ACADGILD

SESSION 11: Linear Models

Assignment 2

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Data Analytics

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1. Problem Statement

1. Use the link given below and locate the bank marketing dataset.
https://archive.ics.uci.edu/ml/machine-learning-databases/00222/

Perform the below operations:

a) Is there any association between job and default?
b) Is there any significant difference in duration of last call between? people having housing loan or not?
c) Is there any association between consumer price index and consumer?
d) Is the employment variation rate consistent across Job types?
e) Is the employment variation rate same across Education?
f) Which group is more confident?

2. Solution

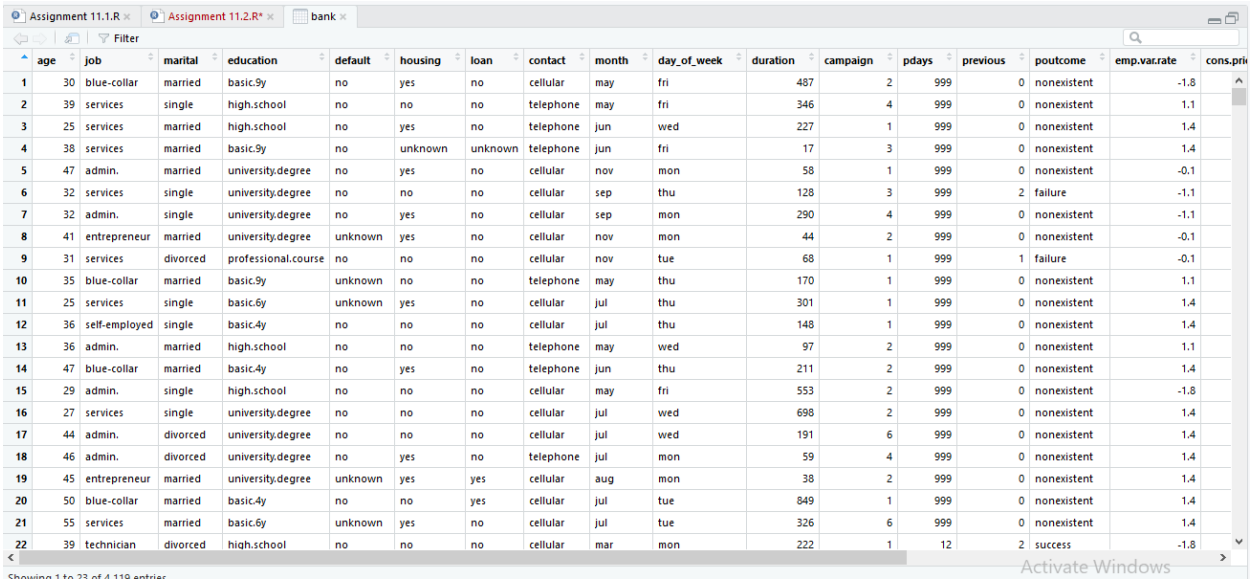
a. Is there any association between job and default?

The R-script for the given problem is as follows:

```
# Import BankMArketing Data
library(readr)
bank <- read.csv("E:/uday/acadgild data analytics/supporting files/bank-additional/bank-additional/bank-additional.csv", sep=";")
View(bank)
dim(bank)
str(bank)


#a.	Is there any association between job and default?
chisq.test(bank$job, bank$default)

#OR

with(bank,chisq.test( job, default))
with(bank, table( job, default) )
with(bank, prop.table(table( job,default)))
```

The output of the R-Script (from Console window) is given as follows:

```
> # Import BankMArketing Data
> library(readr)
> bank <- read.csv("E:/uday/acadgild data analytics/supporting
files/bank-additional/bank-additional/bank-additional.csv", sep=";")
> View(bank)
```



