output:

 word_document: default

 html_document:

 df_print: paged

```{r}

#Variable Description

#age: age of client

#job : type of job

#marital : marital status

#education: highest educational achievement

#default: has credit in default?

#housing: has housing loan?

#loan: has personal loan?

#contact: contact communication type

#month: last contact month of year

#day_of_week: last contact day of the week

#duration: last contact duration, in seconds

#campaign: number of contacts performed during this campaign and for this client

#pdays: number of days that passed by after the client was last contacted from a previous campaign

(999 means client was not previously contacted)

#previous: number of contacts performed before this campaign and for this client

#poutcome: outcome of the previous marketing campaign

#emp.var.rate: employment variation rate - quarterly indicator

#cons.price.idx: consumer price index - monthly indicator

#cons.conf.idx: consumer confidence index - monthly indicator

#euribor3m: euribor 3 month rate - daily indicator

#nr.employed: number of employees - quarterly indicator

#y - has the client subscribed a term deposit?

## The data set can be obtained from http://archive.ics.uci.edu/ml/datasets/Bank+Marketing

## DATASET UNDERSTANDING

```r
library(readr)

bank_full <- read_delim("C:/Users/Seshan/Desktop/Bank/bank-full.csv",

";", escape_double = FALSE, trim_ws = TRUE)

#Lets look at dataset and generate initial understanding about the column types

str(bank_full)

#A deep check for NA in a particular column let say age

if(length(which(is.na(bank_full$age)==TRUE)>0)){

print("Missing Value found in the specified column")

} else

print("All okay: No Missing Value found in the specified column")

# Check another example say

if(length(which(is.na(bank_full$campaign)==TRUE)>0)){print("Missing Value found in the specified

column")} else

print("All okay: No Missing Value found in the specified column")

head(bank_full) ## Displays first 6 rows for each variable

str(bank_full) ## Describes each variables

summary(bank_full) ## Provides basic statistical information of each variable

## DATA EXPLORATION - Check for Missing Data

## Option 1

is.na(bank_full) ## Displays True for a missing value

## Since it is a large dataset, graphical display of missing values will prove to be easier

##Option 2

require(Amelia)

missmap(bank_full,main="Missing Data - Bank ", col=c("red","grey"),legend=FALSE)

## No red colour stripes are visible. hence no missing values.

summary(bank_full) ## displays missing values if any under every variable
```

#The Pearson's chi-squared test of independence is one of the most basic and common hypothesis tests

in the statistical analysis of categorical data. It is a significance test. Given two categorical random

variables, X and Y, the chi-squared test of independence determines whether or not there exists a

statistical dependence between them. Formally, it is a hypothesis test. The chi-squared test assumes a

null hypothesis and an alternate hypothesis. The general practice is, if the p-value that comes out in the

result is less than a pre-determined significance level, which is 0.05 usually, then we reject the null

hypothesis.

#H0: The The two variables are independent

#H1: The The two variables are dependent

#The null hypothesis of the chi-squared test is that the two variables are independent and the alternate

hypothesis is that they are related.

#To establish that two categorical variables (or predictors) are dependent, the chi-squared statistic must

have a certain cutoff. This cutoff increases as the number of classes within the variable (or predictor)

increases.

#i. Pearson's chi-squared test of independence (significance test)

Is there any association between Job and default?

with(bank_full, chisq.test(job, default))

with(bank_full, table(job, default))

OR

with(bank_full, prop.table(table(job,default)))

#Pearson's Chi-squared test

```
data:  job and default
X-squared = 60.343, df = 11, p-value = 8.008e-09

              default
job              no   yes
  admin.        5097    74
  blue-collar   9531   201
  entrepreneur  1432    55
  housemaid     1218    22
  management    9294   164
  retired       2238    26
  self-employed 1546    33
  services      4079    75
  student        935     3
  technician    7467   130
  unemployed    1273    30
  unknown        286     2
              default
job               no              yes
  admin.       1.127381e-01 1.636770e-03
  blue-collar  2.108115e-01 4.445821e-03
  entrepreneur 3.167371e-02 1.216518e-03
  housemaid    2.694035e-02 4.866072e-04
  management   2.055694e-01 3.627436e-03
  retired      4.950123e-02 5.750813e-04
  self-employed 3.419522e-02 7.299109e-04
  services     9.022141e-02 1.658888e-03
  student      2.068081e-02 6.635553e-05
  technician   1.651589e-01 2.875406e-03
```

p-value = 8.008e-09 #Pearson's Chi-squared test #since the p-value is < 2.2e-16 is less than the cu$t-off value of 0.05, we can reject the null hypothesis in

favor of alternative hypothesis and conclude, that the variables,(job & default- p-value = 8.008e-09) are

dependent to each other.

b. Is there any significant difference in duration of last call between

people having housing loan or not?

with(bank_additional_full, chisq.tes t(duration,housing))

with(bank_additional_full, table(duration,housing))

OR

with(bank_additional_full, prop.table(table(duration, housing)))

#data: duration and housing

#X-squared = 3162.3, df = 3086, p-value = 0.1657

#P value is above 0.05#

```
Chi-squared approximation may be incorrect
        Pearson's Chi-squared test

data:  duration and housing
X-squared = 3162.3, df = 3086, p-value = 0.1657

         housing
duration no unknown yes
       0   1       0   3
       1   2       0   1
       2   1       0   0
       3   2       0   1
       4   2       0  10
       5  16       0  14
       6  13       0  24
       7  22       1  31
       8  27       3  39
       9  33       2  42
      10  36       1  35
      11  34       2  45
      12  24       2  39
      13  44       0  33
      14  25       2  43
      15  34       1  33
      16  35       1  44
      17  34       1  41
      18  43       1  40
```

19	24	3	34
20	29	0	32
21	30	1	42
22	35	2	39
23	21	5	39
24	30	2	32
25	25	2	38
26	23	1	37
27	31	1	33
28	25	0	24
29	31	0	36
30	17	2	35
31	28	3	32
32	20	1	21
33	19	0	27
34	31	3	34
35	34	3	30
36	42	1	39
37	32	2	36
38	26	2	32
39	32	0	39
40	26	2	38
41	33	2	55
42	35	1	45
43	31	2	46
44	33	3	49
45	28	3	39
46	37	3	37
47	25	3	45
48	43	3	46
49	49	3	44
50	41	3	52
51	41	1	59
52	48	4	50
53	49	0	44
54	46	2	58
55	48	4	69
56	51	2	57
57	41	3	65
58	44	0	66
59	53	6	72
60	47	1	57
61	49	6	68
62	49	0	59
63	55	1	71
64	63	2	74
65	57	2	64
66	57	3	48
67	65	6	76

67	65	6	76
68	68	5	67
69	63	3	64
70	59	3	67
71	76	9	67
72	63	7	91
73	74	8	85
74	64	3	69
75	65	0	73

77	56	3	87
78	56	3	86
79	71	0	67
80	69	3	76
81	69	6	72
82	57	3	94
83	59	6	84
84	66	6	59
85	85	1	84
86	55	3	70
87	70	3	89
88	64	5	81
89	68	3	82
90	73	3	94
91	75	2	70
92	72	7	77
93	76	6	69
94	66	2	68
95	63	5	80
96	86	2	67
97	79	3	76
98	70	2	72
99	55	3	71
100	61	2	82
101	62	3	80
102	64	4	73
103	68	1	78
104	70	10	81
105	62	4	79
106	67	4	88
107	60	6	84
108	62	2	73
109	66	1	91
110	71	3	68
111	72	2	86
112	61	3	80
113	62	1	79
114	74	6	76
115	58	1	76
116	62	5	59
117	64	2	68
118	49	1	81
119	72	4	79
120	52	2	68
121	61	4	76
122	69	4	84
123	69	6	74
124	65	5	94
125	67	5	80
126	62	2	88
127	68	3	75

```
128    70         4    73
129    64         2    70
130    62         4    76
131    69         5    60
132    56         3    53
```

134	74	1	58
135	78	9	69
136	77	8	83
137	61	6	56
138	51	4	64
139	87	5	63
140	64	2	79
141	52	4	62
142	57	1	58
143	63	5	65
144	64	2	71
145	59	3	68
146	54	3	45
147	56	7	68
148	51	6	66
149	51	0	68
150	49	2	82
151	56	3	70
152	49	2	64
153	47	6	67
154	62	8	66
155	63	5	68
156	47	5	76
157	71	4	70
158	43	4	82
159	65	4	71
160	48	4	85
161	57	3	69
162	46	3	57
163	46	3	64
164	55	4	71
165	66	3	67
166	73	1	68
167	44	4	57
168	59	1	71
169	50	3	53
170	37	3	60
171	59	3	53
172	53	2	68
173	51	3	71
174	57	2	63
175	48	2	65
176	39	4	58
177	47	3	56
178	59	5	63
179	46	7	55
180	58	3	56
181	49	1	63
182	39	5	57
183	39	1	50
184	56	3	54
185	56	3	55
186	37	1	48
187	54	2	52
188	58	1	55
189	63	2	49

190	54	2	40
191	54	2	53
192	49	4	51
193	45	3	58
194	40	0	54
195	31	3	54
196	40	0	48
197	50	0	57
198	56	2	49
199	49	2	44
200	60	1	47
201	41	2	67
202	45	4	47
203	50	3	40
204	47	2	42
205	41	0	46
206	50	1	41
207	54	2	58
208	46	3	41
209	45	2	47
210	42	2	56
211	50	1	57
212	44	3	46
213	47	3	40
214	39	2	50
215	38	4	49
216	33	3	44
217	41	2	49
218	36	1	39
219	40	0	45
220	37	1	48
221	45	1	43
222	52	2	39
223	38	0	31
224	30	1	42
225	42	3	45
226	29	3	61
227	39	4	39
228	28	1	44
229	26	3	40
230	36	6	40
231	34	0	45
232	38	1	36
233	26	1	34
234	37	4	37
235	29	3	30
236	27	1	44
237	31	1	34
238	32	1	43
239	35	2	55
240	31	4	52
241	36	1	37
242	23	3	32
243	34	0	45
244	34	0	41
245	49	2	40
246	39	3	37

249	33	2	41
250	40	1	39
251	34	1	48
252	36	1	43
253	31	1	33
254	27	4	41
255	38	1	33
256	25	1	39
257	36	3	32
258	29	1	38
259	33	2	36
260	23	0	38
261	29	1	32
262	35	3	34
263	37	1	36
264	31	0	30
265	23	0	43
266	26	0	32
267	33	1	38
268	35	4	32
269	23	0	31
270	38	1	18
271	27	5	25
272	26	5	36
273	23	0	37
274	23	1	32
275	21	1	34
276	23	2	24
277	33	1	29
278	27	1	25
279	19	2	22
280	27	0	30
281	30	0	31
282	21	4	31
283	31	1	30
284	27	0	26
285	29	1	30
286	19	0	29
287	25	0	21
288	24	2	31
289	23	2	28
290	29	1	26
291	29	2	28
292	18	0	35
293	28	0	34
294	24	1	35
295	35	4	28
296	33	1	23
297	28	3	32
298	29	1	25
299	22	1	24
300	18	0	28
301	35	2	25
302	20	1	25
303	16	0	23

