

# FDA

## LAB 3

### PRACTICE OF LAB-3

```
x<-c(9:20,1:5,3:7,0:8)
```

```
> x
```

```
[1] 9 10 11 12 13 14 15 16 17 18 19 20 1 2 3 4 5 3 4 5 6 7 0 1 2 3 4 5
```

```
[29] 6 7 8
```

```
> duplicated(x)
```

```
[1] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE  
FALSE FALSE FALSE
```

```
[15] FALSE FALSE FALSE TRUE TRUE TRUE FALSE FALSE FALSE TRUE TRUE TRUE  
TRUE TRUE
```

```
[29] TRUE TRUE FALSE
```

```
> x[duplicated(x)]
```

```
[1] 3 4 5 1 2 3 4 5 6 7
```

```
> x[!duplicated(x)]
```

```
[1] 9 10 11 12 13 14 15 16 17 18 19 20 1 2 3 4 5 6 7 0 8
```

```
> x[duplicated(x,fromLast=TRUE)]
```

```
[1] 1 2 3 4 5 3 4 5 6 7
```

```
> x[!duplicated(x,fromLast=TRUE)]
```

```
[1] 9 10 11 12 13 14 15 16 17 18 19 20 0 1 2 3 4 5 6 7 8
```

```
> which(duplicated(x))
```

```
[1] 18 19 20 24 25 26 27 28 29 30
```

```
> which(!duplicated(x))
```

```
[1] 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 21 22 23 31
```

```
> sum(duplicated(x))
```

```
[1] 10
```

```
> sum(!duplicated(x))
```

```
[1] 21
```

```
> a<-c(rep("A",3),rep("B",3),rep("c",2))
```

```
> b<-c(1,1,2,4,1,1,2,2)
```

```
> df<-data.frame(a,b)
> df
  a b
1 A 1
2 A 1
3 A 2
4 B 4
5 B 1
6 B 1
7 c 2
8 c 2
> duplicated(df)
[1] FALSE TRUE FALSE FALSE FALSE TRUE FALSE TRUE
> df[duplicated(df),]
  a b
2 A 1
6 B 1
8 c 2
> df[!duplicated(df),]
  a b
1 A 1
3 A 2
4 B 4
5 B 1
7 c 2
> which(duplicated(df))
[1] 2 6 8
> which(!duplicated(df))
[1] 1 3 4 5 7
> sum(duplicated(df))
[1] 3
> sum(!duplicated(df))
```

```
[1] 5
```

```
> iris
```

	Sepal.Length	Sepal.Width	Petal.Length	Petal.Width	Species
1	5.1	3.5	1.4	0.2	setosa
2	4.9	3.0	1.4	0.2	setosa
3	4.7	3.2	1.3	0.2	setosa
4	4.6	3.1	1.5	0.2	setosa
5	5.0	3.6	1.4	0.2	setosa
6	5.4	3.9	1.7	0.4	setosa
7	4.6	3.4	1.4	0.3	setosa
8	5.0	3.4	1.5	0.2	setosa
9	4.4	2.9	1.4	0.2	setosa
10	4.9	3.1	1.5	0.1	setosa
11	5.4	3.7	1.5	0.2	setosa
12	4.8	3.4	1.6	0.2	setosa
13	4.8	3.0	1.4	0.1	setosa
14	4.3	3.0	1.1	0.1	setosa
15	5.8	4.0	1.2	0.2	setosa
16	5.7	4.4	1.5	0.4	setosa
17	5.4	3.9	1.3	0.4	setosa
18	5.1	3.5	1.4	0.3	setosa
19	5.7	3.8	1.7	0.3	setosa
20	5.1	3.8	1.5	0.3	setosa
21	5.4	3.4	1.7	0.2	setosa
22	5.1	3.7	1.5	0.4	setosa
23	4.6	3.6	1.0	0.2	setosa
24	5.1	3.3	1.7	0.5	setosa
25	4.8	3.4	1.9	0.2	setosa
26	5.0	3.0	1.6	0.2	setosa
27	5.0	3.4	1.6	0.4	setosa
28	5.2	3.5	1.5	0.2	setosa
29	5.2	3.4	1.4	0.2	setosa