Assignment 11.1.R | Assignment 11.2.R* | bank

Filter

	age	job	marital	education	default	housing	loan	contact	month	day_of_week	duration	campaign	pdays	previous	poutcome	emp.var.rate	cons.pri
1	30	blue-collar	married	basic.9y	no	yes	no	cellular	may	fri	487	2	999	0	nonexistent	-1.8	
2	39	services	single	high.school	no	no	no	telephone	may	fri	346	4	999	0	nonexistent	1.1	
3	25	services	married	high.school	no	yes	no	telephone	jun	wed	227	1	999	0	nonexistent	1.4	
4	38	services	married	basic.9y	no	unknown	unknown	telephone	jun	fri	17	3	999	0	nonexistent	1.4	
5	47	admin.	married	university.degree	no	yes	no	cellular	nov	mon	58	1	999	0	nonexistent	-0.1	
6	32	services	single	university.degree	no	no	no	cellular	sep	thu	128	3	999	2	failure	-1.1	
7	32	admin.	single	university.degree	no	yes	no	cellular	sep	mon	290	4	999	0	nonexistent	-1.1	
8	41	entrepreneur	married	university.degree	unknown	yes	no	cellular	nov	mon	44	2	999	0	nonexistent	-0.1	
9	31	services	divorced	professional.course	no	no	no	cellular	nov	tue	68	1	999	1	failure	-0.1	
10	35	blue-collar	married	basic.9y	unknown	no	no	telephone	may	thu	170	1	999	0	nonexistent	1.1	
11	25	services	single	basic.6y	unknown	yes	no	cellular	jul	thu	301	1	999	0	nonexistent	1.4	
12	36	self-employed	single	basic.4y	no	no	no	cellular	jul	thu	148	1	999	0	nonexistent	1.4	
13	36	admin.	married	high.school	no	no	no	telephone	may	wed	97	2	999	0	nonexistent	1.1	
14	47	blue-collar	married	basic.4y	no	yes	no	telephone	jun	thu	211	2	999	0	nonexistent	1.4	
15	29	admin.	single	high.school	no	no	no	cellular	may	fri	553	2	999	0	nonexistent	-1.8	
16	27	services	single	university.degree	no	no	no	cellular	jul	wed	698	2	999	0	nonexistent	1.4	
17	44	admin.	divorced	university.degree	no	no	no	cellular	jul	wed	191	6	999	0	nonexistent	1.4	
18	46	admin.	divorced	university.degree	no	yes	no	telephone	jul	mon	59	4	999	0	nonexistent	1.4	
19	45	entrepreneur	married	university.degree	unknown	yes	yes	cellular	aug	mon	38	2	999	0	nonexistent	1.4	
20	50	blue-collar	married	basic.4y	no	no	yes	cellular	jul	tue	849	1	999	0	nonexistent	1.4	
21	55	services	married	basic.6y	unknown	yes	no	cellular	jul	tue	326	6	999	0	nonexistent	1.4	
22	39	technician	divorced	high.school	no	no	no	cellular	mar	mon	222	1	12	2	success	-1.8	

Showing 1 to 23 of 4,119 entries


```
> dim(bank)
[1] 4119   21
> str(bank)
'data.frame':   4119 obs. of  21 variables:
 $ age            : int  30 39 25 38 47 32 32 41 31 35 ...
 $ job            : Factor w/ 12 levels "admin.","blue-collar",..: 2 8 8 8 1 8
 1 3 8 2 ...
  $ marital       : Factor w/ 4 levels "divorced","married",..: 2 3 2 2 2 3 3
2 1 2 ...
 $ education      : Factor w/ 8 levels "basic.4y","basic.6y",..: 3 4 4 3 7 7 7
7 6 3 ...
 $ default        : Factor w/ 3 levels "no","unknown",..: 1 1 1 1 1 1 1 2 1 2
...
 $ housing        : Factor w/ 3 levels "no","unknown",..: 3 1 3 2 3 1 3 3 1 1
...
 $ loan           : Factor w/ 3 levels "no","unknown",..: 1 1 1 2 1 1 1 1 1 1
...
 $ contact        : Factor w/ 2 levels "cellular","telephone": 1 2 2 2 1 1 1 1
1 2 ...
  $ month         : Factor w/ 10 levels "apr","aug","dec",..: 7 7 5 5 8 10 10
 8 8 7 ...
 $ day_of_week    : Factor w/ 5 levels "fri","mon","thu",..: 1 1 5 1 2 3 2 2 4
3 ...
 $ duration       : int  487 346 227 17 58 128 290 44 68 170 ...
 $ campaign       : int  2 4 1 3 1 3 4 2 1 1 ...
 $ pdays          : int  999 999 999 999 999 999 999 999 999 999 ...
 $ previous       : int  0 0 0 0 0 2 0 0 1 0 ...
 $ poutcome       : Factor w/ 3 levels "failure","nonexistent",..: 2 2 2 2 2 1
2 2 1 2 ...
 $ emp.var.rate   : num  -1.8 1.1 1.4 1.4 -0.1 -1.1 -1.1 -0.1 -0.1 1.1 ...
 $ cons.price.idx: num  92.9 94 94.5 94.5 93.2 ...
 $ cons.conf.idx : num  -46.2 -36.4 -41.8 -41.8 -42 -37.5 -37.5 -42 -42 -36.4
...
```

```
 $ euribor3m     : num  1.31 4.86 4.96 4.96 4.19 ...
 $ nr.employed   : num  5099 5191 5228 5228 5196 ...
 $ y             : Factor w/ 2 levels "no","yes": 1 1 1 1 1 1 1 1 1 1 ...
> chisq.test(bank$job, bank$default)

        Pearson's Chi-squared test

data:  bank$job and bank$default
X-squared = 224.29, df = 22, p-value < 2.2e-16

> with(bank,chisq.test( job, default))

        Pearson's Chi-squared test

data:  job and default
X-squared = 224.29, df = 22, p-value < 2.2e-16

> with(bank, table( job, default) )
               default
job              no unknown yes
  admin.        889     123   0
  blue-collar   599     285   0
  entrepreneur  113      35   0
  housemaid      79      31   0
  management    280      44   0
  retired       126      40   0
  self-employed 134      25   0
  services      306      87   0
  student        70      12   0
  technician    606      85   0
  unemployed     92      18   1
  unknown        21      18   0
> with(bank, prop.table(table( job,default)))
               default
job                        no      unknown          yes
  admin.        0.2158290847 0.0298616169 0.0000000000
  blue-collar   0.1454236465 0.0691915513 0.0000000000
  entrepreneur  0.0274338432 0.0084972081 0.0000000000
  housemaid     0.0191794125 0.0075260986 0.0000000000
  management    0.0679776645 0.0106822044 0.0000000000
  retired       0.0305899490 0.0097110949 0.0000000000
  self-employed 0.0325321680 0.0060694343 0.0000000000
  services      0.0742898762 0.0211216315 0.0000000000
  student       0.0169944161 0.0029133285 0.0000000000
  technician    0.1471230881 0.0206360767 0.0000000000
  unemployed    0.0223355183 0.0043699927 0.0002427774
  unknown       0.0050983248 0.0043699927 0.0000000000
```