```
304 25    0  29
305 26    1  35
306 23    0  35
307 18    0  19
308 16    4  21
309 16    1  27
310 10    0  23
311 24    5  16
312 25    1  23
313 20    3  27
314 27    1  27
315 18    2  19
316 23    2  20
317 21    3  33
318 18    1  37
319 28    2  16
320 16    1  30
321 14    0  21
322 31    1  25
323 20    1  27
324 20    0  33
325 17    0  25
326 19    0  31
327 24    1  16
328 19    1  29
329 25    1  34
330 10    0  18
331 18    1  16
332 27    2  24
 [ reached getOption("max.print") -- omitted 1211 rows
       housing
duration           no      unknown          yes
       0  2.427892e-05 0.000000e+00 7.283675e-05
       1  4.855783e-05 0.000000e+00 2.427892e-05
       2  2.427892e-05 0.000000e+00 0.000000e+00
       3  4.855783e-05 0.000000e+00 2.427892e-05
       4  4.855783e-05 0.000000e+00 2.427892e-04
       5  3.884627e-04 0.000000e+00 3.399048e-04
       6  3.156259e-04 0.000000e+00 5.826940e-04
       7  5.341362e-04 2.427892e-05 7.526464e-04
       8  6.555307e-04 7.283675e-05 9.468777e-04
       9  8.012042e-04 4.855783e-05 1.019714e-03
      10  8.740410e-04 2.427892e-05 8.497621e-04
      11  8.254832e-04 4.855783e-05 1.092551e-03
      12  5.826940e-04 4.855783e-05 9.468777e-04
      13  1.068272e-03 0.000000e+00 8.012042e-04
      14  6.069729e-04 4.855783e-05 1.043993e-03
      15  8.254832e-04 2.427892e-05 8.012042e-04
      16  8.497621e-04 2.427892e-05 1.068272e-03
      17  8.254832e-04 2.427892e-05 9.954356e-04
      18  1.043993e-03 2.427892e-05 9.711566e-04
      19  5.826940e-04 7.283675e-05 8.254832e-04
      20  7.040886e-04 0.000000e+00 7.769253e-04
      21  7.283675e-04 2.427892e-05 1.019714e-03
      22  8.497621e-04 4.855783e-05 9.468777e-04
      23  5.098572e-04 1.213946e-04 9.468777e-04
      24  7.283675e-04 4.855783e-05 7.769253e-04
```

25	6.069729e-04	4.855783e-05	9.225988e-04
26	5.584151e-04	2.427892e-05	8.983199e-04
27	7.526464e-04	2.427892e-05	8.012042e-04
28	6.069729e-04	0.000000e+00	5.826940e-04
29	7.526464e-04	0.000000e+00	8.740410e-04
30	4.127416e-04	4.855783e-05	8.497621e-04
31	6.798097e-04	7.283675e-05	7.769253e-04
32	4.855783e-04	2.427892e-05	5.098572e-04
33	4.612994e-04	0.000000e+00	6.555307e-04
34	7.526464e-04	7.283675e-05	8.254832e-04
35	8.254832e-04	7.283675e-05	7.283675e-04
36	1.019714e-03	2.427892e-05	9.468777e-04
37	7.769253e-04	4.855783e-05	8.740410e-04
38	6.312518e-04	4.855783e-05	7.769253e-04
39	7.769253e-04	0.000000e+00	9.468777e-04
40	6.312518e-04	4.855783e-05	9.225988e-04
41	8.012042e-04	4.855783e-05	1.335340e-03
42	8.497621e-04	2.427892e-05	1.092551e-03
43	7.526464e-04	4.855783e-05	1.116830e-03
44	8.012042e-04	7.283675e-05	1.189667e-03
45	6.798097e-04	7.283675e-05	9.468777e-04
46	8.983199e-04	7.283675e-05	8.983199e-04
47	6.069729e-04	7.283675e-05	1.092551e-03
48	1.043993e-03	7.283675e-05	1.116830e-03
49	1.189667e-03	7.283675e-05	1.068272e-03
50	9.954356e-04	7.283675e-05	1.262504e-03
51	9.954356e-04	2.427892e-05	1.432456e-03
52	1.165388e-03	9.711566e-05	1.213946e-03
53	1.189667e-03	0.000000e+00	1.068272e-03
54	1.116830e-03	4.855783e-05	1.408177e-03
55	1.165388e-03	9.711566e-05	1.675245e-03
56	1.238225e-03	4.855783e-05	1.383898e-03
57	9.954356e-04	7.283675e-05	1.578130e-03
58	1.068272e-03	0.000000e+00	1.602408e-03
59	1.286783e-03	1.456735e-04	1.748082e-03
60	1.141109e-03	2.427892e-05	1.383898e-03
61	1.189667e-03	1.456735e-04	1.650966e-03
62	1.189667e-03	0.000000e+00	1.432456e-03
63	1.335340e-03	2.427892e-05	1.723803e-03
64	1.529572e-03	4.855783e-05	1.796640e-03
65	1.383898e-03	4.855783e-05	1.553851e-03
66	1.383898e-03	7.283675e-05	1.165388e-03
67	1.578130e-03	1.456735e-04	1.845198e-03
68	1.650966e-03	1.213946e-04	1.626687e-03
69	1.529572e-03	7.283675e-05	1.553851e-03
70	1.432456e-03	7.283675e-05	1.626687e-03
71	1.845198e-03	2.185102e-04	1.626687e-03
72	1.529572e-03	1.699524e-04	2.209381e-03
73	1.796640e-03	1.942313e-04	2.063708e-03
74	1.553851e-03	7.283675e-05	1.675245e-03
75	1.578130e-03	0.000000e+00	1.772361e-03
76	1.626687e-03	0.000000e+00	2.087987e-03
77	1.359619e-03	7.283675e-05	2.112266e-03
78	1.359619e-03	7.283675e-05	2.087987e-03
79	1.723803e-03	0.000000e+00	1.626687e-03
80	1.675245e-03	7.283675e-05	1.845198e-03
81	1.675245e-03	1.456735e-04	1.748082e-03

```
83   1.432456e-03 1.456735e-04 2.039429e-03
84   1.602408e-03 1.456735e-04 1.432456e-03
85   2.063708e-03 2.427892e-05 2.039429e-03
86   1.335340e-03 7.283675e-05 1.699524e-03
87   1.699524e-03 7.283675e-05 2.160824e-03
88   1.553851e-03 1.213946e-04 1.966592e-03
89   1.650966e-03 7.283675e-05 1.990871e-03
90   1.772361e-03 7.283675e-05 2.282218e-03
91   1.820919e-03 4.855783e-05 1.699524e-03
92   1.748082e-03 1.699524e-04 1.869477e-03
93   1.845198e-03 1.456735e-04 1.675245e-03
94   1.602408e-03 4.855783e-05 1.650966e-03
95   1.529572e-03 1.213946e-04 1.942313e-03
96   2.087987e-03 4.855783e-05 1.626687e-03
97   1.918034e-03 7.283675e-05 1.845198e-03
98   1.699524e-03 4.855783e-05 1.748082e-03
99   1.335340e-03 7.283675e-05 1.723803e-03
100  1.481014e-03 4.855783e-05 1.990871e-03
101  1.505293e-03 7.283675e-05 1.942313e-03
102  1.553851e-03 9.711566e-05 1.772361e-03
103  1.650966e-03 2.427892e-05 1.893755e-03
104  1.699524e-03 2.427892e-04 1.966592e-03
105  1.505293e-03 9.711566e-05 1.918034e-03
106  1.626687e-03 9.711566e-05 2.136545e-03
107  1.456735e-03 1.456735e-04 2.039429e-03
108  1.505293e-03 4.855783e-05 1.772361e-03
109  1.602408e-03 2.427892e-05 2.209381e-03
110  1.723803e-03 7.283675e-05 1.650966e-03
111  1.748082e-03 4.855783e-05 2.087987e-03
112  1.481014e-03 7.283675e-05 1.942313e-03
113  1.505293e-03 2.427892e-05 1.918034e-03
114  1.796640e-03 1.456735e-04 1.845198e-03
115  1.408177e-03 2.427892e-05 1.845198e-03
116  1.505293e-03 1.213946e-04 1.432456e-03
117  1.553851e-03 4.855783e-05 1.650966e-03
118  1.189667e-03 2.427892e-05 1.966592e-03
119  1.748082e-03 9.711566e-05 1.918034e-03
120  1.262504e-03 4.855783e-05 1.650966e-03
121  1.481014e-03 9.711566e-05 1.845198e-03
122  1.675245e-03 9.711566e-05 2.039429e-03
123  1.675245e-03 1.456735e-04 1.796640e-03
124  1.578130e-03 1.213946e-04 2.282218e-03
125  1.626687e-03 1.213946e-04 1.942313e-03
126  1.505293e-03 4.855783e-05 2.136545e-03
127  1.650966e-03 7.283675e-05 1.820919e-03
128  1.699524e-03 9.711566e-05 1.772361e-03
129  1.553851e-03 4.855783e-05 1.699524e-03
130  1.505293e-03 9.711566e-05 1.845198e-03
131  1.675245e-03 1.213946e-04 1.456735e-03
132  1.359619e-03 7.283675e-05 1.286783e-03
133  1.383898e-03 9.711566e-05 1.990871e-03
134  1.796640e-03 2.427892e-05 1.408177e-03
135  1.893755e-03 2.185102e-04 1.675245e-03
136  1.869477e-03 1.942313e-04 2.015150e-03
137  1.481014e-03 1.456735e-04 1.359619e-03
138  1.238225e-03 9.711566e-05 1.553851e-03
```

