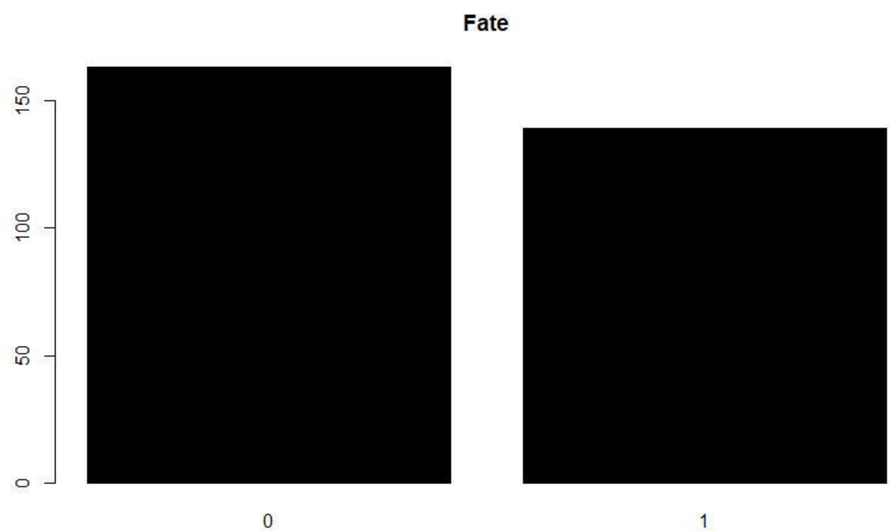
```
# Roll no. 33235
# Batch: L10
# P.S.: Application of Linear regression and KNN on Heart disease dataset to
        predict the fate (prob. of heart disease)
```

```
> # Read the CSV file and analyse

> hdata <- read.csv(file.choose()header=TRUE, sep=",")
> names(hdata)

 [1] "X63.0" "X1.0" "X1.0.1" "X145.0" "X233.0" "X1.0.2" "X2.0" "X150.0" "X0.0"
 "X2.3" "X3.0" "X0.0.1" "X6.0"
[14] "X0"

> str(hdata)
'data.frame':  302 obs. of  14 variables:
 $ X63.0 : num  67 67 37 41 56 62 57 63 53 57 ...
 $ X1.0  : num  1 1 1 0 1 0 0 1   11...
 $ X1.0.1: num  4 4 3 2 2 4 4 4   44...
 $ X145.0: num  160 120 130 130 120 140 120 130 140 140 ...
 $ X233.0: num  286 229 250 204 236 268 354 254 203 192 ...
 $ X1.0.2: num  0 0 0 0 0 0 0 0   10...
 $ X2.0  : num  2 2 0 2 0 2 0 2   20...
 $ X150.0: num  108 129 187 172 178 160 163 147 155 148 ...
 $ X0.0  : num  1 1 0 0 0 0 1 0   10...
 $ X2.3  : num  1.5 2.6 3.5 1.4 0.8 3.6 0.6 1.4 3.1 0.4 ...
 $ X3.0  : num  2 2 3 1 1 3 1 2   32...
  $ X0.0.1: Factor w/ 5 levels "?","0.0","1.0",..: 5 4 2 2 2 4 2 3  22...
$ X6.0   : Factor w/ 4 levels "?","3.0","6.0",..: 2 4 2 2 2 2 2 4  43...
$ X0     : int  2     100030 210...