Conclusion/Interpretation:

Ho : There is NO association between Job and default.

Since the p-value is 2.2e-16 is less than the cut-off value of 0.05, we can reject the null hypothesis in favor of alternative hypothesis and conclude, that the variables, job & default are dependent to each other.

b. Is there any significant difference in duration of last call between? people having housing loan or not?

The R-script for the given problem is as follows:

```
with(bank, chisq.test(duration,housing))
with(bank, table( duration,housing) )
```

The output of the R-Script (from Console window) is given as follows:

```
> with(bank, chisq.test(duration,housing))

  Pearson's Chi-squared test

data:  duration and housing
X-squared = 1616, df = 1654, p-value = 0.7433

> with(bank, table( duration,housing) )
        housing
duration no unknown yes
    0     0       0   1
    4     0       0   1
    5     3       0   1
    6     2       0   3
    7     2       0   2
    8     0       0   6
    9     6       0   3
    10    4       0   6
    11    3       0   5
    12    4       0   2
    13    2       0   4
    14    3       0   3
    15    3       0   3
    16    4       0   7
    17    5       1   4
    18    1       0   3
    19    3       0   6
    20    5       0   2
    21    4       0   3
    22    5       0   4
    23    2       1   5
    24    4       0   3
    25    1       0   4
    26    3       0   6
    27    4       0   5
    28    1       0   2
    29    2       0   2
    30    1       1   2
    31    3       0   5
    32    0       0   6
    33    0       0   3
    34    3       0   3
    35    3       2   4
    36    3       0   6
    37    2       1   3
    38    2       0   6
    39    3       0   4
```

40	4	0	2
41	3	0	2
42	5	0	5
43	1	0	8
44	2	0	6
45	1	0	3
46	2	0	1
47	1	0	5
48	1	0	4
49	9	0	1
50	6	0	2
51	7	1	4
52	2	0	3
53	2	0	5
54	7	0	5
55	6	0	6
56	4	1	3
57	4	0	9
58	3	0	7
59	6	1	7
60	5	0	2
61	3	1	6
62	4	0	6
63	4	0	8
64	7	0	6
65	6	0	2
66	6	0	3
67	6	1	7
68	8	0	6
69	9	0	8
70	8	0	5
71	7	0	6
72	6	1	6
73	10	0	12
74	7	0	6
75	5	0	8
76	8	0	5
77	8	1	15
78	6	0	7
79	8	0	2
80	7	0	5
81	10	2	9
82	4	0	12
83	11	0	9
84	10	0	3
85	8	1	7
86	5	0	6
87	7	1	10
88	6	0	13
89	8	0	5
90	8	1	11
91	12	0	2
92	7	0	5
93	6	1	7
94	7	0	8
95	9	2	6
96	8	0	7
97	5	0	8
98	5	0	7
99	6	0	7