```
139  2.112266e-03  1.213946e-04  1.529572e-03
140  1.553851e-03  4.855783e-05  1.918034e-03
141  1.262504e-03  9.711566e-05  1.505293e-03
142  1.383898e-03  2.427892e-05  1.408177e-03
143  1.529572e-03  1.213946e-04  1.578130e-03
144  1.553851e-03  4.855783e-05  1.723803e-03
145  1.432456e-03  7.283675e-05  1.650966e-03
146  1.311061e-03  7.283675e-05  1.092551e-03
147  1.359619e-03  1.699524e-04  1.650966e-03
148  1.238225e-03  1.456735e-04  1.602408e-03
149  1.238225e-03  0.000000e+00  1.650966e-03
150  1.189667e-03  4.855783e-05  1.990871e-03
151  1.359619e-03  7.283675e-05  1.699524e-03
152  1.189667e-03  4.855783e-05  1.553851e-03
153  1.141109e-03  1.456735e-04  1.626687e-03
154  1.505293e-03  1.942313e-04  1.602408e-03
155  1.529572e-03  1.213946e-04  1.650966e-03
156  1.141109e-03  1.213946e-04  1.845198e-03
157  1.723803e-03  9.711566e-05  1.699524e-03
158  1.043993e-03  9.711566e-05  1.990871e-03
159  1.578130e-03  9.711566e-05  1.723803e-03
160  1.165388e-03  9.711566e-05  2.063708e-03
161  1.383898e-03  7.283675e-05  1.675245e-03
162  1.116830e-03  7.283675e-05  1.383898e-03
163  1.116830e-03  7.283675e-05  1.553851e-03
164  1.335340e-03  9.711566e-05  1.723803e-03
165  1.602408e-03  7.283675e-05  1.626687e-03
166  1.772361e-03  2.427892e-05  1.650966e-03
167  1.068272e-03  9.711566e-05  1.383898e-03
168  1.432456e-03  2.427892e-05  1.723803e-03
169  1.213946e-03  7.283675e-05  1.286783e-03
170  8.983199e-04  7.283675e-05  1.456735e-03
171  1.432456e-03  7.283675e-05  1.286783e-03
172  1.286783e-03  4.855783e-05  1.650966e-03
173  1.238225e-03  7.283675e-05  1.723803e-03
174  1.383898e-03  4.855783e-05  1.529572e-03
175  1.165388e-03  4.855783e-05  1.578130e-03
176  9.468777e-04  9.711566e-05  1.408177e-03
177  1.141109e-03  7.283675e-05  1.359619e-03
178  1.432456e-03  1.213946e-04  1.529572e-03
179  1.116830e-03  1.699524e-04  1.335340e-03
180  1.408177e-03  7.283675e-05  1.359619e-03
181  1.189667e-03  2.427892e-05  1.529572e-03
182  9.468777e-04  1.213946e-04  1.383898e-03
183  9.468777e-04  2.427892e-05  1.213946e-03
184  1.359619e-03  7.283675e-05  1.311061e-03
185  1.359619e-03  7.283675e-05  1.335340e-03
186  8.983199e-04  2.427892e-05  1.165388e-03
187  1.311061e-03  4.855783e-05  1.262504e-03
188  1.408177e-03  2.427892e-05  1.335340e-03
189  1.529572e-03  4.855783e-05  1.189667e-03
190  1.311061e-03  4.855783e-05  9.711566e-04
191  1.311061e-03  4.855783e-05  1.286783e-03
192  1.189667e-03  9.711566e-05  1.238225e-03
193  1.092551e-03  7.283675e-05  1.408177e-03
194  9.711566e-04  0.000000e+00  1.311061e-03
```

```
198    1.359619e-03 4.855783e-05 1.189667e-03
199    1.189667e-03 4.855783e-05 1.068272e-03
200    1.456735e-03 2.427892e-05 1.141109e-03
201    9.954356e-04 4.855783e-05 1.626687e-03
202    1.092551e-03 9.711566e-05 1.141109e-03
203    1.213946e-03 7.283675e-05 9.711566e-04
204    1.141109e-03 4.855783e-05 1.019714e-03
205    9.954356e-04 0.000000e+00 1.116830e-03
206    1.213946e-03 2.427892e-05 9.954356e-04
207    1.311061e-03 4.855783e-05 1.408177e-03
208    1.116830e-03 7.283675e-05 9.954356e-04
209    1.092551e-03 4.855783e-05 1.141109e-03
210    1.019714e-03 4.855783e-05 1.359619e-03
211    1.213946e-03 2.427892e-05 1.383898e-03
212    1.068272e-03 7.283675e-05 1.116830e-03
213    1.141109e-03 7.283675e-05 9.711566e-04
214    9.468777e-04 4.855783e-05 1.213946e-03
215    9.225988e-04 9.711566e-05 1.189667e-03
216    8.012042e-04 7.283675e-05 1.068272e-03
217    9.954356e-04 4.855783e-05 1.189667e-03
218    8.740410e-04 2.427892e-05 9.468777e-04
219    9.711566e-04 0.000000e+00 1.092551e-03
220    8.983199e-04 2.427892e-05 1.165388e-03
221    1.092551e-03 2.427892e-05 1.043993e-03
222    1.262504e-03 4.855783e-05 9.468777e-04
223    9.225988e-04 0.000000e+00 7.526464e-04
224    7.283675e-04 2.427892e-05 1.019714e-03
225    1.019714e-03 7.283675e-05 1.092551e-03
226    7.040886e-04 7.283675e-05 1.481014e-03
227    9.468777e-04 9.711566e-05 9.468777e-04
228    6.798097e-04 2.427892e-05 1.068272e-03
229    6.312518e-04 7.283675e-05 9.711566e-04
230    8.740410e-04 1.456735e-04 9.711566e-04
231    8.254832e-04 0.000000e+00 1.092551e-03
232    9.225988e-04 2.427892e-05 8.740410e-04
233    6.312518e-04 2.427892e-05 8.254832e-04
234    8.983199e-04 9.711566e-05 8.983199e-04
235    7.040886e-04 7.283675e-05 7.283675e-04
236    6.555307e-04 2.427892e-05 1.068272e-03
237    7.526464e-04 2.427892e-05 8.254832e-04
238    7.769253e-04 2.427892e-05 1.043993e-03
239    8.497621e-04 4.855783e-05 1.335340e-03
240    7.526464e-04 9.711566e-05 1.262504e-03
241    8.740410e-04 2.427892e-05 8.983199e-04
242    5.584151e-04 7.283675e-05 7.769253e-04
243    8.254832e-04 0.000000e+00 1.092551e-03
244    8.254832e-04 0.000000e+00 9.954356e-04
245    1.189667e-03 4.855783e-05 9.711566e-04
246    9.468777e-04 7.283675e-05 8.983199e-04
247    7.526464e-04 4.855783e-05 1.262504e-03
248    5.826940e-04 7.283675e-05 1.043993e-03
249    8.012042e-04 4.855783e-05 9.954356e-04
250    9.711566e-04 2.427892e-05 9.468777e-04
251    8.254832e-04 2.427892e-05 1.165388e-03
252    8.740410e-04 2.427892e-05 1.043993e-03
```

```
253  7.526464e-04 2.427892e-05 6.012042e-04
254  6.555307e-04 9.711566e-05 9.954356e-04
255  9.225988e-04 2.427892e-05 8.012042e-04
256  6.069729e-04 2.427892e-05 9.468777e-04
257  8.740410e-04 7.283675e-05 7.769253e-04
258  7.040886e-04 2.427892e-05 9.225988e-04
259  8.012042e-04 4.855783e-05 8.740410e-04
260  5.584151e-04 0.000000e+00 9.225988e-04
261  7.040886e-04 2.427892e-05 7.769253e-04
262  8.497621e-04 7.283675e-05 8.254832e-04
263  8.983199e-04 2.427892e-05 8.740410e-04
264  7.526464e-04 0.000000e+00 7.283675e-04
265  5.584151e-04 0.000000e+00 1.043993e-03
266  6.312518e-04 0.000000e+00 7.769253e-04
267  8.012042e-04 2.427892e-05 9.225988e-04
268  8.497621e-04 9.711566e-05 7.769253e-04
269  5.584151e-04 0.000000e+00 7.526464e-04
270  9.225988e-04 2.427892e-05 4.370205e-04
271  6.555307e-04 1.213946e-04 6.069729e-04
272  6.312518e-04 1.213946e-04 8.740410e-04
273  5.584151e-04 0.000000e+00 8.983199e-04
274  5.584151e-04 2.427892e-05 7.769253e-04
275  5.098572e-04 2.427892e-05 8.254832e-04
276  5.584151e-04 4.855783e-05 5.826940e-04
277  8.012042e-04 2.427892e-05 7.040886e-04
278  6.555307e-04 2.427892e-05 6.069729e-04
279  4.612994e-04 4.855783e-05 5.341362e-04
280  6.555307e-04 0.000000e+00 7.283675e-04
281  7.283675e-04 0.000000e+00 7.526464e-04
282  5.098572e-04 9.711566e-05 7.526464e-04
283  7.526464e-04 2.427892e-05 7.283675e-04
284  6.555307e-04 0.000000e+00 6.312518e-04
285  7.040886e-04 2.427892e-05 7.283675e-04
286  4.612994e-04 0.000000e+00 7.040886e-04
287  6.069729e-04 0.000000e+00 5.098572e-04
288  5.826940e-04 4.855783e-05 7.526464e-04
289  5.584151e-04 4.855783e-05 6.798097e-04
290  7.040886e-04 2.427892e-05 6.312518e-04
291  7.040886e-04 4.855783e-05 6.798097e-04
292  4.370205e-04 0.000000e+00 8.497621e-04
293  6.798097e-04 0.000000e+00 8.254832e-04
294  5.826940e-04 2.427892e-05 8.497621e-04
295  8.497621e-04 9.711566e-05 6.798097e-04
296  8.012042e-04 2.427892e-05 5.584151e-04
297  6.798097e-04 7.283675e-05 7.769253e-04
298  7.040886e-04 2.427892e-05 6.069729e-04
299  5.341362e-04 2.427892e-05 5.826940e-04
300  4.370205e-04 0.000000e+00 6.798097e-04
301  8.497621e-04 4.855783e-05 6.069729e-04
302  4.855783e-04 2.427892e-05 6.069729e-04
303  3.884627e-04 0.000000e+00 5.584151e-04
304  6.069729e-04 0.000000e+00 7.040886e-04
305  6.312518e-04 2.427892e-05 8.497621e-04
306  5.584151e-04 0.000000e+00 8.497621e-04
307  4.370205e-04 0.000000e+00 4.612994e-04
308  3.884627e-04 9.711566e-05 5.098572e-04
309  3.884627e-04 2.427892e-05 6.555307e-04
```