> dim(hdata)
[1] 302 14

> # Change the headers
```

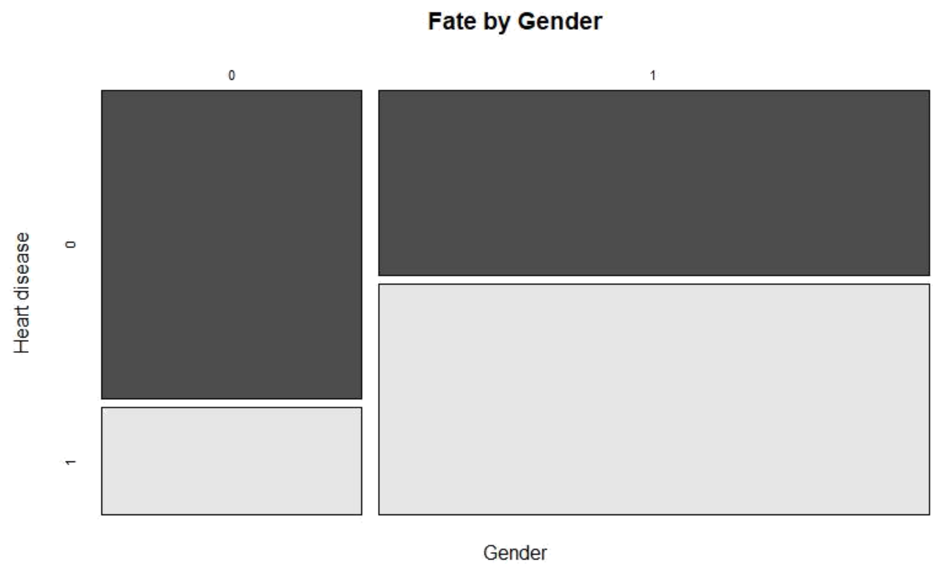
```
> names(hdata)[1] <- "age"

> names(hdata)[2] <- "sex"

> names(hdata)[3] <- "cp"

> names(hdata)[4] <- "trestbps"

> names(hdata)[5] <- "chol"

> names(hdata)[6] <- "fbs"

> names(hdata)[7] <- "restecg"

> names(hdata)[8] <- "thalach"

> names(hdata)[9] <- "exang"

> names(hdata)[10] <- "oldpeak"

> names(hdata)[11] <- "slope"

> names(hdata)[12] <- "ca"

> names(hdata)[13] <- "thal"

> names(hdata)[14] <- "num"

> hdata$ca
  [1] 3.0 2.0 0.0 0.0 0.0 2.0 0.0 1.0 0.0 0.0 0.0 1.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
      0.0 0.0 2.0 2.0 0.0 0.0 0.0 0.0 0.0
 [30] 2.0 2.0 0.0 0.0 0.0 0.0 0.0 1.0 1.0 0.0 3.0 0.0 2.0 0.0 0.0 1.0 0.0 0.0 1.0 0.0
      1.0 0.0 1.0 0.0 1.0 1.0 1.0 0.0 1.0
 [59] 1.0 0.0 0.0 3.0 0.0 1.0 2.0 0.0 0.0 0.0 0.0 0.0 2.0 2.0 2.0 1.0 0.0 1.0 1.0 0.0
      0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
 [88] 0.0 0.0 0.0 3.0 3.0 0.0 0.0 1.0 1.0 2.0 1.0 0.0 0.0 0.0 1.0 1.0 3.0 0.0 1.0 1.0
      1.0 0.0 0.0 1.0 0.0 0.0 1.0 0.0 0.0
[117] 0.0 3.0 1.0 2.0 3.0 0.0 0.0 1.0 0.0 2.0 1.0 0.0 0.0 0.0 1.0 0.0 0.0 0.0 0.0 0.0
      1.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
[146] 3.0 0.0 0.0 1.0 0.0 0.0 0.0 1.0 1.0 3.0 0.0 2.0 2.0 1.0 0.0 3.0 0.0 0.0 2.0 0.0
      1.0 1.0 0.0 0.0 1.0 0.0 0.0 0.0 2.0
[175] 1.0 3.0 1.0 1.0 3.0 0.0 2.0 2.0 0.0 0.0 2.0 0.0 3.0 1.0 3.0 0.0 3.0 2.0 3.0 0.0
      2.0 1.0 0.0 0.0 0.0 0.0 0.0 1.0 0.0
[204] 0.0 3.0 2.0 0.0 0.0 0.0 0.0 0.0 0.0 2.0 1.0 0.0 0.0 0.0 2.0 0.0 0.0 0.0 0.0 2.0
      2.0 0.0 0.0 1.0 1.0 1.0 0.0 0.0 3.0
[233] 1.0 1.0 2.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 2.0 0.0 0.0 1.0 1.0 2.0 0.0 0.0 1.0 1.0
      0.0 0.0 0.0 2.0 0.0 0.0 0.0 1.0 2.0
[262] 0.0 0.0 1.0 0.0 0.0 1.0 0.0 0.0 1.0 0.0 2.0 0.0 2.0 0.0 1.0 0.0 1.0 0.0 1.0 0.0
      1.0 0.0 1.0 3.0 2.0 ?   0.0 0.0 0.0
[291] 0.0 0.0 2.0 0.0 0.0 2.0 0.0 0.0 2.0 1.0 1.0

? Levels: ? 0.0 1.0 2.0 3.0

> levels(hdata$ca)[levels(hdata$ca) == "?"]<-"0.0"

> hdata
   age sex cp trestbps chol fbs restecg thalach exang oldpeak slope  ca thal num
1    67   1  4      160  286   0       2     108     1     1.5     2 3.0  3.0   2
2    67   1  4      120  229   0       2     129     1     2.6     2 2.0  7.0   1
3    37   1  3      130  250   0       0     187     0     3.5     3 0.0  3.0   0
4    41   0  2      130  204   0       2     172     0     1.4     1 0.0  3.0   0
5    56   1  2      120  236   0       0     178     0     0.8     1 0.0  3.0   0