100	5	1	6
101	6	1	9
102	8	0	9
103	11	0	7
104	3	1	9
105	2	0	8
106	3	0	8
107	5	2	11
108	3	1	4
109	5	0	7
110	2	0	4
111	7	0	10
112	9	0	14
113	5	0	15
114	10	0	9
115	6	0	7
116	3	1	5
117	5	0	5
118	3	0	7
119	8	0	5
120	3	0	5
121	8	0	8
122	7	1	12
123	5	2	7
124	9	0	4
125	7	0	6
126	10	1	5
127	8	1	5
128	8	0	8
129	5	0	6
130	8	0	9
131	9	1	9
132	6	0	5
133	4	1	6
134	7	0	5
135	7	2	10
136	8	1	7
137	4	0	9
138	3	0	4
139	8	0	9
140	5	0	6
141	7	1	5
142	6	0	8
143	3	1	9
144	6	1	5
145	6	0	14
146	8	1	7
147	7	3	7
148	6	0	7
149	5	0	6
150	1	0	10
151	9	0	4
152	4	0	7
153	4	2	5
154	5	1	6
155	8	1	9
156	2	1	9
157	9	0	6
158	4	0	7
159	6	0	12

160	5	0	12
161	8	0	9
162	6	0	4
163	5	0	7
164	7	1	8
165	6	0	7
166	7	0	9
167	2	0	9
168	6	0	9
169	2	3	4
170	5	0	6
171	7	1	5
172	4	0	6
173	3	1	9
174	4	0	3
175	6	1	7
176	2	0	6
177	5	0	4
178	6	0	5
179	4	0	2
180	9	0	8
181	6	0	10
182	4	0	7
183	6	0	7
184	4	0	11
185	5	0	3
186	3	0	4
187	6	0	5
188	5	0	7
189	3	0	3
190	4	0	3
191	5	0	5
192	4	0	4
193	5	0	8
194	2	0	3
195	3	0	6
196	2	0	5
197	6	0	2
198	5	1	5
199	4	1	3
200	7	0	7
201	6	0	8
202	4	1	5
203	5	0	5
204	9	1	7
205	0	0	2
206	8	0	6
207	4	0	9
208	3	0	5
209	4	0	4
210	0	0	7
211	5	0	8
212	4	0	8
213	5	0	3
214	5	0	3
215	3	1	9
216	2	0	2
217	7	0	2
218	7	0	4
219	5	0	10

220	2	0	1
221	4	1	5
222	4	1	4
223	6	0	3
224	4	0	6
225	4	0	8
226	2	0	9
227	2	1	4
228	5	1	5
229	0	1	3
230	4	0	5
231	3	0	8
232	5	0	7
233	1	0	6
234	4	1	5
235	4	0	0
236	2	0	5
237	1	0	2
238	4	0	3
239	4	0	5
240	2	0	4
241	4	0	3
242	2	0	2
243	3	0	4
244	5	0	5
245	6	1	7
246	5	1	5
247	4	0	9
248	2	0	3
249	1	0	6
250	2	0	6
251	3	0	2
252	4	0	9
253	4	0	2
254	0	0	3
255	1	0	4
256	3	0	3
257	7	0	3
258	8	0	5
259	8	0	5
260	2	0	3
261	4	0	3
262	4	1	3
263	4	0	4
264	4	0	4
265	3	0	4
266	2	0	6
267	1	0	5
268	4	0	3
269	1	0	3
270	3	1	2
271	2	1	3
272	4	1	2
273	2	0	3
274	1	0	4
275	3	0	3
276	3	1	0
277	0	0	2
278	4	0	1
279	2	0	2

```
    280   3       0   3
    281   4       0   7
    282   1       0   1
    283   1       0   0
    284   3       0   2
    285   3       0   0
    286   5       0   5
    287   4       0   1
    288   2       0   5
    289   4       0   1
    290   2       0   2
    291   2       0   3
    292   3       0   2
    293   3       0   4
    294   2       0   3
    295   5       0   1
    296   5       0   1
    297   2       0   3
    298   2       0   2
    299   3       0   0
    300   2       0   4
    301   4       0   2
    302   2       0   1
    303   0       0   2
    304   2       0   4
    305   1       0   4
    306   1       0   0
    307   2       0   2
    308   1       0   3
    309   1       1   4
    310   2       0   2
    311   1       1   2
    312   1       0   2
    313   4       1   3
    314   2       0   5
    315   3       0   0
    316   5       0   3
    317   4       0   0
    318   2       1   3
    319   2       1   0
    320   0       0   7
    321   2       0   2
    322   3       0   7
    323   1       0   1
    324   0       0   2
    325   0       0   1
    326   1       0   5
    327   2       0   1
    328   2       0   2
    329   5       0   2
    330   1       0   2
    331   2       1   2
    332   4       0   1
    333   2       1   1
    334   1       0   3
    335   2       0   1
 [ reached getOption("max.print") -- omitted 495 rows ]
```

c. Is there any association between consumer price index and consumer?