```
310  2.427892e-04 0.000000e+00 5.584151e-04
311  5.826940e-04 1.213946e-04 3.884627e-04
312  6.069729e-04 2.427892e-05 5.584151e-04
313  4.855783e-04 7.283675e-05 6.555307e-04
314  6.555307e-04 2.427892e-05 6.555307e-04
315  4.370205e-04 4.855783e-05 4.612994e-04
316  5.584151e-04 4.855783e-05 4.855783e-04
317  5.098572e-04 7.283675e-05 8.012042e-04
318  4.370205e-04 2.427892e-05 8.983199e-04
319  6.798097e-04 4.855783e-05 3.884627e-04
320  3.884627e-04 2.427892e-05 7.283675e-04
321  3.399048e-04 0.000000e+00 5.098572e-04
322  7.526464e-04 2.427892e-05 6.069729e-04
323  4.855783e-04 2.427892e-05 6.555307e-04
324  4.855783e-04 0.000000e+00 8.012042e-04
325  4.127416e-04 0.000000e+00 6.069729e-04
326  4.612994e-04 0.000000e+00 7.526464e-04
327  5.826940e-04 2.427892e-05 3.884627e-04
328  4.612994e-04 2.427892e-05 7.040886e-04
329  6.069729e-04 2.427892e-05 8.254832e-04
330  2.427892e-04 0.000000e+00 4.370205e-04
331  4.370205e-04 2.427892e-05 3.884627e-04
332  6.555307e-04 4.855783e-05 5.826940e-04
[ reached getOption("max.print") -- omitted 1211 rows ]
```

Is there any association between consumer price index and consumer?

#Is there any association between consumer price index and consumer?

with(bank_additional_full, chisq.test(cons.price.idx,cons.conf.idx))

with(bank_additional_full, table(cons.price.idx,cons.conf.idx))

OR

with(bank_additional_full, prop.table(table(cons.price.idx,cons.conf.idx)))

#p-value < 2.2e-16 and it is very much less than 0.05.we can reject the null hypothesis in favor

of alternative hypothesis and conclude, that the variables, (job & Marital-p-value < 2.2e16),(con.price.idx

, consumer- are dependent to each other.

```
Chi-squared approximation may be incorrect
        Pearson's Chi-squared test

data:  cons.price.idx and cons.conf.idx
X-squared = 1029700, df = 625, p-value < 2.2e-16

              cons.conf.idx
cons.price.idx -50.8  -50 -49.5 -47.1 -46.2 -45.9 -42.7  -42 -41.8 -40.8 -
40.4
```

cons.price.idx										
92.201	0	0	0	0	0	0	0	0	0	0
92.379	0	0	0	0	0	0	0	0	0	0
92.431	0	0	0	0	0	0	0	0	0	0
92.469	0	0	0	0	0	0	0	0	0	0
92.649	0	0	0	0	0	0	0	0	0	0
92.713	0	0	0	0	0	0	0	0	0	0
92.756	0	0	0	0	0	10	0	0	0	0
92.843	0	282	0	0	0	0	0	0	0	0
92.893	0	0	0	0	5794	0	0	0	0	0
92.963	0	0	0	0	0	0	0	0	0	715
93.075	0	0	0	2458	0	0	0	0	0	0
93.2	0	0	0	0	0	0	0	3616	0	0
93.369	0	0	0	0	0	0	0	0	0	0
93.444	0	0	0	0	0	0	0	0	0	0
93.749	0	0	0	0	0	0	0	0	0	0
93.798	0	0	0	0	0	0	0	0	0	0
93.876	0	0	0	0	0	0	0	0	0	0
93.918	0	0	0	0	0	0	6685	0	0	0
93.994	0	0	0	0	0	0	0	0	0	0
94.027	0	0	0	0	0	0	0	0	0	0
94.055	0	0	0	0	0	0	0	0	0	0
94.199	0	0	0	0	0	0	0	0	0	0
94.215	0	0	0	0	0	0	0	0	0	0
94.465	0	0	0	0	0	0	0	0	4374	0
94.601	0	0	204	0	0	0	0	0	0	0
94.767	128	0	0	0	0	0	0	0	0	0

cons.conf.idx

cons.price.idx	-40.3	-40	-39.8	-38.3	-37.5	-36.4	-36.1	-34.8	-34.6	-33.6	-33
92.201	0	0	0	0	0	0	0	0	0	0	
92.379	0	0	0	0	0	0	0	0	0	0	
92.431	0	0	0	0	0	0	0	0	0	0	
92.469	0	0	0	0	0	0	0	0	0	178	

cons.price.idx											
92.649	0	0	0	0	0	0	0	0	0	0	0
92.713	0	0	0	0	0	0	0	0	0	0	172
92.756	0	0	0	0	0	0	0	0	0	0	0
92.843	0	0	0	0	0	0	0	0	0	0	0
92.893	0	0	0	0	0	0	0	0	0	0	0
92.963	0	0	0	0	0	0	0	0	0	0	0
93.075	0	0	0	0	0	0	0	0	0	0	0
93.2	0	0	0	0	0	0	0	0	0	0	0
93.369	0	0	0	0	0	0	0	264	0	0	0
93.444	0	0	0	0	0	0	5175	0	0	0	0
93.749	0	0	0	0	0	0	0	0	174	0	0
93.798	0	0	0	0	0	0	0	0	0	0	0
93.876	0	212	0	0	0	0	0	0	0	0	0
93.918	0	0	0	0	0	0	0	0	0	0	0
93.994	0	0	0	0	0	7763	0	0	0	0	0
94.027	0	0	0	233	0	0	0	0	0	0	0
94.055	0	0	229	0	0	0	0	0	0	0	0
94.199	0	0	0	0	303	0	0	0	0	0	0
94.215	311	0	0	0	0	0	0	0	0	0	0
94.465	0	0	0	0	0	0	0	0	0	0	0
94.601	0	0	0	0	0	0	0	0	0	0	0
94.767	0	0	0	0	0	0	0	0	0	0	0

cons.conf.idx

cons.price.idx	-31.4	-30.1	-29.8	-26.9
92.201	770	0	0	0
92.379	0	0	267	0
92.431	0	0	0	447
92.469	0	0	0	0
92.649	0	357	0	0
92.713	0	0	0	0
92.756	0	0	0	0
92.843	0	0	0	0
92.893	0	0	0	0
92.963	0	0	0	0
93.075	0	0	0	0
93.2	0	0	0	0
93.369	0	0	0	0
93.444	0	0	0	0
93.749	0	0	0	0
93.798	0	0	0	0
93.876	0	0	0	0
93.918	0	0	0	0

```
        93.994     0     0     0     0
        94.027     0     0     0     0
        94.055     0     0     0     0
        94.199     0     0     0     0
        94.215     0     0     0     0
        94.465     0     0     0     0
        94.601     0     0     0     0
        94.767     0     0     0     0
               cons.conf.idx
cons.price.idx          -50.8           -50          -49.5          -47.1          -
46.2
        92.201 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        92.379 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        92.431 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        92.469 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        92.649 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        92.713 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        92.756 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        92.843 0.0000000000 0.0068466544 0.0000000000 0.0000000000
0.0000000000
        92.893 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.1406720404
        92.963 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        93.075 0.0000000000 0.0000000000 0.0000000000 0.0596775760
0.0000000000
        93.2   0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        93.369 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        93.444 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        93.749 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        93.798 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        93.876 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        93.918 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        93.994 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        94.027 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        94.055 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        94.199 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        94.215 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        94.465 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        94.601 0.0000000000 0.0000000000 0.0049528989 0.0000000000
0.0000000000
        94.767 0.0031077013 0.0000000000 0.0000000000 0.0000000000
0.0000000000
```

```
cons.price.idx          -45.9          -42.7            -42          -41.8
40.8
       92.201 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
       92.379 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
       92.431 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
       92.469 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
       92.649 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
       92.713 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
       92.756 0.0002427892 0.0000000000 0.0000000000 0.0000000000
0.0000000000
       92.843 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
       92.893 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
       92.963 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0173594251
       93.075 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
       93.2    0.0000000000 0.0000000000 0.0877925609 0.0000000000
0.0000000000
       93.369 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
       93.444 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
       93.749 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
       93.798 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
       93.876 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
       93.918 0.0000000000 0.1623045547 0.0000000000 0.0000000000
0.0000000000
       93.994 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
       94.027 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
       94.055 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
       94.199 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
       94.215 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
       94.465 0.0000000000 0.0000000000 0.0000000000 0.1061959794
0.0000000000
       94.601 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
       94.767 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
               cons.conf.idx
cons.price.idx          -40.4          -40.3            -40          -39.8
38.3
       92.201 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
       92.379 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
       92.431 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
```

```
        92.469 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        92.649 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        92.713 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        92.756 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        92.843 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        92.893 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        92.963 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        93.075 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        93.2    0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        93.369 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        93.444 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        93.749 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        93.798 0.0016266874 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        93.876 0.0000000000 0.0000000000 0.0051471302 0.0000000000
0.0000000000
        93.918 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        93.994 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        94.027 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0056569875
        94.055 0.0000000000 0.0000000000 0.0000000000 0.0055598718
0.0000000000
        94.199 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        94.215 0.0000000000 0.0075507429 0.0000000000 0.0000000000
0.0000000000
        94.465 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        94.601 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        94.767 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
               cons.conf.idx
cons.price.idx        -37.5         -36.4         -36.1         -34.8
34.6
        92.201 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        92.379 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        92.431 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        92.469 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        92.649 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        92.713 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        92.756 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
```

