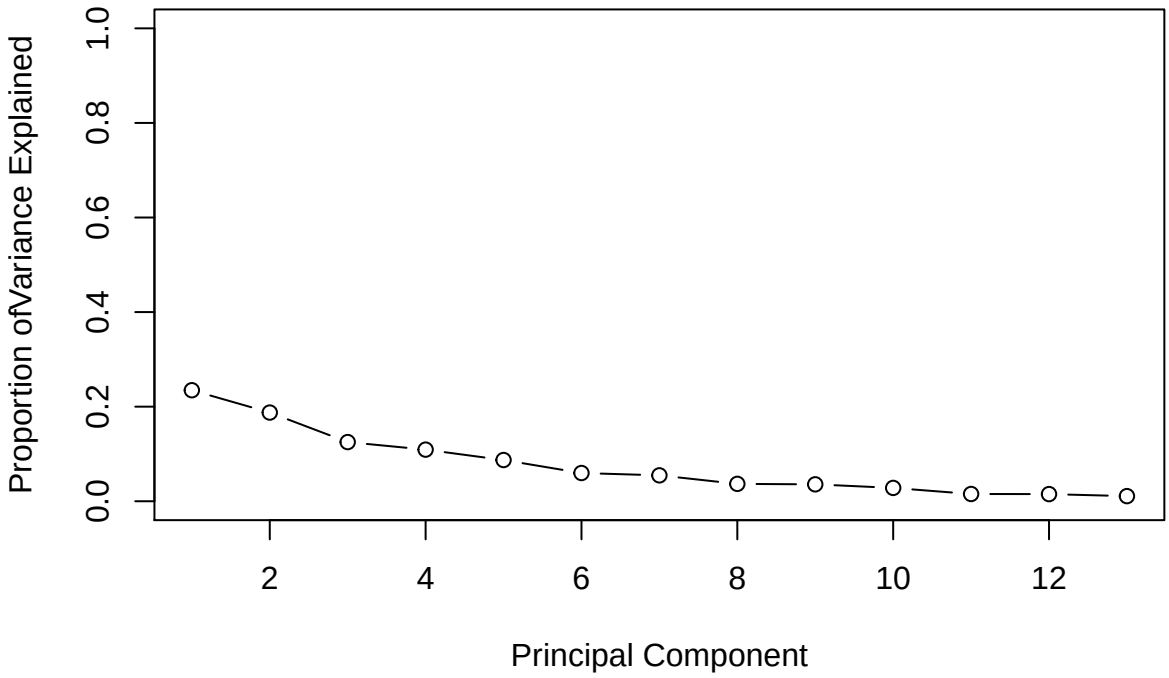

```
pr.out$sdev
```

```
##  [1] 1.7468653 1.5615092 1.2753145 1.1910868 1.0645638 0.8807616 0.8437433
##  [8] 0.6911847 0.6813230 0.6053720 0.4460684 0.4425991 0.3752499
```

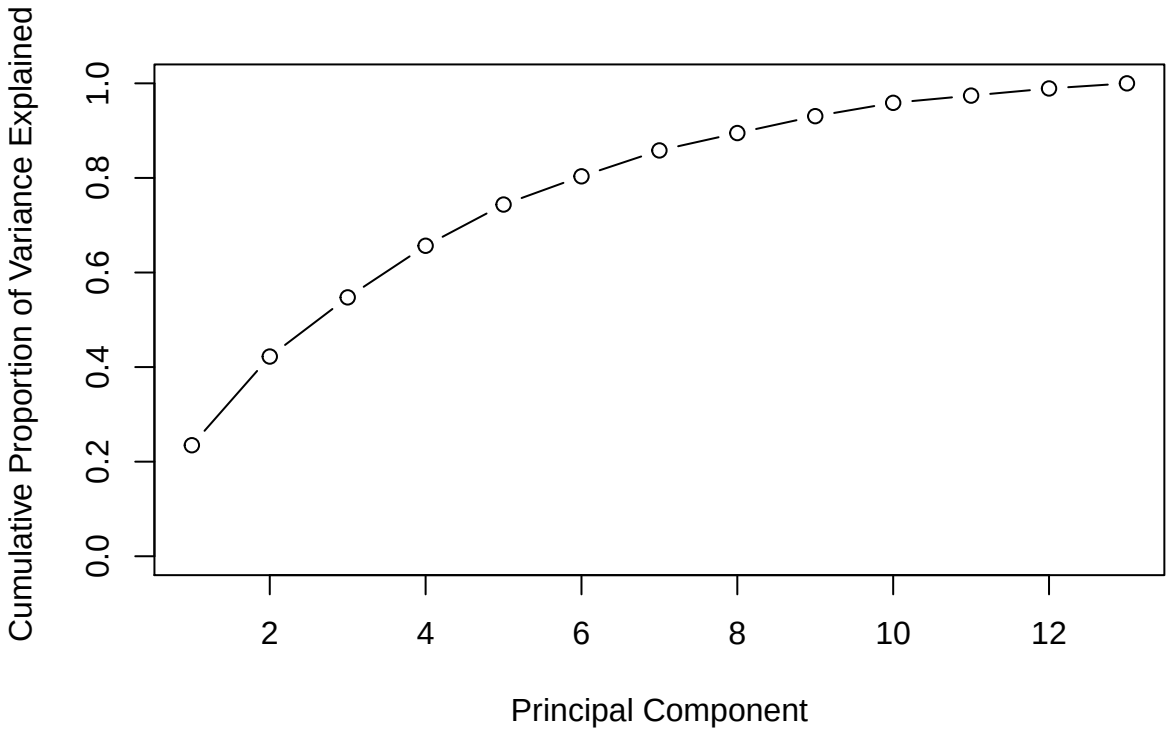
```
pr.var<-pr.out$sdev^2
pve=pr.var/sum(pr.var)
pve
```

```
##  [1] 0.23473372 0.18756237 0.12510977 0.10912984 0.08717663 0.05967239
##  [7] 0.05476175 0.03674895 0.03570777 0.02819040 0.01530593 0.01506877
## [13] 0.01083173
```

```
plot(pve , xlab=" Principal Component ", ylab=" Proportion ofVariance Explained ", ylim=c(0,1),type="b"
```




```
plot(cumsum (pve ), xlab=" Principal Component ", ylab ="Cumulative Proportion of Variance Explained ",
```



Looks like first 6 principal components explain 80% of the variance in