30	4.7	3.2	1.6	0.2	setosa
31	4.8	3.1	1.6	0.2	setosa
32	5.4	3.4	1.5	0.4	setosa
33	5.2	4.1	1.5	0.1	setosa
34	5.5	4.2	1.4	0.2	setosa
35	4.9	3.1	1.5	0.2	setosa
36	5.0	3.2	1.2	0.2	setosa
37	5.5	3.5	1.3	0.2	setosa
38	4.9	3.6	1.4	0.1	setosa
39	4.4	3.0	1.3	0.2	setosa
40	5.1	3.4	1.5	0.2	setosa
41	5.0	3.5	1.3	0.3	setosa
42	4.5	2.3	1.3	0.3	setosa
43	4.4	3.2	1.3	0.2	setosa
44	5.0	3.5	1.6	0.6	setosa
45	5.1	3.8	1.9	0.4	setosa
46	4.8	3.0	1.4	0.3	setosa
47	5.1	3.8	1.6	0.2	setosa
48	4.6	3.2	1.4	0.2	setosa
49	5.3	3.7	1.5	0.2	setosa
50	5.0	3.3	1.4	0.2	setosa
51	7.0	3.2	4.7	1.4	versicolor
52	6.4	3.2	4.5	1.5	versicolor
53	6.9	3.1	4.9	1.5	versicolor
54	5.5	2.3	4.0	1.3	versicolor
55	6.5	2.8	4.6	1.5	versicolor
56	5.7	2.8	4.5	1.3	versicolor
57	6.3	3.3	4.7	1.6	versicolor
58	4.9	2.4	3.3	1.0	versicolor
59	6.6	2.9	4.6	1.3	versicolor
60	5.2	2.7	3.9	1.4	versicolor
61	5.0	2.0	3.5	1.0	versicolor

62	5.9	3.0	4.2	1.5 versicolor
63	6.0	2.2	4.0	1.0 versicolor
64	6.1	2.9	4.7	1.4 versicolor
65	5.6	2.9	3.6	1.3 versicolor
66	6.7	3.1	4.4	1.4 versicolor
67	5.6	3.0	4.5	1.5 versicolor
68	5.8	2.7	4.1	1.0 versicolor
69	6.2	2.2	4.5	1.5 versicolor
70	5.6	2.5	3.9	1.1 versicolor
71	5.9	3.2	4.8	1.8 versicolor
72	6.1	2.8	4.0	1.3 versicolor
73	6.3	2.5	4.9	1.5 versicolor
74	6.1	2.8	4.7	1.2 versicolor
75	6.4	2.9	4.3	1.3 versicolor
76	6.6	3.0	4.4	1.4 versicolor
77	6.8	2.8	4.8	1.4 versicolor
78	6.7	3.0	5.0	1.7 versicolor
79	6.0	2.9	4.5	1.5 versicolor
80	5.7	2.6	3.5	1.0 versicolor
81	5.5	2.4	3.8	1.1 versicolor
82	5.5	2.4	3.7	1.0 versicolor
83	5.8	2.7	3.9	1.2 versicolor
84	6.0	2.7	5.1	1.6 versicolor
85	5.4	3.0	4.5	1.5 versicolor
86	6.0	3.4	4.5	1.6 versicolor
87	6.7	3.1	4.7	1.5 versicolor
88	6.3	2.3	4.4	1.3 versicolor
89	5.6	3.0	4.1	1.3 versicolor
90	5.5	2.5	4.0	1.3 versicolor
91	5.5	2.6	4.4	1.2 versicolor
92	6.1	3.0	4.6	1.4 versicolor
93	5.8	2.6	4.0	1.2 versicolor

94	5.0	2.3	3.3	1.0 versicolor
95	5.6	2.7	4.2	1.3 versicolor
96	5.7	3.0	4.2	1.2 versicolor
97	5.7	2.9	4.2	1.3 versicolor
98	6.2	2.9	4.3	1.3 versicolor
99	5.1	2.5	3.0	1.1 versicolor
100	5.7	2.8	4.1	1.3 versicolor
101	6.3	3.3	6.0	2.5 virginica
102	5.8	2.7	5.1	1.9 virginica
103	7.1	3.0	5.9	2.1 virginica
104	6.3	2.9	5.6	1.8 virginica
105	6.5	3.0	5.8	2.2 virginica
106	7.6	3.0	6.6	2.1 virginica
107	4.9	2.5	4.5	1.7 virginica
108	7.3	2.9	6.3	1.8 virginica
109	6.7	2.5	5.8	1.8 virginica
110	7.2	3.6	6.1	2.5 virginica
111	6.5	3.2	5.1	2.0 virginica
112	6.4	2.7	5.3	1.9 virginica
113	6.8	3.0	5.5	2.1 virginica
114	5.7	2.5	5.0	2.0 virginica
115	5.8	2.8	5.1	2.4 virginica
116	6.4	3.2	5.3	2.3 virginica
117	6.5	3.0	5.5	1.8 virginica
118	7.7	3.8	6.7	2.2 virginica
119	7.7	2.6	6.9	2.3 virginica
120	6.0	2.2	5.0	1.5 virginica
121	6.9	3.2	5.7	2.3 virginica
122	5.6	2.8	4.9	2.0 virginica
123	7.7	2.8	6.7	2.0 virginica
124	6.3	2.7	4.9	1.8 virginica
125	6.7	3.3	5.7	2.1 virginica