6    62   0  4      140  268   0       2     160     0     3.6     3 2.0  3.0   3
7    57   0  4      120  354   0       0     163     1     0.6     1 0.0  3.0   0
```

8	63	1	4	130	254	0	2	147	0	1.4	2	1.0	7.0	2
9	53	1	4	140	203	1	2	155	1	3.1	3	0.0	7.0	1
10	57	1	4	140	192	0	0	148	0	0.4	2	0.0	6.0	0
11	56	0	2	140	294	0	2	153	0	1.3	2	0.0	3.0	0
12	56	1	3	130	256	1	2	142	1	0.6	2	1.0	6.0	2
13	44	1	2	120	263	0	0	173	0	0.0	1	0.0	7.0	0
14	52	1	3	172	199	1	0	162	0	0.5	1	0.0	7.0	0
15	57	1	3	150	168	0	0	174	0	1.6	1	0.0	3.0	0
16	48	1	2	110	229	0	0	168	0	1.0	3	0.0	7.0	1
17	54	1	4	140	239	0	0	160	0	1.2	1	0.0	3.0	0
18	48	0	3	130	275	0	0	139	0	0.2	1	0.0	3.0	0
19	49	1	2	130	266	0	0	171	0	0.6	1	0.0	3.0	0
20	64	1	1	110	211	0	2	144	1	1.8	2	0.0	3.0	0
21	58	0	1	150	283	1	2	162	0	1.0	1	0.0	3.0	0
22	58	1	2	120	284	0	2	160	0	1.8	2	0.0	3.0	1
23	58	1	3	132	224	0	2	173	0	3.2	1	2.0	7.0	3
24	60	1	4	130	206	0	2	132	1	2.4	2	2.0	7.0	4
25	50	0	3	120	219	0	0	158	0	1.6	2	0.0	3.0	0
26	58	0	3	120	340	0	0	172	0	0.0	1	0.0	3.0	0
27	66	0	1	150	226	0	0	114	0	2.6	3	0.0	3.0	0
28	43	1	4	150	247	0	0	171	0	1.5	1	0.0	3.0	0
29	40	1	4	110	167	0	2	114	1	2.0	2	0.0	7.0	3
30	69	0	1	140	239	0	0	151	0	1.8	1	2.0	3.0	0
31	60	1	4	117	230	1	0	160	1	1.4	1	2.0	7.0	2
32	64	1	3	140	335	0	0	158	0	0.0	1	0.0	3.0	1
33	59	1	4	135	234	0	0	161	0	0.5	2	0.0	7.0	0
34	44	1	3	130	233	0	0	179	1	0.4	1	0.0	3.0	0
35	42	1	4	140	226	0	0	178	0	0.0	1	0.0	3.0	0
36	43	1	4	120	177	0	2	120	1	2.5	2	0.0	7.0	3
37	57	1	4	150	276	0	2	112	1	0.6	2	1.0	6.0	1
38	55	1	4	132	353	0	0	132	1	1.2	2	1.0	7.0	3
39	61	1	3	150	243	1	0	137	1	1.0	2	0.0	3.0	0
40	65	0	4	150	225	0	2	114	0	1.0	2	3.0	7.0	4
41	40	1	1	140	199	0	0	178	1	1.4	1	0.0	7.0	0
42	71	0	2	160	302	0	0	162	0	0.4	1	2.0	3.0	0
43	59	1	3	150	212	1	0	157	0	1.6	1	0.0	3.0	0
44	61	0	4	130	330	0	2	169	0	0.0	1	0.0	3.0	1
45	58	1	3	112	230	0	2	165	0	2.5	2	1.0	7.0	4
46	51	1	3	110	175	0	0	123	0	0.6	1	0.0	3.0	0
47	50	1	4	150	243	0	2	128	0	2.6	2	0.0	7.0	4
48	65	0	3	140	417	1	2	157	0	0.8	1	1.0	3.0	0
49	53	1	3	130	197	1	2	152	0	1.2	3	0.0	3.0	0
50	41	0	2	105	198	0	0	168	0	0.0	1	1.0	3.0	0
51	65	1	4	120	177	0	0	140	0	0.4	1	0.0	7.0	0
52	44	1	4	112	290	0	2	153	0	0.0	1	1.0	3.0	2
53	44	1	2	130	219	0	2	188	0	0.0	1	0.0	3.0	0
54	60	1	4	130	253	0	0	144	1	1.4	1	1.0	7.0	1
55	54	1	4	124	266	0	2	109	1	2.2	2	1.0	7.0	1
56	50	1	3	140	233	0	0	163	0	0.6	2	1.0	7.0	1
57	41	1	4	110	172	0	2	158	0	0.0	1	0.0	7.0	1
58	54	1	3	125	273	0	2	152	0	0.5	3	1.0	3.0	0
59	51	1	1	125	213	0	2	125	1	1.4	1	1.0	3.0	0