The R-script for the given problem is as follows:

```
chisq.test(bank$cons.price.idx,bank$cons.conf.idx)

#OR

with(bank, chisq.test(cons.price.idx,cons.conf.idx))
with(bank, table(cons.price.idx,cons.conf.idx))
```

The output of the R-Script (from Console window) is given as follows:

```
> chisq.test(bank$cons.price.idx,bank$cons.conf.idx)

  Pearson's Chi-squared test

data:  bank$cons.price.idx and bank$cons.conf.idx
X-squared = 102980, df = 625, p-value < 2.2e-16

> #OR
>
> with(bank, chisq.test(cons.price.idx,cons.conf.idx))

  Pearson's Chi-squared test

data:  cons.price.idx and cons.conf.idx
X-squared = 102980, df = 625, p-value < 2.2e-16

> with(bank, table(cons.price.idx,cons.conf.idx))
              cons.conf.idx
cons.price.idx -50.8 -50 -49.5 -47.1 -46.2 -45.9 -42.7 -42 -41.8 -40.8
        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     1     0   0     0     0
        92.843     0  25     0     0     0     0     0   0     0     0
        92.893     0   0     0     0   597     0     0   0     0     0
        92.963     0   0     0     0     0     0     0   0     0    75
        93.075     0   0     0   201     0     0     0   0     0     0
        93.2       0   0     0     0     0     0     0 386     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   667   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   431     0
          94.601     0   0    20     0     0     0     0   0     0     0
          94.767    24   0     0     0     0     0     0   0     0     0
                 cons.conf.idx
cons.price.idx -40.4 -40.3 -40 -39.8 -38.3 -37.5 -36.4 -36.1 -34.8 -
34.6
          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     0     0     0     0
0
          92.843     0     0   0     0     0     0     0     0     0
0
          92.893     0     0   0     0     0     0     0     0     0
0
          92.963     0     0   0     0     0     0     0     0     0
0
          93.075     0     0   0     0     0     0     0     0     0
0
          93.2       0     0   0     0     0     0     0     0     0
0
          93.369     0     0   0     0     0     0     0     0    23
0
          93.444     0     0   0     0     0     0     0   528     0
0
          93.749     0     0   0     0     0     0     0     0     0
14
          93.798     6     0   0     0     0     0     0     0     0
0
          93.876     0     0  23     0     0     0     0     0     0
0
          93.918     0     0   0     0     0     0     0     0     0
0
          93.994     0     0   0     0     0     0   758     0     0
0
          94.027     0     0   0     0    33     0     0     0     0
0
          94.055     0     0   0    24     0     0     0     0     0
0
          94.199     0     0   0     0     0    39     0     0     0
0
          94.215     0    30   0     0     0     0     0     0     0
0
          94.465     0     0   0     0     0     0     0     0     0
0
          94.601     0     0   0     0     0     0     0     0     0
0
          94.767     0     0   0     0     0     0     0     0     0
0
```

```
                cons.conf.idx
cons.price.idx -33.6 -33 -31.4 -30.1 -29.8 -26.9
        92.201     0   0    75     0     0     0
        92.379     0   0     0     0    25     0
        92.431     0   0     0     0     0    43
        92.469    14   0     0     0     0     0
        92.649     0   0     0    36     0     0
        92.713     0  21     0     0     0     0
        92.756     0   0     0     0     0     0
        92.843     0   0     0     0     0     0
        92.893     0   0     0     0     0     0
        92.963     0   0     0     0     0     0
        93.075     0   0     0     0     0     0
        93.2       0   0     0     0     0     0
        93.369     0   0     0     0     0     0
        93.444     0   0     0     0     0     0
        93.749     0   0     0     0     0     0
        93.798     0   0     0     0     0     0
        93.876     0   0     0     0     0     0
        93.918     0   0     0     0     0     0
        93.994     0   0     0     0     0     0
        94.027     0   0     0     0     0     0
        94.055     0   0     0     0     0     0
        94.199     0   0     0     0     0     0
        94.215     0   0     0     0     0     0
        94.465     0   0     0     0     0     0
        94.601     0   0     0     0     0     0
        94.767     0   0     0     0     0     0
```

Conclusion/Interpretation:

Ho : There is NO association between Job and default.