126	7.2	3.2	6.0	1.8	virginica
127	6.2	2.8	4.8	1.8	virginica
128	6.1	3.0	4.9	1.8	virginica
129	6.4	2.8	5.6	2.1	virginica
130	7.2	3.0	5.8	1.6	virginica
131	7.4	2.8	6.1	1.9	virginica
132	7.9	3.8	6.4	2.0	virginica
133	6.4	2.8	5.6	2.2	virginica
134	6.3	2.8	5.1	1.5	virginica
135	6.1	2.6	5.6	1.4	virginica
136	7.7	3.0	6.1	2.3	virginica
137	6.3	3.4	5.6	2.4	virginica
138	6.4	3.1	5.5	1.8	virginica
139	6.0	3.0	4.8	1.8	virginica
140	6.9	3.1	5.4	2.1	virginica
141	6.7	3.1	5.6	2.4	virginica
142	6.9	3.1	5.1	2.3	virginica
143	5.8	2.7	5.1	1.9	virginica
144	6.8	3.2	5.9	2.3	virginica
145	6.7	3.3	5.7	2.5	virginica
146	6.7	3.0	5.2	2.3	virginica
147	6.3	2.5	5.0	1.9	virginica
148	6.5	3.0	5.2	2.0	virginica
149	6.2	3.4	5.4	2.3	virginica
150	5.9	3.0	5.1	1.8	virginica

```
> str(iris)
```

```
'data.frame':   150 obs. of  5 variables:
```

```
$ Sepal.Length: num  5.1 4.9 4.7 4.6 5 5.4 4.6 5 4.4 4.9 ...
```

```
$ Sepal.Width : num  3.5 3 3.2 3.1 3.6 3.9 3.4 3.4 2.9 3.1 ...
```

```
$ Petal.Length: num  1.4 1.4 1.3 1.5 1.4 1.7 1.4 1.5 1.4 1.5 ...
```

```
$ Petal.Width : num  0.2 0.2 0.2 0.2 0.2 0.4 0.3 0.2 0.2 0.1 ...
```

```
$ Species      : Factor w/ 3 levels "setosa","versicolor",...: 1 1 1 1 1 1 1 1 1 1 ...
```

```
> summary(iris)
```

```
 Sepal.Length Sepal.Width Petal.Length Petal.Width Species
Min. :4.300 Min. :2.000 Min. :1.000 Min. :0.100 setosa :50
1st Qu.:5.100 1st Qu.:2.800 1st Qu.:1.600 1st Qu.:0.300 versicolor:50
Median :5.800 Median :3.000 Median :4.350 Median :1.300 virginica :50
Mean :5.843 Mean :3.057 Mean :3.758 Mean :1.199
3rd Qu.:6.400 3rd Qu.:3.300 3rd Qu.:5.100 3rd Qu.:1.800
Max. :7.900 Max. :4.400 Max. :6.900 Max. :2.500
```

```
> nrow(iris)
```

```
[1] 150
```

```
> duplicated(iris)
```

```
[1] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
FALSE FALSE FALSE
```

```
[15] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
FALSE FALSE FALSE
```

```
[29] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
FALSE FALSE FALSE
```

```
[43] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
FALSE FALSE FALSE
```

```
[57] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
FALSE FALSE FALSE
```

```
[71] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
FALSE FALSE FALSE
```

```
[85] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
FALSE FALSE FALSE
```

```
[99] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
FALSE FALSE FALSE
```

```
[113] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
FALSE FALSE FALSE
```

```
[127] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
FALSE FALSE FALSE
```

```
[141] FALSE FALSE TRUE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
```

```
> iris[duplicated(iris),]
```

```
 Sepal.Length Sepal.Width Petal.Length Petal.Width Species
143         5.8         2.7         5.1         1.9 virginica
```

```
> iris[!duplicated(iris),]
```