```
          92.843 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
          92.893 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
          92.963 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
          93.075 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
          93.2   0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
          93.369 0.0000000000 0.0000000000 0.0000000000 0.0064096339
0.0000000000
          93.444 0.0000000000 0.0000000000 0.1256433913 0.0000000000
0.0000000000
          93.749 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0042245314
          93.798 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
          93.876 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
          93.918 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
          93.994 0.0000000000 0.1884772264 0.0000000000 0.0000000000
0.0000000000
          94.027 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
          94.055 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
          94.199 0.0073565116 0.0000000000 0.0000000000 0.0000000000
0.0000000000
          94.215 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
          94.465 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
          94.601 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
          94.767 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
                 cons.conf.idx
cons.price.idx         -33.6          -33        -31.4        -30.1
29.8
          92.201 0.0000000000 0.0000000000 0.0186947655 0.0000000000
0.0000000000
          92.379 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0064824706
          92.431 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
          92.469 0.0043216471 0.0000000000 0.0000000000 0.0000000000
0.0000000000
          92.649 0.0000000000 0.0000000000 0.0000000000 0.0086675731
0.0000000000
          92.713 0.0000000000 0.0041759736 0.0000000000 0.0000000000
0.0000000000
          92.756 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
          92.843 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
          92.893 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
          92.963 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
          93.075 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
```

```
        93.369 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        93.444 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        93.749 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        93.798 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        93.876 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        93.918 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        93.994 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        94.027 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        94.055 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        94.199 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        94.215 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        94.465 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        94.601 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
        94.767 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000
                cons.conf.idx
cons.price.idx          -26.9
        92.201 0.0000000000
        92.379 0.0000000000
        92.431 0.0108526755
        92.469 0.0000000000
        92.649 0.0000000000
        92.713 0.0000000000
        92.756 0.0000000000
        92.843 0.0000000000
        92.893 0.0000000000
        92.963 0.0000000000
        93.075 0.0000000000
        93.2   0.0000000000
        93.369 0.0000000000
        93.444 0.0000000000
        93.749 0.0000000000
        93.798 0.0000000000
        93.876 0.0000000000
        93.918 0.0000000000
        93.994 0.0000000000
        94.027 0.0000000000
        94.055 0.0000000000
        94.199 0.0000000000
        94.215 0.0000000000
        94.465 0.0000000000
        94.601 0.0000000000
        94.767 0.0000000000
```

Is the employment variation rate consistent across job types?

```
#

with(bank_additional_full, chisq.test( job,emp.var.rate))

with(bank_additional_full, table( job,emp.var.rate) )

# OR

with(bank_additional_full, prop.table(table( job,emp.var.rate)))
```

#p-value < 2.2e-16 is very much less than 0.05

```
        Pearson's Chi-squared test

data:  job and emp.var.rate
X-squared = 4676.8, df = 99, p-value < 2.2e-16


              emp.var.rate
job             -3.4    -3 -2.9 -1.8 -1.7 -1.1 -0.2 -0.1  1.1  1.4
  admin.         321    47  562 2231  246  187    3  940 1601 4284
  blue-collar     64     9   99 2519   58   33    3  575 2295 3599
  entrepreneur    24     1   38  306   14    7    0  265  289  512
  housemaid       32     9   41  120   18   16    1   70  229  524
  management      98    12  121  593   47   38    0  522  553  940
  retired        193    33  181  338   96   83    0   72  215  509
  self-employed   40     6   60  287   24   12    0  187  253  552
  services        32     2   88 1040   47   40    0  311  932 1477
  student         62    20  144  311   72   73    0   21   66  106
  technician     145    22  234 1243  110  115    2  575 1060 3237
  unemployed      44     9   76  164   31   28    1  141  171  349
  unknown         16     2   19   32   10    3    0    4   99  145
              emp.var.rate
job                     -3.4           -3         -2.9         -1.8
1.7
  admin.        7.793532e-03 1.141109e-03 1.364475e-02 5.416626e-02
5.972613e-03
  blue-collar   1.553851e-03 2.185102e-04 2.403613e-03 6.115859e-02
1.408177e-03
  entrepreneur  5.826940e-04 2.427892e-05 9.225988e-04 7.429348e-03
3.399048e-04
  housemaid     7.769253e-04 2.185102e-04 9.954356e-04 2.913470e-03
4.370205e-04
  management    2.379334e-03 2.913470e-04 2.937749e-03 1.439740e-02
1.141109e-03
  retired       4.685831e-03 8.012042e-04 4.394484e-03 8.206274e-03
2.330776e-03
  self-employed 9.711566e-04 1.456735e-04 1.456735e-03 6.968049e-03
5.826940e-04
  services      7.769253e-04 4.855783e-05 2.136545e-03 2.525007e-02
1.141109e-03
  student       1.505293e-03 4.855783e-04 3.496164e-03 7.550743e-03
1.748082e-03
  technician    3.520443e-03 5.341362e-04 5.681266e-03 3.017869e-02
2.670681e-03
  unemployed    1.068272e-03 2.185102e-04 1.845198e-03 3.981742e-03
7.526464e-04
```

```
 unknown             3.884627e-04 4.855783e-05 4.612994e-04 7.769253e-04
2.427892e-04
                 emp.var.rate
job                      -1.1          -0.2          -0.1           1.1
1.4
  admin.         4.540157e-03 7.283675e-05 2.282218e-02 3.887054e-02
1.040109e-01
  blue-collar    8.012042e-04 7.283675e-05 1.396038e-02 5.572011e-02
8.737982e-02
  entrepreneur   1.699524e-04 0.000000e+00 6.433913e-03 7.016607e-03
1.243081e-02
  housemaid      3.884627e-04 2.427892e-05 1.699524e-03 5.559872e-03
1.272215e-02
  management     9.225988e-04 0.000000e+00 1.267359e-02 1.342624e-02
2.282218e-02
  retired        2.015150e-03 0.000000e+00 1.748082e-03 5.219967e-03
1.235797e-02
  self-employed  2.913470e-04 0.000000e+00 4.540157e-03 6.142566e-03
1.340196e-02
  services       9.711566e-04 0.000000e+00 7.550743e-03 2.262795e-02
3.585996e-02
  student        1.772361e-03 0.000000e+00 5.098572e-04 1.602408e-03
2.573565e-03
  technician     2.792075e-03 4.855783e-05 1.396038e-02 2.573565e-02
7.859085e-02
  unemployed     6.798097e-04 2.427892e-05 3.423327e-03 4.151695e-03
8.473342e-03
  unknown        7.283675e-05 0.000000e+00 9.711566e-05 2.403613e-03
3.520443e-03
```

Is the employment variation rate same across education?

Which group is more confident?

with(bank_additional_full, chisq.test(education,emp.var.rate))

with(bank_additional_full, table(education, emp.var.rate))

OR

with(bank_additional_full, prop.table(table(education,emp.var.rate)))

```
Pearson's Chi-squared test

data:  education and emp.var.rate
X-squared = 1451.6, df = 63, p-value < 2.2e-16

                     emp.var.rate
education             -3.4   -3 -2.9 -1.8 -1.7 -1.1 -0.2 -0.1  1.1  1.4
  basic.4y             141   17  106  843   75   59    3  238  993 1701
  basic.6y              36    0   35  584   18    9    0  154  592  864
  basic.9y              69   16  110 1628   53   27    0  504 1428 2210
  high.school          216   36  358 2366  183  143    4  809 1857 3543
  illiterate             0    0    3    3    0    0    0    3    2    7
  professional.course  131   19  196 1041   93  113    3  470  887 2290
  university.degree    411   70  758 2403  301  242    0 1414 1627 4942
```

```
unknown                     67   14   97  316   50   42    0   91  377  677
                   emp.var.rate
education                   -3.4            -3           -2.9           -1.8
  basic.4y          3.423327e-03 4.127416e-04 2.573565e-03 2.046713e-02
  basic.6y          8.740410e-04 0.000000e+00 8.497621e-04 1.417889e-02
  basic.9y          1.675245e-03 3.884659e-04 2.670681e-03 3.952608e-02
  high.school       5.244246e-03 8.740410e-04 8.691852e-03 5.744392e-02
  illiterate        0.000000e+00 0.000000e+00 7.283675e-05 7.283675e-05
  professional.course 3.180538e-03 4.612994e-04 4.758668e-03 2.527435e-02
  university.degree 9.978635e-03 1.699524e-03 1.840342e-02 5.834224e-02
  unknown           1.626687e-03 3.399048e-04 2.355055e-03 7.672138e-03
                   emp.var.rate
education                   -1.7          -1.1          -0.2           -0.1
  basic.4y          1.820919e-03 1.432456e-03 7.283675e-05 5.778382e-03
  basic.6y          4.370205e-04 2.185102e-04 0.000000e+00 3.738953e-03
  basic.9y          1.286783e-03 6.555307e-04 0.000000e+00 1.223657e-02
  high.school       4.443042e-03 3.471885e-03 9.711566e-05 1.964164e-02
  illiterate        0.000000e+00 0.000000e+00 0.000000e+00 7.283675e-05
  professional.course 2.257939e-03 2.743518e-03 7.283675e-05 1.141109e-02
  university.degree 7.307954e-03 5.875498e-03 0.000000e+00 3.433039e-02
  unknown           1.213946e-03 1.019714e-03 0.000000e+00 2.209381e-03
                   emp.var.rate
education                    1.1           1.4
  basic.4y          2.410896e-02 4.129844e-02
  basic.6y          1.437312e-02 2.097698e-02
  basic.9y          3.467029e-02 5.365640e-02
  high.school       4.508595e-02 8.602020e-02
  illiterate        4.855783e-05 1.699524e-04
  professional.course 2.153540e-02 5.559872e-02
  university.degree 3.950180e-02 1.199864e-01
```

```
bank_marketing_data <- read_delim("C:/Users/Seshan/Desktop/bank_marketing_data.csv",

";", escape_double = FALSE, trim_ws = TRUE)

head(bank_marketing_data)

# We look at difference between mean and median in summary if it's more there might be

outliers

boxplot(bank_marketing_data$age, main="Age Box plot",yaxt="n", xlab="Age",

horizontal=TRUE, col=terrain.colors(2))

# By plotting histogram we can ensure if there are outliers or not

## DATA VISUALISATION

## Use Box plots (Only for continuous variables)- To Check Ouliers

boxplot(bank_marketing_data$age~bank_marketing_data$contact, main=" AGE",ylab="age of

customers",xlab="contact")

boxplot(bank_marketing_data$age~bank_marketing_data$job, main=" AGE",ylab="age of

customers",xlab="job")

boxplot(bank_marketing_data$age~bank_marketing_data$education, main=" AGE",ylab="age

of customers",xlab="education")

boxplot(bank_marketing_data$age~bank_marketing_data$marital, main=" AGE",ylab="age of
```

customers",xlab="marital")

Barplots for Categorical Variables

```
barplot(table(bank_marketing_data$job),col="red",main="JOB")

barplot(table(bank_marketing_data$marital),col="green",main="Marital")

barplot(table(bank_marketing_data$education),col="red",main="Education")

barplot(table(bank_marketing_data$emp.var.rate ),col="red",main="emp.var.rate")

hist(bank_marketing_data$age,col=terrain.colors(10))
```

#Correlation Analysis What we saw in the box plot can be emphasized by correlation plot, It can tell if predictor is a good predictor or not a good predictor. This analysis can help us decide if we can drop some columns/predictors depending upon its correlation with the outcome variable.