Since the p-value is 2.2e-16 is less than the cut-off value of 0.05, we can reject the null hypothesis in favor of alternative hypothesis and conclude, that the variables, consumer price index and consumer are dependent to each other.

d. Is the employment variation rate consistent across Job types?

The R-script for the given problem is as follows:

```
chisq.test(bank$job,bank$emp.var.rate)
#OR
with(bank, chisq.test( job,emp.var.rate))
with(bank, table( job,emp.var.rate) )
```

The output of the R-Script (from Console window) is given as follows:

```
> chisq.test(bank$job,bank$emp.var.rate)

  Pearson's Chi-squared test

data:  bank$job and bank$emp.var.rate
X-squared = 512.04, df = 99, p-value < 2.2e-16
```

```
> with(bank, chisq.test( job,emp.var.rate))

        Pearson's Chi-squared test

data:  job and emp.var.rate
X-squared = 512.04, df = 99, p-value < 2.2e-16

> with(bank, table( job,emp.var.rate) )
                emp.var.rate
job              -3.4  -3 -2.9 -1.8 -1.7 -1.1 -0.2 -0.1 1.1 1.4
  admin.           33   4   52  199   24   23    0   92 161 424
  blue-collar       8   1    3  246    5    8    1   59 203 350
  entrepreneur      2   0    2   26    1    1    0   34  34  48
  housemaid         4   1    5    9    1    4    0   10  17  59
  management        6   3   15   71    5    5    0   62  50 107
  retired          14   3   18   28   11   10    0   11  19  52
  self-employed     4   2    6   30    4    2    0   21  34  56
  services          1   1   14  112    6    7    0   23  84 145
  student           8   1   12   18   12    6    0    4   8  13
  technician       18   1   27  122   13   13    0   59 123 315
  unemployed        5   3    6   19    4    4    0   17  13  40
  unknown           1   1    4    3    1    0    0    0  12  17
```

e. Is the employment variation rate same across Education?

The R-script for the given problem is as follows:

```
with(bank, chisq.test( education,emp.var.rate))
with(bank, table( education, emp.var.rate) )
```

The output of the R-Script (from Console window) is given as follows:

```
> with(bank, chisq.test( education,emp.var.rate))

        Pearson's Chi-squared test

data:  education and emp.var.rate
X-squared = 193.46, df = 63, p-value = 3.5e-15

> with(bank, table( education, emp.var.rate) )
                     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              13   2    7   83    6    8    0   28  93 189
  basic.6y               1   0    2   59    1    2    0   20  57  86
  basic.9y               8   2    4  152    5    4    0   56 127 216
  high.school           23   4   34  231   19   18    1   83 161 347
  illiterate             0   0    1    0    0    0    0    0   0   0
  professional.course   15   2   22   97   12   15    0   46 106 220
  university.degree     40   9   80  230   37   31    0  150 177 510
  unknown                4   2   14   31    7    5    0    9  37  58
```

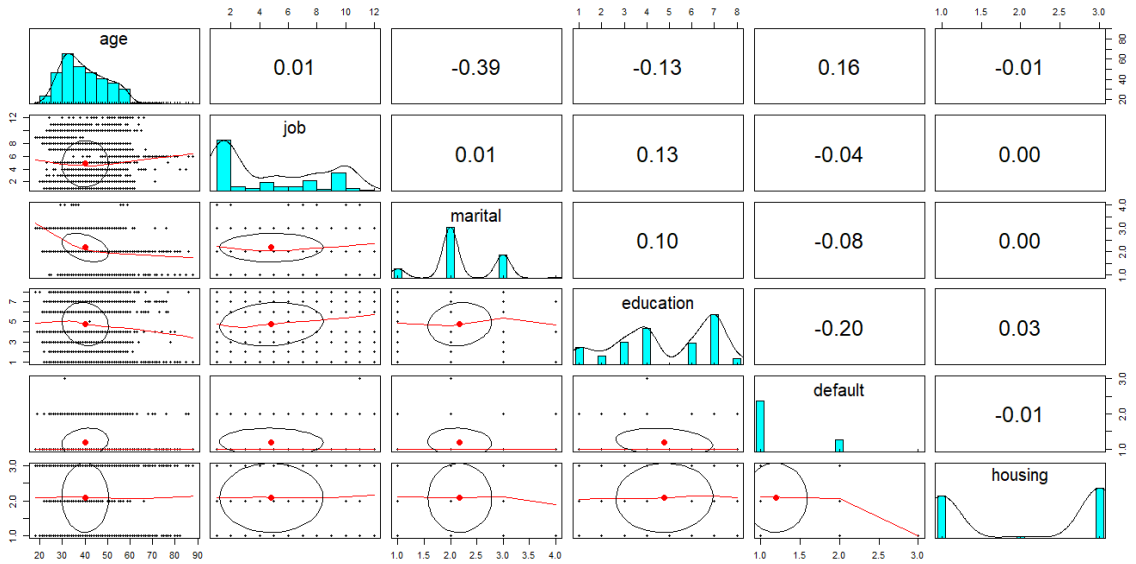
f. Which group is more confident?