	Sepal.Length	Sepal.Width	Petal.Length	Petal.Width	Species
1	5.1	3.5	1.4	0.2	setosa
2	4.9	3.0	1.4	0.2	setosa
3	4.7	3.2	1.3	0.2	setosa
4	4.6	3.1	1.5	0.2	setosa
5	5.0	3.6	1.4	0.2	setosa
6	5.4	3.9	1.7	0.4	setosa
7	4.6	3.4	1.4	0.3	setosa
8	5.0	3.4	1.5	0.2	setosa
9	4.4	2.9	1.4	0.2	setosa
10	4.9	3.1	1.5	0.1	setosa
11	5.4	3.7	1.5	0.2	setosa
12	4.8	3.4	1.6	0.2	setosa
13	4.8	3.0	1.4	0.1	setosa
14	4.3	3.0	1.1	0.1	setosa
15	5.8	4.0	1.2	0.2	setosa
16	5.7	4.4	1.5	0.4	setosa
17	5.4	3.9	1.3	0.4	setosa
18	5.1	3.5	1.4	0.3	setosa
19	5.7	3.8	1.7	0.3	setosa
20	5.1	3.8	1.5	0.3	setosa
21	5.4	3.4	1.7	0.2	setosa
22	5.1	3.7	1.5	0.4	setosa
23	4.6	3.6	1.0	0.2	setosa
24	5.1	3.3	1.7	0.5	setosa
25	4.8	3.4	1.9	0.2	setosa
26	5.0	3.0	1.6	0.2	setosa
27	5.0	3.4	1.6	0.4	setosa
28	5.2	3.5	1.5	0.2	setosa
29	5.2	3.4	1.4	0.2	setosa
30	4.7	3.2	1.6	0.2	setosa
31	4.8	3.1	1.6	0.2	setosa

32	5.4	3.4	1.5	0.4	setosa
33	5.2	4.1	1.5	0.1	setosa
34	5.5	4.2	1.4	0.2	setosa
35	4.9	3.1	1.5	0.2	setosa
36	5.0	3.2	1.2	0.2	setosa
37	5.5	3.5	1.3	0.2	setosa
38	4.9	3.6	1.4	0.1	setosa
39	4.4	3.0	1.3	0.2	setosa
40	5.1	3.4	1.5	0.2	setosa
41	5.0	3.5	1.3	0.3	setosa
42	4.5	2.3	1.3	0.3	setosa
43	4.4	3.2	1.3	0.2	setosa
44	5.0	3.5	1.6	0.6	setosa
45	5.1	3.8	1.9	0.4	setosa
46	4.8	3.0	1.4	0.3	setosa
47	5.1	3.8	1.6	0.2	setosa
48	4.6	3.2	1.4	0.2	setosa
49	5.3	3.7	1.5	0.2	setosa
50	5.0	3.3	1.4	0.2	setosa
51	7.0	3.2	4.7	1.4	versicolor
52	6.4	3.2	4.5	1.5	versicolor
53	6.9	3.1	4.9	1.5	versicolor
54	5.5	2.3	4.0	1.3	versicolor
55	6.5	2.8	4.6	1.5	versicolor
56	5.7	2.8	4.5	1.3	versicolor
57	6.3	3.3	4.7	1.6	versicolor
58	4.9	2.4	3.3	1.0	versicolor
59	6.6	2.9	4.6	1.3	versicolor
60	5.2	2.7	3.9	1.4	versicolor
61	5.0	2.0	3.5	1.0	versicolor
62	5.9	3.0	4.2	1.5	versicolor
63	6.0	2.2	4.0	1.0	versicolor