```
library(psych)

pairs.panels(bank_marketing_data[, c(1:8,17)])

pairs.panels(bank_marketing_data[, c(9:17)])
```

pairs.panels(bank_marketing_data[, c(1:8,19)])

Age Box plot

Histogram of bank_marketing_data$age

AGE

AGE
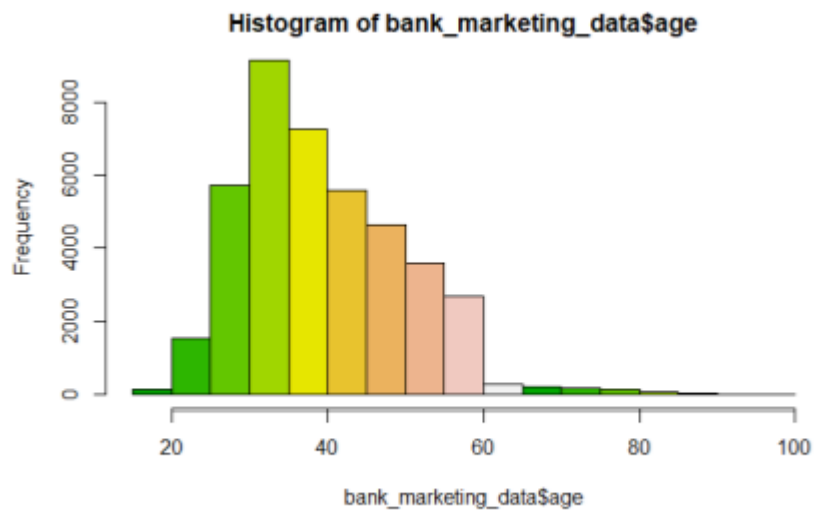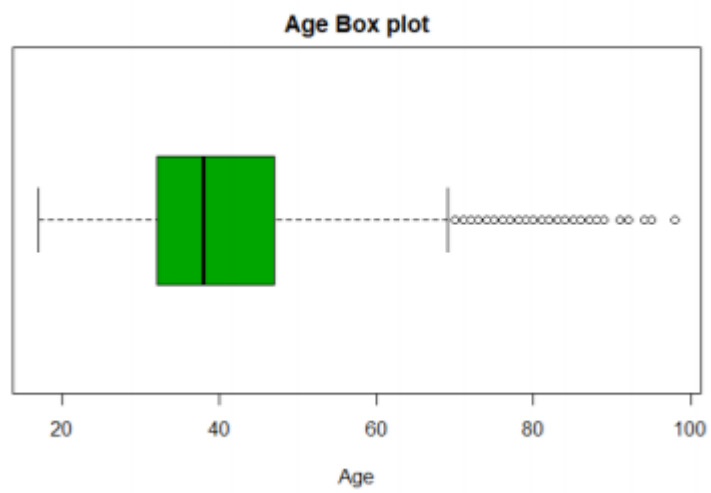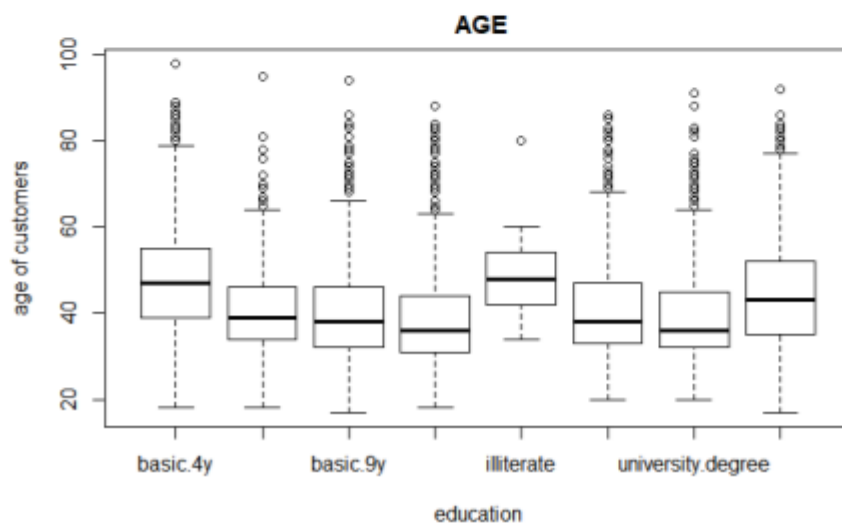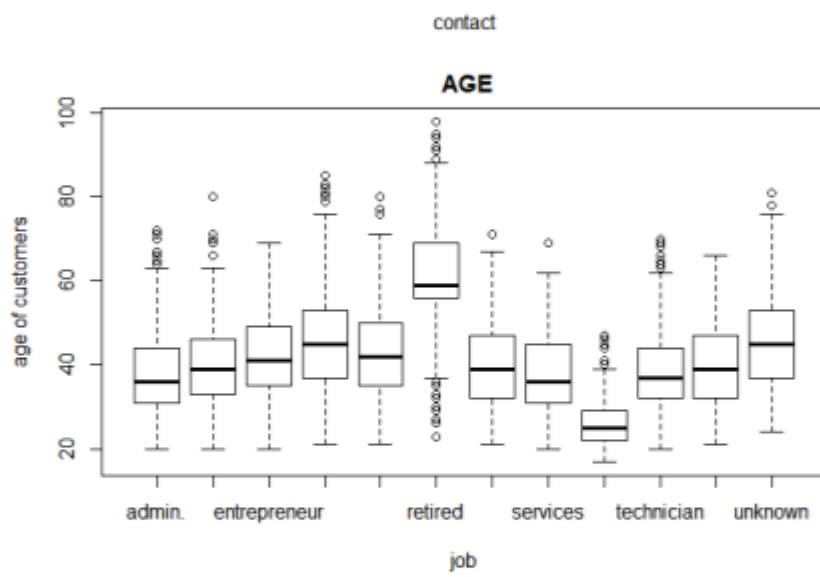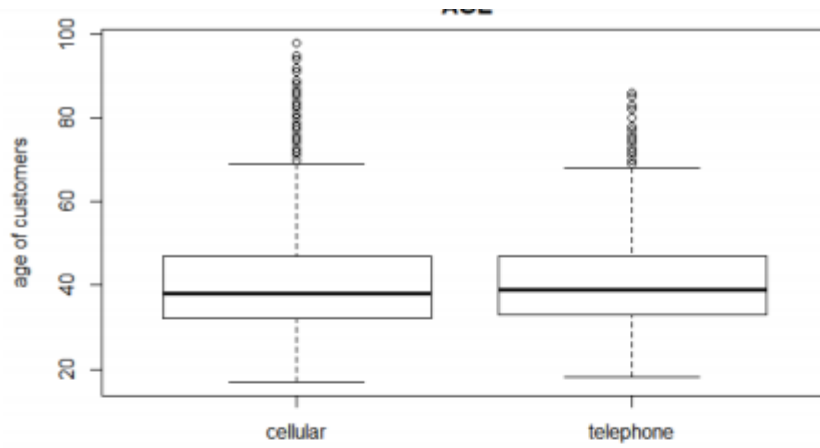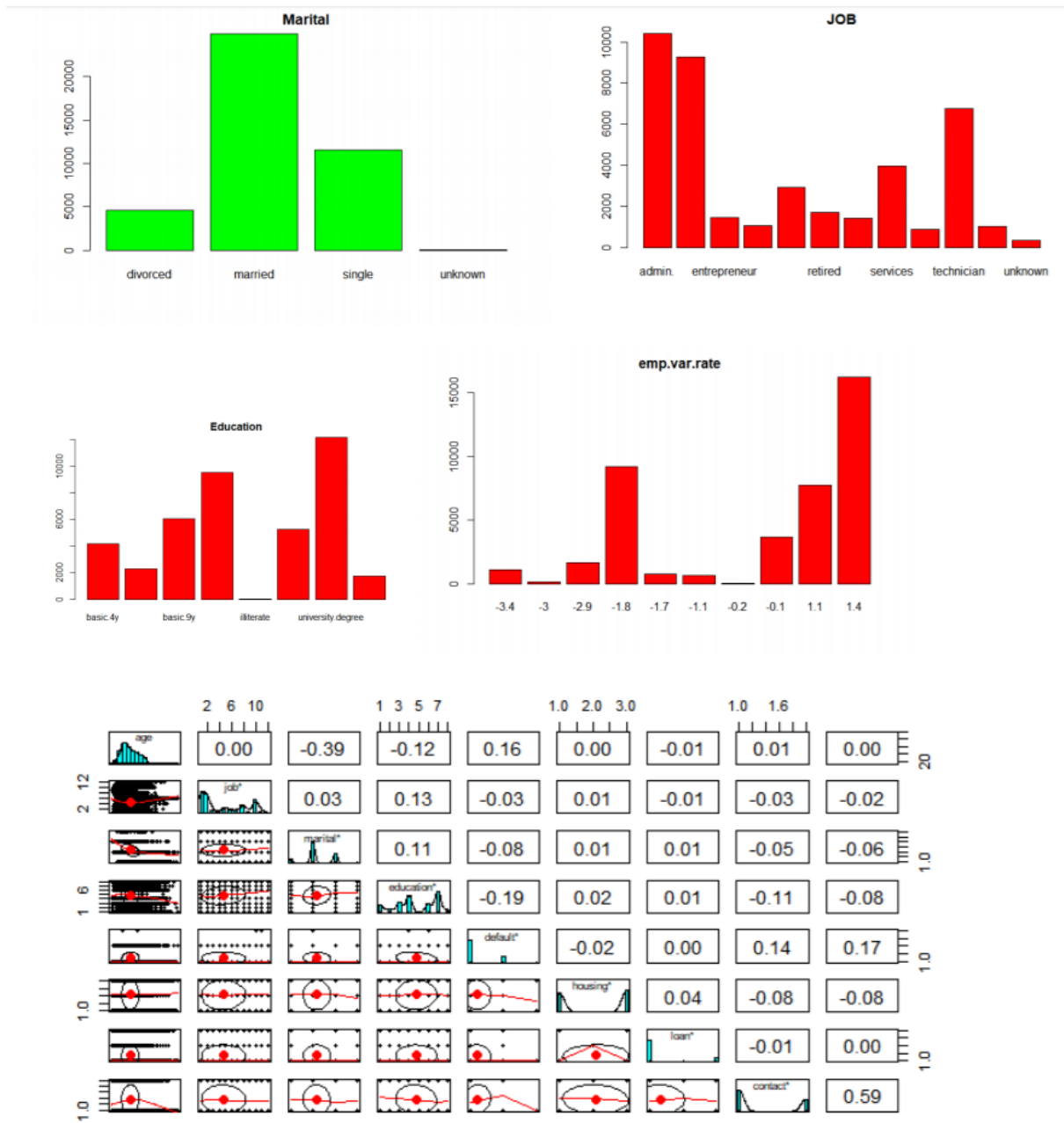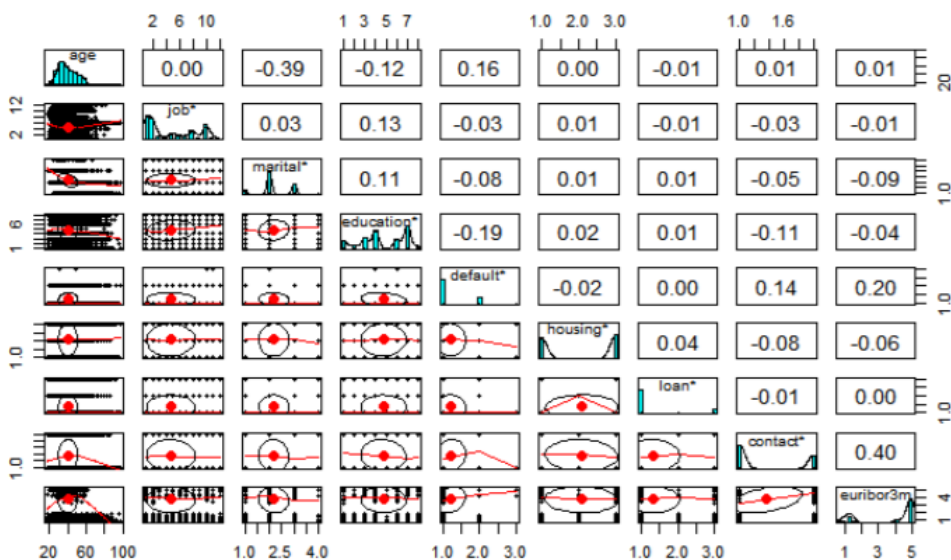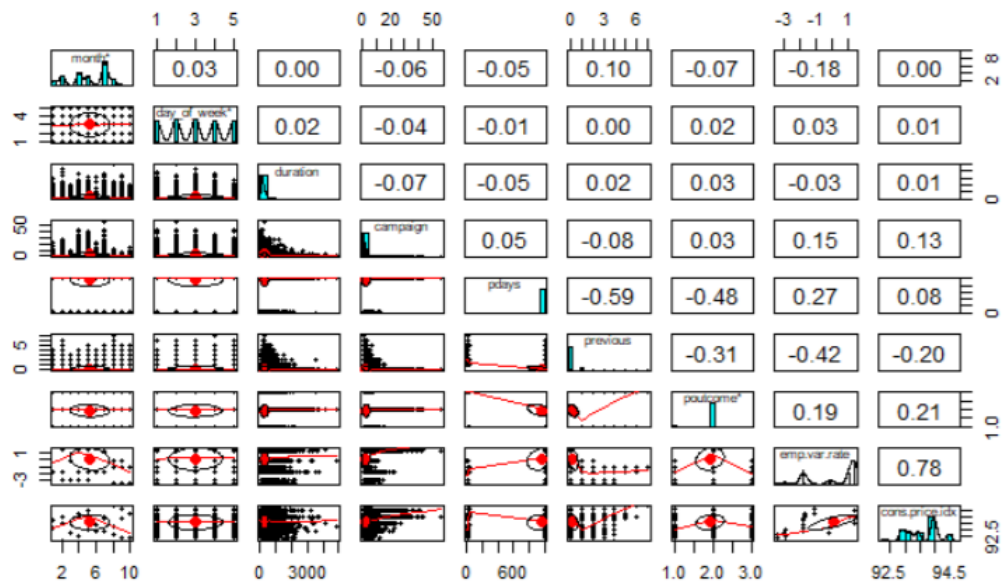
Subset Selection/ Feature-space reduction: Features-space can be reduced by selecting subsets

based upon correlation values obtained

###############Subset Selection################ lib

bank_marketing_data_sub<-bank_marketing_data[, c(1:4,7:9,12,14,15,17)]

str(bank_marketing_data_sub)

pairs.panels(bank_marketing_data_sub)