60	51	0	4	130	305	0	0	142	1	1.2	2	0.0	7.0	2
61	46	0	3	142	177	0	2	160	1	1.4	3	0.0	3.0	0
62	58	1	4	128	216	0	2	131	1	2.2	2	3.0	7.0	1
63	54	0	3	135	304	1	0	170	0	0.0	1	0.0	3.0	0
64	54	1	4	120	188	0	0	113	0	1.4	2	1.0	7.0	2
65	60	1	4	145	282	0	2	142	1	2.8	2	2.0	7.0	2
66	60	1	3	140	185	0	2	155	0	3.0	2	0.0	3.0	1
67	54	1	3	150	232	0	2	165	0	1.6	1	0.0	7.0	0
68	59	1	4	170	326	0	2	140	1	3.4	3	0.0	7.0	2
69	46	1	3	150	231	0	0	147	0	3.6	2	0.0	3.0	1
70	65	0	3	155	269	0	0	148	0	0.8	1	0.0	3.0	0
71	67	1	4	125	254	1	0	163	0	0.2	2	2.0	7.0	3

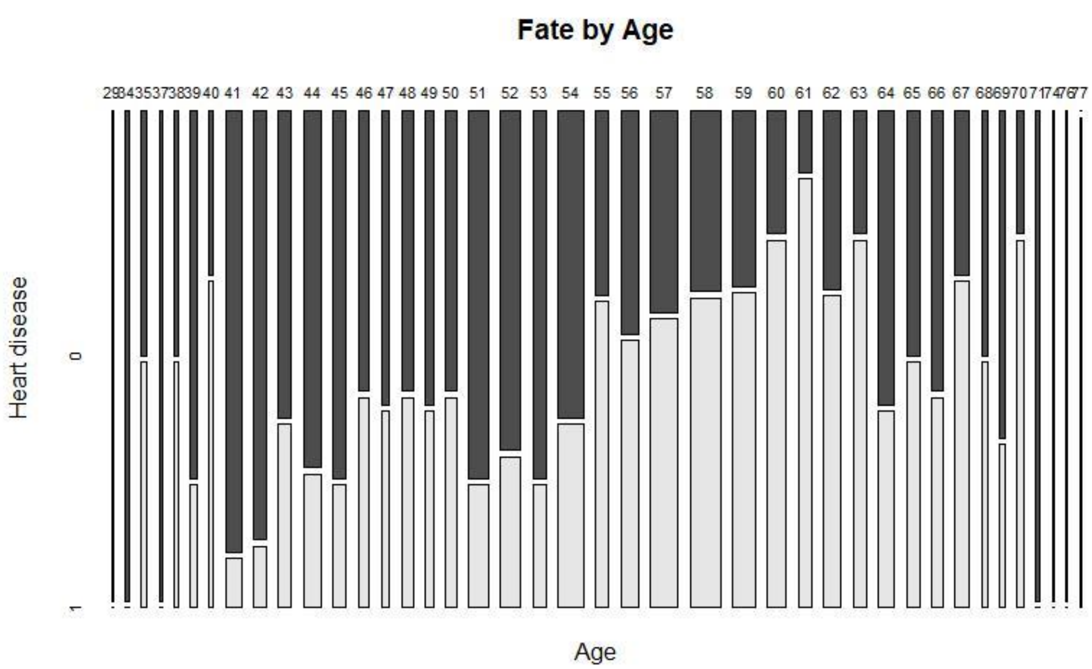
```
 [ reached 'max' / getOption("max.print") -- omitted 231 rows ]

> hdata$ca[hdata$ca ==
1.0] factor(0)
Levels: 0.0 1.0 2.0 3.0

> typeof(hdata$ca)
[1] "integer"

> nrow(hdata)
[1] 302

> # Plotting Fate vs number of records

> hdata$num[hdata$num >= 1] <- 1 # Edit the fate to 0 and 1

> barplot(table(hdata$num), main="Fate", col="black")
```




```
> # Plot Fate vs gender

> mosaicplot(hdata$sex ~ hdata$num,main="Fate by Gender",
+            shade=FALSE,color=TRUE,xlab="Gender", ylab="Heart disease")
```




```
> # Plot Fate vs Age

> mosaicplot(hdata$age ~ hdata$num,main="Fate by Age",
+              shade=FALSE,color=TRUE,xlab="Age", ylab="Heart disease")
```




```
> # Most important step, change the values of NA

> levels(hdata$thal)[levels(hdata$thal)=="?"]<-"3.0"

> # removal of additional NA
```

```
> hdata$thal

  [1] 3.0 7.0 3.0 3.0 3.0 3.0 3.0 7.0 7.0 6.0 3.0 6.0 7.0 7.0 3.0 7.0 3.0 3.0 3.0 3.0
      3.0 3.0 7.0 7.0 3.0 3.0 3.0 3.0 7.0
 [30] 3.0 7.0 3.0 7.0 3.0 3.0 7.0 6.0 7.0 3.0 7.0 7.0 3.0 3.0 3.0 7.0 3.0 7.0 3.0 3.0
      3.0 7.0 3.0 3.0 7.0 7.0 7.0 7.0 3.0
 [59] 3.0 7.0 3.0 7.0 3.0 7.0 7.0 3.0 7.0 7.0 3.0 3.0 7.0 7.0 6.0 3.0 3.0 7.0 3.0 3.0
      7.0 3.0 3.0 3.0 7.0 3.0 3.0 3.0 3.0
 [88] 3.0 3.0 3.0 7.0 7.0 3.0 3.0 7.0 7.0 7.0 3.0 3.0 3.0 3.0 3.0 3.0 7.0 7.0 7.0 7.0
      7.0 7.0 7.0 3.0 6.0 7.0 7.0 6.0 3.0
[117] 3.0 7.0 7.0 7.0 7.0 3.0 7.0 3.0 3.0 7.0 7.0 3.0 3.0 7.0 7.0 3.0 3.0 3.0 3.0 7.0
      7.0 7.0 3.0 3.0 7.0 3.0 7.0 7.0 3.0
[146] 7.0 3.0 3.0 3.0 7.0 3.0 7.0 7.0 3.0 3.0 7.0 7.0 7.0 7.0 7.0 3.0 3.0 3.0 3.0 7.0
      3.0 3.0 7.0 3.0 7.0 7.0 3.0 3.0 6.0
[175] 7.0 7.0 6.0 3.0 3.0 7.0 7.0 3.0 7.0 3.0 3.0 7.0 6.0 7.0 7.0 3.0 7.0 7.0 3.0 3.0
      3.0 3.0 3.0 3.0 3.0 3.0 3.0 7.0 7.0
[204] 7.0 7.0 7.0 7.0 3.0 3.0 3.0 7.0 3.0 7.0 3.0 7.0 3.0 3.0 3.0 3.0 3.0 3.0 3.0 7.0
      3.0 3.0 3.0 3.0 3.0 3.0 3.0 3.0 3.0
[233] 3.0 3.0 3.0 7.0 7.0 3.0 3.0 3.0 3.0 3.0 3.0 3.0 3.0 7.0 3.0 7.0 3.0 6.0 7.0 7.0