64	6.1	2.9	4.7	1.4 versicolor
65	5.6	2.9	3.6	1.3 versicolor
66	6.7	3.1	4.4	1.4 versicolor
67	5.6	3.0	4.5	1.5 versicolor
68	5.8	2.7	4.1	1.0 versicolor
69	6.2	2.2	4.5	1.5 versicolor
70	5.6	2.5	3.9	1.1 versicolor
71	5.9	3.2	4.8	1.8 versicolor
72	6.1	2.8	4.0	1.3 versicolor
73	6.3	2.5	4.9	1.5 versicolor
74	6.1	2.8	4.7	1.2 versicolor
75	6.4	2.9	4.3	1.3 versicolor
76	6.6	3.0	4.4	1.4 versicolor
77	6.8	2.8	4.8	1.4 versicolor
78	6.7	3.0	5.0	1.7 versicolor
79	6.0	2.9	4.5	1.5 versicolor
80	5.7	2.6	3.5	1.0 versicolor
81	5.5	2.4	3.8	1.1 versicolor
82	5.5	2.4	3.7	1.0 versicolor
83	5.8	2.7	3.9	1.2 versicolor
84	6.0	2.7	5.1	1.6 versicolor
85	5.4	3.0	4.5	1.5 versicolor
86	6.0	3.4	4.5	1.6 versicolor
87	6.7	3.1	4.7	1.5 versicolor
88	6.3	2.3	4.4	1.3 versicolor
89	5.6	3.0	4.1	1.3 versicolor
90	5.5	2.5	4.0	1.3 versicolor
91	5.5	2.6	4.4	1.2 versicolor
92	6.1	3.0	4.6	1.4 versicolor
93	5.8	2.6	4.0	1.2 versicolor
94	5.0	2.3	3.3	1.0 versicolor
95	5.6	2.7	4.2	1.3 versicolor

96	5.7	3.0	4.2	1.2 versicolor
97	5.7	2.9	4.2	1.3 versicolor
98	6.2	2.9	4.3	1.3 versicolor
99	5.1	2.5	3.0	1.1 versicolor
100	5.7	2.8	4.1	1.3 versicolor
101	6.3	3.3	6.0	2.5 virginica
102	5.8	2.7	5.1	1.9 virginica
103	7.1	3.0	5.9	2.1 virginica
104	6.3	2.9	5.6	1.8 virginica
105	6.5	3.0	5.8	2.2 virginica
106	7.6	3.0	6.6	2.1 virginica
107	4.9	2.5	4.5	1.7 virginica
108	7.3	2.9	6.3	1.8 virginica
109	6.7	2.5	5.8	1.8 virginica
110	7.2	3.6	6.1	2.5 virginica
111	6.5	3.2	5.1	2.0 virginica
112	6.4	2.7	5.3	1.9 virginica
113	6.8	3.0	5.5	2.1 virginica
114	5.7	2.5	5.0	2.0 virginica
115	5.8	2.8	5.1	2.4 virginica
116	6.4	3.2	5.3	2.3 virginica
117	6.5	3.0	5.5	1.8 virginica
118	7.7	3.8	6.7	2.2 virginica
119	7.7	2.6	6.9	2.3 virginica
120	6.0	2.2	5.0	1.5 virginica
121	6.9	3.2	5.7	2.3 virginica
122	5.6	2.8	4.9	2.0 virginica
123	7.7	2.8	6.7	2.0 virginica
124	6.3	2.7	4.9	1.8 virginica
125	6.7	3.3	5.7	2.1 virginica
126	7.2	3.2	6.0	1.8 virginica
127	6.2	2.8	4.8	1.8 virginica

128	6.1	3.0	4.9	1.8	virginica
129	6.4	2.8	5.6	2.1	virginica
130	7.2	3.0	5.8	1.6	virginica
131	7.4	2.8	6.1	1.9	virginica
132	7.9	3.8	6.4	2.0	virginica
133	6.4	2.8	5.6	2.2	virginica
134	6.3	2.8	5.1	1.5	virginica
135	6.1	2.6	5.6	1.4	virginica
136	7.7	3.0	6.1	2.3	virginica
137	6.3	3.4	5.6	2.4	virginica
138	6.4	3.1	5.5	1.8	virginica
139	6.0	3.0	4.8	1.8	virginica
140	6.9	3.1	5.4	2.1	virginica
141	6.7	3.1	5.6	2.4	virginica
142	6.9	3.1	5.1	2.3	virginica
144	6.8	3.2	5.9	2.3	virginica
145	6.7	3.3	5.7	2.5	virginica
146	6.7	3.0	5.2	2.3	virginica
147	6.3	2.5	5.0	1.9	virginica
148	6.5	3.0	5.2	2.0	virginica
149	6.2	3.4	5.4	2.3	virginica
150	5.9	3.0	5.1	1.8	virginica

```
> which(duplicated(iris),)
```

```
[1] 143
```

```
> which(duplicated(iris),)
```

```
[1] 143
```

```
> which(!duplicated(iris),)
```

```
[1] 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
```

```
[22] 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42
```

```
[43] 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63
```

```
[64] 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84
```

```
[85] 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105
```

```
[106] 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126
```

```
[127] 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 144 145 146 147 148
```

```
[148] 149 150
```

```
> sum(duplicated(iris));
```

```
[1] 1
```

```
> sum(!duplicated(iris));
```

```
[1] 149
```

```
> vae
```

```
Error: object 'vae' not found
```

```
> var(8)
```

```
[1] NA
```

```
> as.numeric(c("1","2","three","4"))
```

```
[1] 1 2 NA 4
```

```
Warning message:
```

```
NAs introduced by coercion
```

```
> NA-1
```

```
[1] NA
```

```
> a<-data.frame(a=1:3,b=2:4)
```

```
> a
```

```
  a b
```

```
1 1 2
```

```
2 2 3
```

```
3 3 4
```

```
> a[,4]
```

```
Error in `[.data.frame`(a, , 4) : undefined columns selected
```

```
> airquality
```

```
  Ozone Solar.R Wind Temp Month Day
```

```
1   41   190 7.4  67   5   1
```

```
2   36   118 8.0  72   5   2
```

```
3   12   149 12.6  74   5   3
```

```
4   18   313 11.5  62   5   4
```

```
5   NA    NA 14.3  56   5   5
```