#3.4. Data transformation and Binning We do data transformation and binning for better

modeling. We convert categorical variable into numerical using binning.

################Binning and Data Transformation################

#bank_marketing_data_sub$age <- cut(bank_marketing_data_sub$age, c(1,20,40,60,100))

#bank_marketing_data_sub$is_divorced <- ifelse(bank_marketing_data_sub$marital ==

"divorced", 1, 0)

bank_marketing_data_sub$is_nr.employed <- ifelse(bank_marketing_data_sub$education ==

"employed", 1, 0)

#bank_marketing_data_sub$is_single <- ifelse(bank_marketing_data_sub$marital == "single",

1, 0)

bank_marketing_data_sub$nr.employed <- NULL

str(bank_marketing_data_sub)
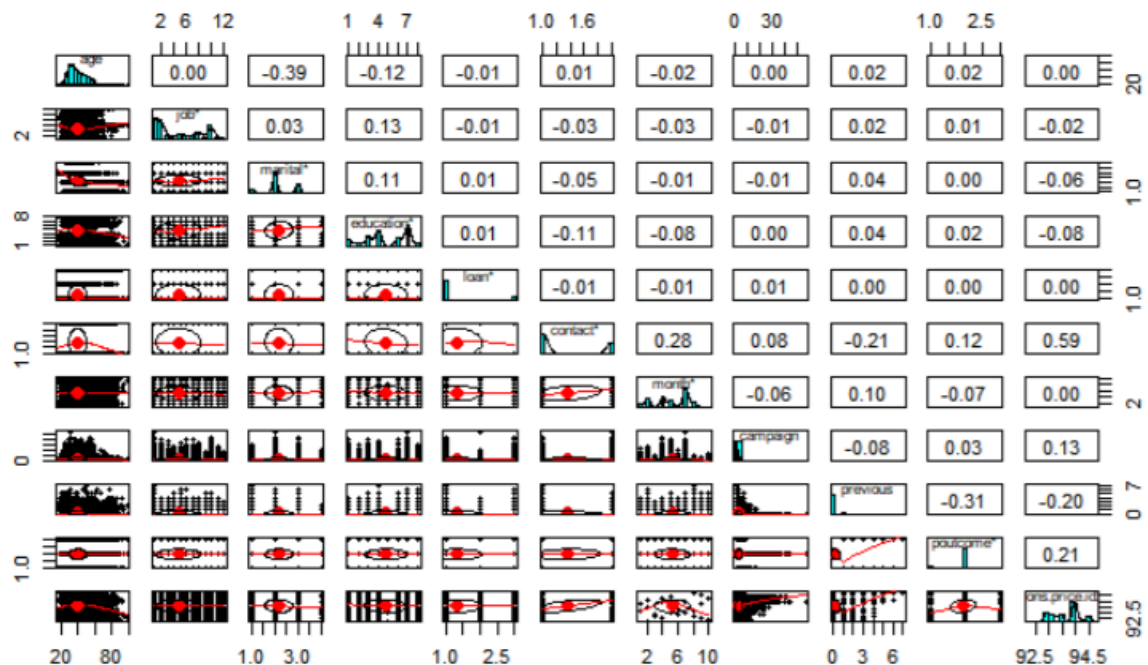
 #scatter.smooth(x=bank_marketing_data$job, y=bank_marketing_data$emp.var.rate,

main="emp.var.rate ~ job") # scatterplot

load library

library(corrplot)

load the data

data<-bank_marketing_data

data(bank_marketing_data_sub)