The R-script for the given problem is as follows:

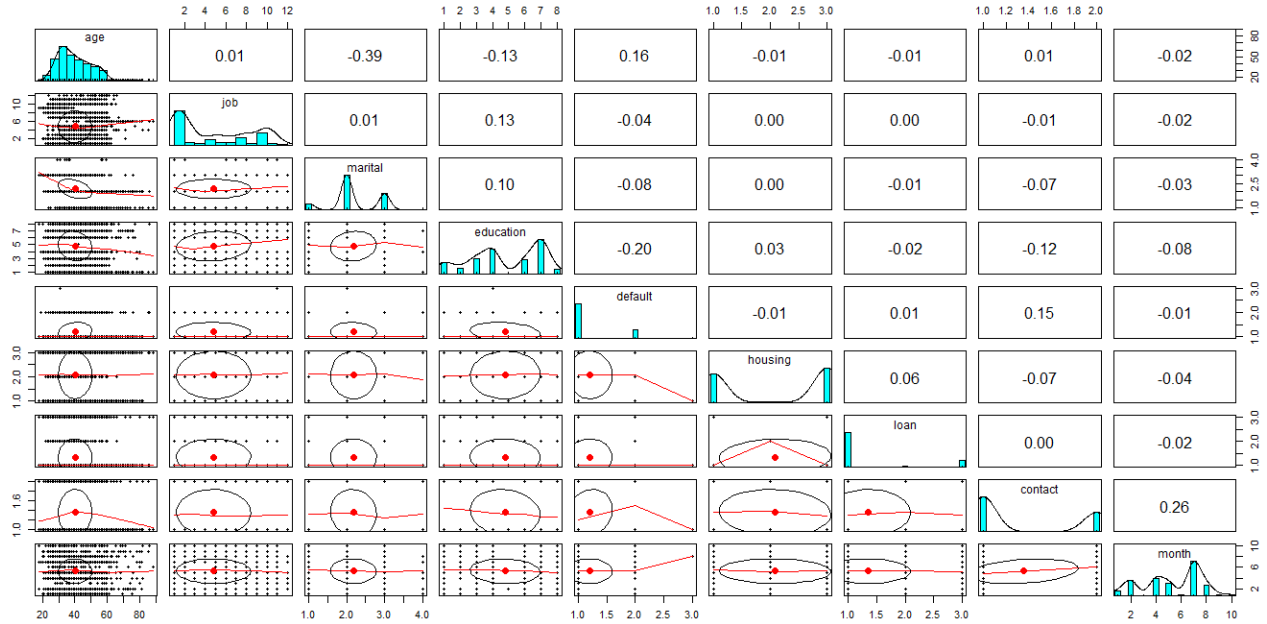
```
library(psych)
pairs.panels(bank[,1:6])
pairs.panels(bank[,1:9])
pairs.panels(bank[,1:14])
summary(bank)
```

The output of the R-Script (from Console window) is given as follows:

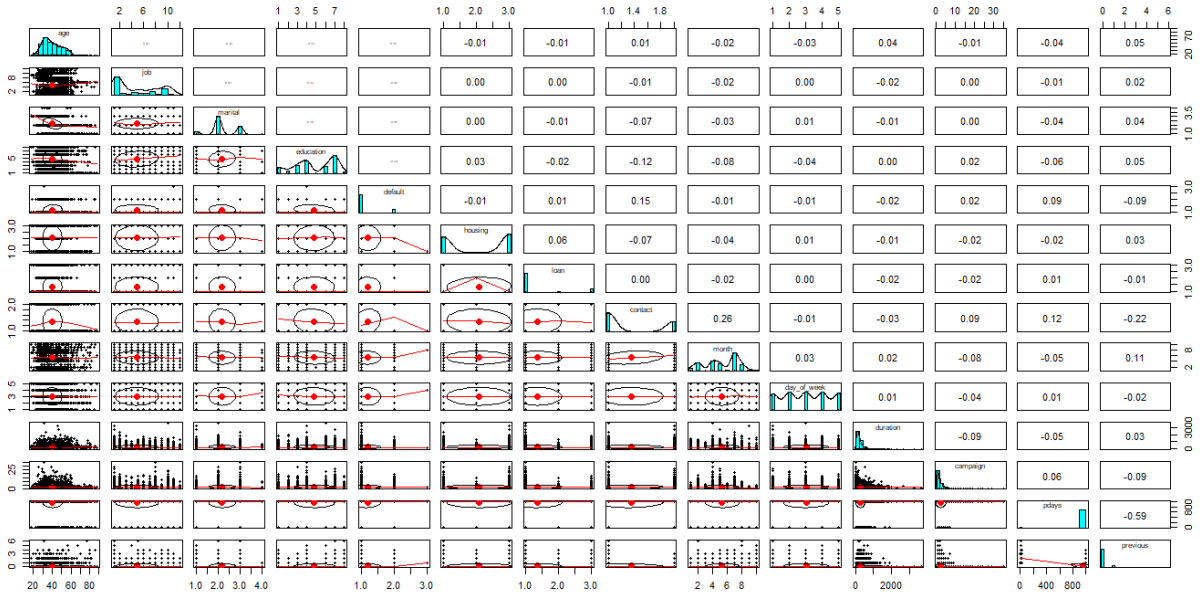
```
> library(psych)
> pairs.panels(bank[,1:6])
```




```
> pairs.panels(bank[,1:9])
```



```
> pairs.panels(bank[,1:14])
```




```
> summary(bank)
      age                    job           marital
 Min.   :18.00   admin.     :1012   divorced: 446
 1st Qu.:32.00   blue-collar: 884   married :2509
 Median :38.00   technician : 691   single  :1153
 Mean   :40.11   services   : 393   unknown :  11
 3rd Qu.:47.00   management : 324
 Max.   :88.00   retired    : 166
                 (Other)    : 649
               education       default        housing
 university.degree  :1264   no     :3315   no     :1839
 high.school        : 921   unknown: 803   unknown: 105
 basic.9y           : 574   yes    :   1   yes    :2175
 professional.course: 535
 basic.4y           : 429
 basic.6y           : 228
 (Other)            : 168
      loan            contact          month      day_of_week
 no     :3349   cellular :2652   may    :1378   fri:768
 unknown: 105   telephone:1467   jul    : 711   mon:855
 yes    : 665                    aug    : 636   thu:860
                                 jun    : 530   tue:841
                                 nov    : 446   wed:795
                                 apr    : 215
                                 (Other): 203
    duration         campaign          pdays
 Min.   :   0.0   Min.   : 1.000   Min.   :  0.0
 1st Qu.: 103.0   1st Qu.: 1.000   1st Qu.:999.0
 Median : 181.0   Median : 2.000   Median :999.0
 Mean   : 256.8   Mean   : 2.537   Mean   :960.4
 3rd Qu.: 317.0   3rd Qu.: 3.000   3rd Qu.:999.0
 Max.   :3643.0   Max.   :35.000   Max.   :999.0

    previous             poutcome     emp.var.rate
 Min.   :0.0000   failure    : 454   Min.   :-3.40000
 1st Qu.:0.0000   nonexistent:3523   1st Qu.:-1.80000
```

```
Median :0.0000   success    : 142   Median : 1.10000
Mean   :0.1903                      Mean   : 0.08497
3rd Qu.:0.0000                      3rd Qu.: 1.40000
Max.   :6.0000                      Max.   : 1.40000

cons.price.idx  cons.conf.idx     euribor3m      nr.employed
Min.   :92.20   Min.   :-50.8   Min.   :0.635   Min.   :4964
1st Qu.:93.08   1st Qu.:-42.7   1st Qu.:1.334   1st Qu.:5099
Median :93.75   Median :-41.8   Median :4.857   Median :5191
Mean   :93.58   Mean   :-40.5   Mean   :3.621   Mean   :5166
3rd Qu.:93.99   3rd Qu.:-36.4   3rd Qu.:4.961   3rd Qu.:5228
Max.   :94.77   Max.   :-26.9   Max.   :5.045   Max.   :5228

  y
no :3668
yes: 451
```