6	28	NA	14.9	66	5	6
7	23	299	8.6	65	5	7
8	19	99	13.8	59	5	8
9	8	19	20.1	61	5	9
10	NA	194	8.6	69	5	10
11	7	NA	6.9	74	5	11
12	16	256	9.7	69	5	12
13	11	290	9.2	66	5	13
14	14	274	10.9	68	5	14
15	18	65	13.2	58	5	15
16	14	334	11.5	64	5	16
17	34	307	12.0	66	5	17
18	6	78	18.4	57	5	18
19	30	322	11.5	68	5	19
20	11	44	9.7	62	5	20
21	1	8	9.7	59	5	21
22	11	320	16.6	73	5	22
23	4	25	9.7	61	5	23
24	32	92	12.0	61	5	24
25	NA	66	16.6	57	5	25
26	NA	266	14.9	58	5	26
27	NA	NA	8.0	57	5	27
28	23	13	12.0	67	5	28
29	45	252	14.9	81	5	29
30	115	223	5.7	79	5	30
31	37	279	7.4	76	5	31
32	NA	286	8.6	78	6	1
33	NA	287	9.7	74	6	2
34	NA	242	16.1	67	6	3
35	NA	186	9.2	84	6	4
36	NA	220	8.6	85	6	5
37	NA	264	14.3	79	6	6

38	29	127	9.7	82	6	7
39	NA	273	6.9	87	6	8
40	71	291	13.8	90	6	9
41	39	323	11.5	87	6	10
42	NA	259	10.9	93	6	11
43	NA	250	9.2	92	6	12
44	23	148	8.0	82	6	13
45	NA	332	13.8	80	6	14
46	NA	322	11.5	79	6	15
47	21	191	14.9	77	6	16
48	37	284	20.7	72	6	17
49	20	37	9.2	65	6	18
50	12	120	11.5	73	6	19
51	13	137	10.3	76	6	20
52	NA	150	6.3	77	6	21
53	NA	59	1.7	76	6	22
54	NA	91	4.6	76	6	23
55	NA	250	6.3	76	6	24
56	NA	135	8.0	75	6	25
57	NA	127	8.0	78	6	26
58	NA	47	10.3	73	6	27
59	NA	98	11.5	80	6	28
60	NA	31	14.9	77	6	29
61	NA	138	8.0	83	6	30
62	135	269	4.1	84	7	1
63	49	248	9.2	85	7	2
64	32	236	9.2	81	7	3
65	NA	101	10.9	84	7	4
66	64	175	4.6	83	7	5
67	40	314	10.9	83	7	6
68	77	276	5.1	88	7	7
69	97	267	6.3	92	7	8