calculate correlations

correlations <- cor(bank_marketing_data[,16:19])

create correlation plot corrplot(correlations, method="circle")
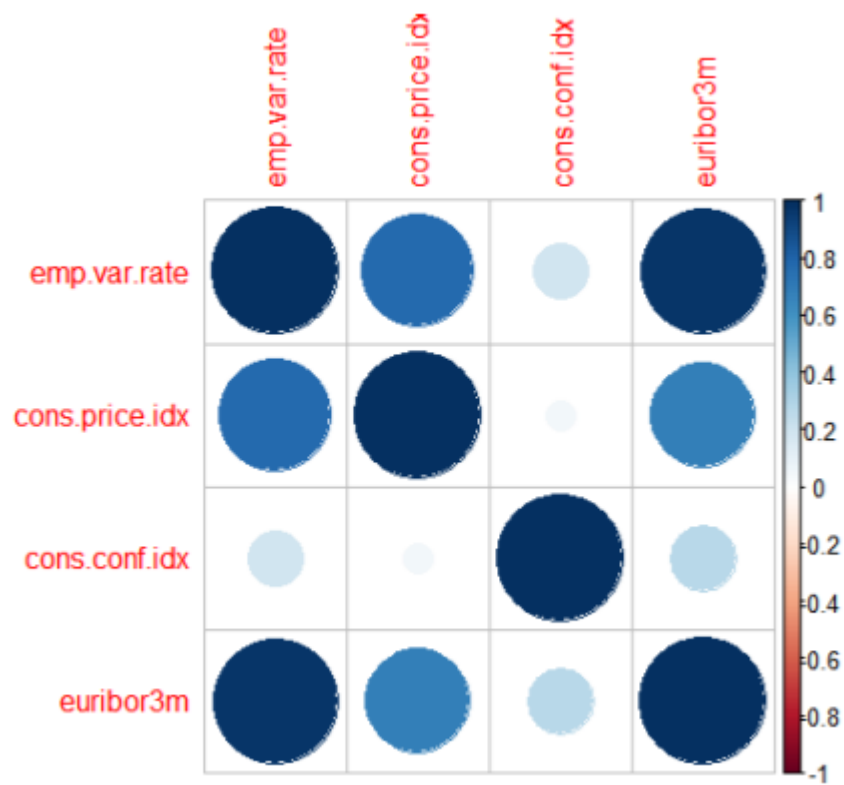
airs.panels(bank_marketing_data[, c(16:20,18)])

pairs.panels(bank_marketing_data[, c(2:4,3)])

pairs.panels(bank_marketing_data[, c(2:4,4)])
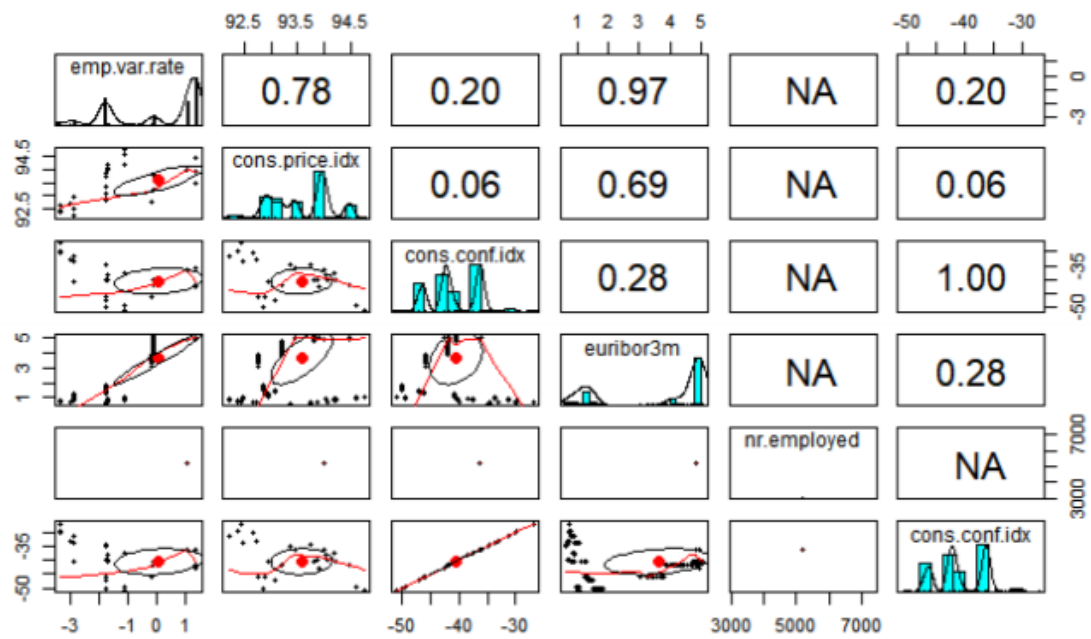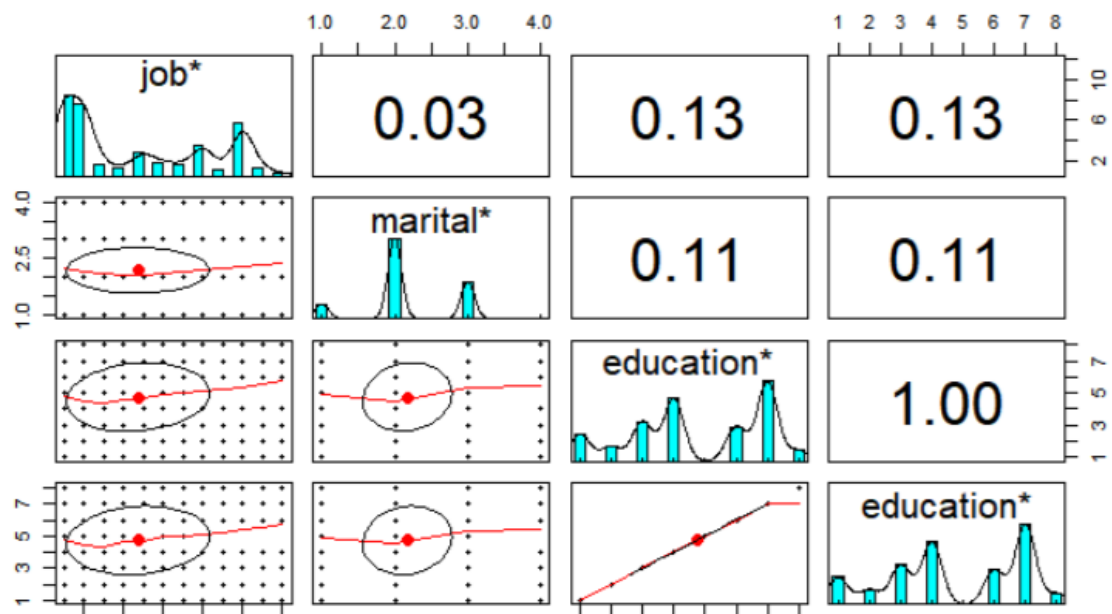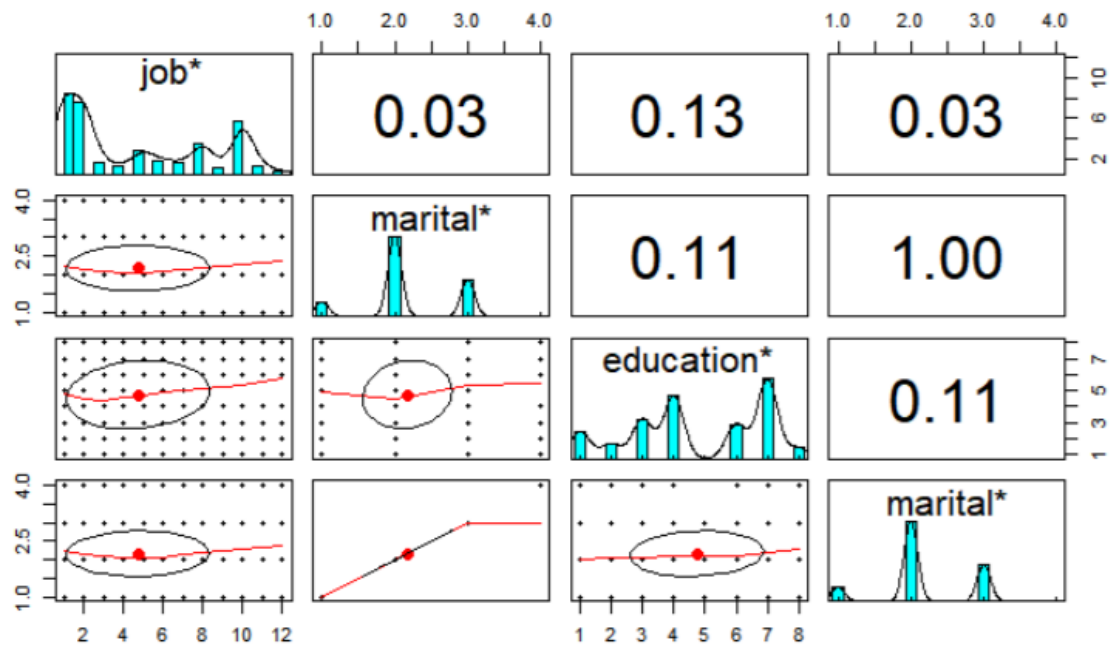
scatter.smooth(x=bank_marketing_data$cons.price.idx, y=bank_marketing_data$nr.employed,

main="nr.employed ~ cons.price.idx")

nr.employed ~ cons.price.idx
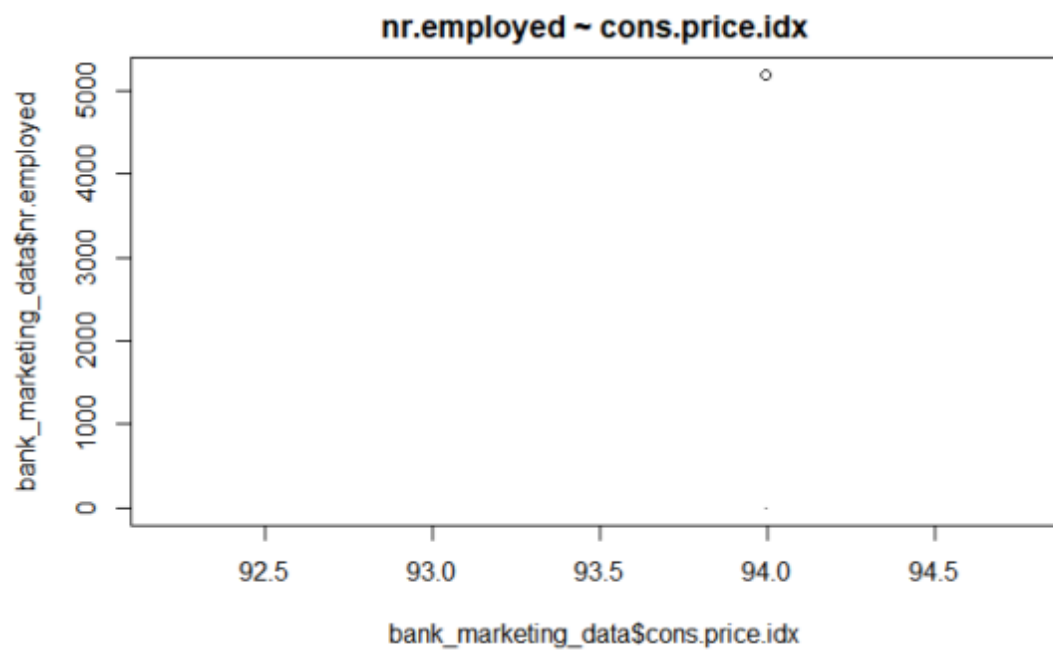
#cor(bank_marketing_data$age, bank_marketing_data$emp.var.rate)

head(bank_marketing_data)

table(bank_marketing_data$job)

table(bank_marketing_data$marital)

plot(table(bank_marketing_data$job))

library(psych) pairs.panels(bank_marketing_data[,1:6])

SSSS