      3.0 3.0 3.0 3.0 3.0 3.0 7.0 3.0 3.0
[262] 3.0 3.0 3.0 6.0 3.0 6.0 7.0 3.0 7.0 6.0 7.0 3.0 3.0 7.0 3.0 3.0 3.0 3.0 7.0 3.0
      7.0 3.0 7.0 6.0 6.0 7.0 7.0 3.0 7.0
[291] 3.0 6.0 7.0 3.0 3.0 6.0 7.0 7.0 7.0 7.0 3.0

3.0 Levels: 3.0 6.0 7.0

> table(hdata$thal)

3.0 6.0 7.0
168  17 117

> table(hdata$ca)

0.0 1.0 2.0 3.0
179  65  38  20

> library(caTools) # import library
caTools Warning message:
package ‘caTools’ was built under R version 3.6.3

> n<- sapply(hdata[, c(1)], mean) # get the average values
> set.seed(123) # generate a pseudo-random number

> v3 <- hdata[c(11:14),c(2,7:9)]

> v3
   sex restecg thalach exang
 11   0       2     153    0
 12   1       2     142    1
 13   1       0     173    0
 14   1       0     162    0

> m<- sapply(v3,max)

> m
            sex restecg   exang
         thalach 12173       1

> set.seed(121)

> # Divide the dataset into 2/3 for training, and 1/3 for testing

> split = sample.split(hdata$num, SplitRatio = 2/3)
```

```
> train_hdata = subset(hdata, split == TRUE)

> test_hdata = subset(hdata, split == FALSE)

> # Apply linear regression for Fate vs age

> regressor=lm(formula = num~age, data=train_hdata)

> View(regressor)

> regressor

Call:
lm(formula = num ~ age, data = train_hdata)

Coefficients:
(Intercept)          age
   -0.33038      0.01453

> # Apply regression on test data
> hd_age_predict = predict(regressor, newdata=test_hdata)

> hd_age_predict
        2         4         7         8        10        18        19        20
  25        29        30        31
 0.6430055 0.2652722 0.4977234 0.5848927 0.4977234 0.3669696 0.3814978 0.5994209
 0.3960260 0.2507440 0.6720619 0.5413081
       33        34        42        43        45        47        52        59
 61        65        68        70
 0.5267799 0.3088568 0.7011183 0.5267799 0.5122517 0.3960260 0.3088568 0.4105542
 0.3379132 0.5413081 0.5267799 0.6139491
       73        75        78        79        83        84        85        86
      108       109       110       111
 0.6139491 0.6139491 0.3669696 0.5122517 0.6575337 0.4250824 0.3088568 0.3524414
 0.5558363 0.2362158 0.5558363 0.4831952
      115       118       122       129       134       136       137       139
      141       144       147       149
 0.2652722 0.5848927 0.4105542 0.5703645 0.2943286 0.6865901 0.5703645 0.4105542
 0.5267799 0.5122517 0.2652722 0.5413081
      155       156       158       168       169       173       175       176
      179       184       185       186