70	97	272	5.7	92	7	9
71	85	175	7.4	89	7	10
72	NA	139	8.6	82	7	11
73	10	264	14.3	73	7	12
74	27	175	14.9	81	7	13
75	NA	291	14.9	91	7	14
76	7	48	14.3	80	7	15
77	48	260	6.9	81	7	16
78	35	274	10.3	82	7	17
79	61	285	6.3	84	7	18
80	79	187	5.1	87	7	19
81	63	220	11.5	85	7	20
82	16	7	6.9	74	7	21
83	NA	258	9.7	81	7	22
84	NA	295	11.5	82	7	23
85	80	294	8.6	86	7	24
86	108	223	8.0	85	7	25
87	20	81	8.6	82	7	26
88	52	82	12.0	86	7	27
89	82	213	7.4	88	7	28
90	50	275	7.4	86	7	29
91	64	253	7.4	83	7	30
92	59	254	9.2	81	7	31
93	39	83	6.9	81	8	1
94	9	24	13.8	81	8	2
95	16	77	7.4	82	8	3
96	78	NA	6.9	86	8	4
97	35	NA	7.4	85	8	5
98	66	NA	4.6	87	8	6
99	122	255	4.0	89	8	7
100	89	229	10.3	90	8	8
101	110	207	8.0	90	8	9

102	NA	222	8.6	92	8	10
103	NA	137	11.5	86	8	11
104	44	192	11.5	86	8	12
105	28	273	11.5	82	8	13
106	65	157	9.7	80	8	14
107	NA	64	11.5	79	8	15
108	22	71	10.3	77	8	16
109	59	51	6.3	79	8	17
110	23	115	7.4	76	8	18
111	31	244	10.9	78	8	19
112	44	190	10.3	78	8	20
113	21	259	15.5	77	8	21
114	9	36	14.3	72	8	22
115	NA	255	12.6	75	8	23
116	45	212	9.7	79	8	24
117	168	238	3.4	81	8	25
118	73	215	8.0	86	8	26
119	NA	153	5.7	88	8	27
120	76	203	9.7	97	8	28
121	118	225	2.3	94	8	29
122	84	237	6.3	96	8	30
123	85	188	6.3	94	8	31
124	96	167	6.9	91	9	1
125	78	197	5.1	92	9	2
126	73	183	2.8	93	9	3
127	91	189	4.6	93	9	4
128	47	95	7.4	87	9	5
129	32	92	15.5	84	9	6
130	20	252	10.9	80	9	7
131	23	220	10.3	78	9	8
132	21	230	10.9	75	9	9
133	24	259	9.7	73	9	10

```

134  44  236 14.9  81   9  11
135  21  259 15.5  76   9  12
136  28  238  6.3  77   9  13
137   9   24 10.9  71   9  14
138  13  112 11.5  71   9  15
139  46  237  6.9  78   9  16
140  18  224 13.8  67   9  17
141  13   27 10.3  76   9  18
142  24  238 10.3  68   9  19
143  16  201  8.0  82   9  20
144  13  238 12.6  64   9  21
145  23   14  9.2  71   9  22
146  36  139 10.3  81   9  23
147   7   49 10.3  69   9  24
148  14   20 16.6  63   9  25
149  30  193  6.9  70   9  26
150  NA   145 13.2  77   9  27
151  14  191 14.3  75   9  28
152  18  131  8.0  76   9  29
153  20  223 11.5  68   9  30

```

```
>str(airquality)
```

```
'data.frame':   153 obs. of  6 variables:
```

```
$ Ozone : int  41 36 12 18 NA 28 23 19 8 NA ...
```

```
$ Solar.R: int  190 118 149 313 NA NA 299 99 19 194 ...
```

```
$ Wind : num  7.4 8 12.6 11.5 14.3 14.9 8.6 13.8 20.1 8.6 ...
```

```
$ Temp : int  67 72 74 62 56 66 65 59 61 69 ...
```

```
$ Month : int  5 5 5 5 5 5 5 5 5 5 ...
```

```
$ Day : int  1 2 3 4 5 6 7 8 9 10 ...
```

```
> summary(airquality)
```

```

Ozone      Solar.R      Wind      Temp      Month
Min. : 1.00  Min. : 7.0  Min. : 1.700  Min. :56.00  Min. :5.000
1st Qu.: 18.00 1st Qu.:115.8 1st Qu.: 7.400 1st Qu.:72.00 1st Qu.:6.000

```

Median : 31.50   Median :205.0   Median : 9.700   Median :79.00   Median :7.000  
 Mean : 42.13   Mean :185.9   Mean : 9.958   Mean :77.88   Mean :6.993  
 3rd Qu.: 63.25   3rd Qu.:258.8   3rd Qu.:11.500   3rd Qu.:85.00   3rd Qu.:8.000  
 Max. :168.00   Max. :334.0   Max. :20.700   Max. :97.00   Max. :9.000  
 NA's :37   NA's :7

Day

Min. : 1.0  
 1st Qu.: 8.0  
 Median :16.0  
 Mean :15.8  
 3rd Qu.:23.0  
 Max. :31.0