 0.6865901 0.4105542 0.5413081 0.1781030 0.3233850 0.5703645 0.4977234 0.4250824
 0.4396106 0.5413081 0.5848927 0.2798004
      187       192       194       197       201       204       206       207
      214       217       219       220
 0.6284773 0.2943286 0.6575337 0.3233850 0.5994209 0.2943286 0.5122517 0.3960260
 0.4250824 0.3379132 0.5267799 0.2652722
      225       226       229       230       232       236       237       240
      241       247       248       252
 0.1635748 0.3524414 0.6284773 0.4250824 0.3814978 0.4831952 0.3379132 0.2652722
 0.2652722 0.3524414 0.4250824 0.5994209
      255       258       262       265       267       273       276       282
      284       285       288       292
 0.2798004 0.6865901 0.5413081 0.2798004 0.5267799 0.7011183 0.6284773 0.4686670
 0.5558363 0.5122517 0.4831952 0.3088568
      293       296       301       302
 0.5848927 0.5267799 0.4977234 0.2216876
> # Round the values of fate in prediction
> round_age=hd_age_predict

> r=round(round_age)

> r
```

```
  2   4   7   8  10  18  19  20  25  29  30  31  33  34  42  43  45  47  52  59  61
65  68  70  73  75  78  79  83  84
  1   0   0   1   0   0   0   1   0   0   1   1   1   0   1   1   1   0   0   0   0
1   1   1   1   1   0   1   1   0
 85  86 108 109 110 111 115 118 122 129 134 136 137 139 141 144 147 149 155 156 158
168 169 173 175 176 179 184 185 186
  0   0   1   0   1   0   0   1   0   1   0   1   1   0   1   1   0   1   1   0   1
 0   0   1   0   0   0   1   1   0
 187 192 194 197 201 204 206 207 214 217 219 220 225 226 229 230 232 236 237 240 241
 247 248 252 255 258 262 265 267 273
  1   0   1   0   1   0   1   0   0   0   1   0   0   0   1   0   0   0   0   0   0
 0   0   1   0   1   1   0   1   1
 276 282 284 285 288 292 293 296 301 302
  1   0   1   1   0   0   1   1   0   0

> table(r,test_hdata$num)

r    0  1
  03420
  12026

> library(e1071)

> library(caret)

> typeof(r)
[1] "double"

> levels(r)
NULL

> levels(test_hdata$num)
NULL

> str(r)

 - attr(*, "names")= chr [1:100] "2" "4" "7" "8" ...

> r1 = as.data.frame(r)



> r1
    r
2   1
4   0
7   0
8   1
10  0
18  0
19  0
20  1
25  0
29  0
30  1
31  1
33  1
34  0
42  1
43  1
45  1
47  0
52  0
59  0
```

61	0
65	1
68	1
70	1
73	1
75	1
78	0
79	1
83	1
84	0
85	0
86	0
108	1
109	0
110	1
111	0
115	0
118	1
122	0
129	1
134	0
136	1
137	1
139	0
141	1
144	1
147	0
149	1
155	1
156	0
158	1
168	0
169	0
173	1
175	0
176	0
179	0
184	1
185	1
186	0
187	1
192	0
194	1
197	0
201	1
204	0
206	1
207	0
214	0
217	0
219	1
220	0
225	0
226	0
229	1
230	0
232	0
236	0
237	0
240	0
241	0
247	0
248	0
252	1

```
255 0
258 1
262 1
265 0
267 1
273 1
276 1
282 0
284 1
285 1
288 0
292 0
293 1
296 1
301 0
302 0
> df1=confusionMatrix(as.factor(r1$r),as.factor(test_hdata$num))
```

```
> df1
Confusion Matrix and Statistics

          Reference
Prediction  0  1
         0 34 20
         1 20 26

               Accuracy : 0.6
                 95% CI : (0.4972, 0.6967)
    No Information Rate : 0.54
    P-Value [Acc > NIR] : 0.1347

                  Kappa : 0.1948

 Mcnemar's Test P-Value : 1.0000

            Sensitivity : 0.6296
            Specificity : 0.5652
         Pos Pred Value : 0.6296
         Neg Pred Value : 0.5652
             Prevalence : 0.5400
         Detection Rate : 0.3400
   Detection Prevalence : 0.5400
      Balanced Accuracy : 0.5974

       'Positive' Class : 0
```

```
>> library(caTools)
> hdata[, c(1)] <- sapply(hdata[, c(1)], as.numeric)
> set.seed(123)
> split = sample.split(hdata$num, SplitRatio = 2/3)
> train_hdata = subset(hdata, split == TRUE)
> test_hdata = subset(hdata, split == FALSE)
> library(caTools)
> #regressor=lm(formula = num~age, data=train_hdata)
> #regressor=lm(formula =
num~age+sex+cp+trestbps+chol+fbs+restecg+thalach+exang+oldpeak+slope,data=tra
in_hdata)
```

```
> hd_age_predict=predict(regressor, newdata=test_hdata)
> hd_age_predict
        2         8         9        11        18        19        22
29        32
0.6407102 0.5828263 0.4381165 0.4815294 0.3657616 0.3802325 0.5104714
0.2499937 0.5972972
       38        41        47        48        52        54        56
59        60
0.4670584 0.2499937 0.3947035 0.6117682 0.3078776 0.5394133 0.3947035
0.4091745 0.4091745
       61        63        68        69        71        72        76
77        80
0.3368196 0.4525874 0.5249423 0.3368196 0.6407102 0.5683553 0.5394133
0.4091745 0.3223486
       82        89        90        94        99       102       111
115       118
0.2355227 0.4091745 0.6262392 0.5828263 0.3657616 0.4960004 0.4815294
0.2644647 0.5828263
      124       125       126       135       140       143       146
147       148
0.6117682 0.3223486 0.4815294 0.4670584 0.5249423 0.5972972 0.4960004
0.2644647 0.3223486
      150       151       152       153       154       156       158
164       165
0.4236455 0.2789357 0.6407102 0.4670584 0.5972972 0.4091745 0.5394133
0.3657616 0.4960004
      179       183       186       187       191       192       193
194       197
0.4381165 0.5249423 0.2789357 0.6262392 0.4091745 0.2934067 0.5683553
0.6551812 0.3223486
      200       201       202       213       215       219       220
221       222
0.3947035 0.5972972 0.4960004 0.6262392 0.4815294 0.5249423 0.2644647
0.4525874 0.2355227
      225       232       236       237       239       244       247
249       250
0.1631678 0.3802325 0.4815294 0.3368196 0.2789357 0.5394133 0.3512906
0.5683553 0.4960004
      254       255       259       261       266       273       279
281       282
0.2934067 0.2789357 0.4960004 0.5104714 0.4236455 0.6985941 0.5104714
0.3512906 0.4670584
      283       287       290       291       293       295       296
299       300
0.1776388 0.5104714 0.6407102 0.4670584 0.5828263 0.2644647 0.5249423
0.6551812 0.4960004
      301
0.4960004
> round_age=hd_age_predict
> rage=round(round_age)
> table(rage,test_hdata$num)

rage  0  1
   0 40 24
   1 14 22
> library(e1071)
> library(caret)
> str(rage)
 Named num [1:100] 1 1 0 0 0 0 1 0 1 0 ...
 - attr(*, "names")= chr [1:100] "2" "8" "9" "11" ...
> r1 = as.data.frame(rage)
> r1
    rage
2      1
```

8	1
9	0
11	0
18	0
19	0
22	1
29	0
32	1
38	0
41	0
47	0
48	1
52	0
54	1
56	0
59	0
60	0
61	0
63	0
68	1
69	0
71	1
72	1
76	1
77	0
80	0
82	0
89	0
90	1
94	1
99	0
102	0
111	0
115	0
118	1
124	1
125	0
126	0
135	0
140	1
143	1
146	0
147	0
148	0
150	0
151	0
152	1
153	0
154	1
156	0
158	1
164	0
165	0
179	0
183	1
186	0
187	1
191	0
192	0
193	1
194	1
197	0
200	0
201	1

```
202    0
213    1
215    0
219    1
220    0
221    0
222    0
225    0
232    0
236    0
237    0
239    0
244    1
247    0
249    1
250    0
254    0
255    0
259    0
261    1
266    0
273    1
279    1
281    0
282    0
283    0
287    1
290    1
291    0
293    1
295    0
296    1
299    1
300    0
301    0
> df=confusionMatrix(as.factor(r1$rage),as.factor(test_hdata$num))
> df
Confusion Matrix and Statistics

          Reference
Prediction  0  1
         0 40 24
         1 14 22

               Accuracy : 0.62
                 95% CI : (0.5175, 0.7152)
    No Information Rate : 0.54
    P-Value [Acc > NIR] : 0.06554

                  Kappa : 0.2226

 Mcnemar's Test P-Value : 0.14429

            Sensitivity : 0.7407
            Specificity : 0.4783
         Pos Pred Value : 0.6250
         Neg Pred Value : 0.6111
             Prevalence : 0.5400
         Detection Rate : 0.4000
   Detection Prevalence : 0.6400
      Balanced Accuracy : 0.6095

       'Positive' Class : 0
```