> head(airquality)

Ozone Solar.R Wind Temp Month Day

1	41	190	7.4	67	5	1
2	36	118	8.0	72	5	2
3	12	149	12.6	74	5	3
4	18	313	11.5	62	5	4
5	NA	NA	14.3	56	5	5
6	28	NA	14.9	66	5	6

> tail(airquality)

Ozone Solar.R Wind Temp Month Day

148	14	20	16.6	63	9	25
149	30	193	6.9	70	9	26
150	NA	145	13.2	77	9	27
151	14	191	14.3	75	9	28
152	18	131	8.0	76	9	29
153	20	223	11.5	68	9	30

> airquality1=head(airquality)

> airquality1

Ozone Solar.R Wind Temp Month Day

```
1  41   190 7.4  67   5   1
2  36   118 8.0  72   5   2
3  12   149 12.6 74   5   3
4  18   313 11.5 62   5   4
5  NA    NA 14.3 56   5   5
6  28    NA 14.9 66   5   6
```

```
> is.na(airquality1)
```

```
  Ozone Solar.R  Wind  Temp Month  Day
```

```
1 FALSE  FALSE FALSE FALSE FALSE FALSE
2 FALSE  FALSE FALSE FALSE FALSE FALSE
3 FALSE  FALSE FALSE FALSE FALSE FALSE
4 FALSE  FALSE FALSE FALSE FALSE FALSE
5 TRUE   TRUE  FALSE FALSE FALSE FALSE
6 FALSE  TRUE  FALSE FALSE FALSE FALSE
```

```
> is.na(airquality)
```

```
  Ozone Solar.R  Wind  Temp Month  Day
```

```
[1,] FALSE  FALSE FALSE FALSE FALSE FALSE
[2,] FALSE  FALSE FALSE FALSE FALSE FALSE
[3,] FALSE  FALSE FALSE FALSE FALSE FALSE
[4,] FALSE  FALSE FALSE FALSE FALSE FALSE
[5,] TRUE   TRUE  FALSE FALSE FALSE FALSE
[6,] FALSE  TRUE  FALSE FALSE FALSE FALSE
[7,] FALSE  FALSE FALSE FALSE FALSE FALSE
[8,] FALSE  FALSE FALSE FALSE FALSE FALSE
[9,] FALSE  FALSE FALSE FALSE FALSE FALSE
[10,] TRUE  FALSE FALSE FALSE FALSE FALSE
[11,] FALSE  TRUE  FALSE FALSE FALSE FALSE
[12,] FALSE  FALSE FALSE FALSE FALSE FALSE
[13,] FALSE  FALSE FALSE FALSE FALSE FALSE
[14,] FALSE  FALSE FALSE FALSE FALSE FALSE
[15,] FALSE  FALSE FALSE FALSE FALSE FALSE
[16,] FALSE  FALSE FALSE FALSE FALSE FALSE
```

[17,] FALSE FALSE FALSE FALSE FALSE FALSE  
[18,] FALSE FALSE FALSE FALSE FALSE FALSE  
[19,] FALSE FALSE FALSE FALSE FALSE FALSE  
[20,] FALSE FALSE FALSE FALSE FALSE FALSE  
[21,] FALSE FALSE FALSE FALSE FALSE FALSE  
[22,] FALSE FALSE FALSE FALSE FALSE FALSE  
[23,] FALSE FALSE FALSE FALSE FALSE FALSE  
[24,] FALSE FALSE FALSE FALSE FALSE FALSE  
[25,] TRUE FALSE FALSE FALSE FALSE FALSE  
[26,] TRUE FALSE FALSE FALSE FALSE FALSE  
[27,] TRUE TRUE FALSE FALSE FALSE FALSE  
[28,] FALSE FALSE FALSE FALSE FALSE FALSE  
[29,] FALSE FALSE FALSE FALSE FALSE FALSE  
[30,] FALSE FALSE FALSE FALSE FALSE FALSE  
[31,] FALSE FALSE FALSE FALSE FALSE FALSE  
[32,] TRUE FALSE FALSE FALSE FALSE FALSE  
[33,] TRUE FALSE FALSE FALSE FALSE FALSE  
[34,] TRUE FALSE FALSE FALSE FALSE FALSE  
[35,] TRUE FALSE FALSE FALSE FALSE FALSE  
[36,] TRUE FALSE FALSE FALSE FALSE FALSE  
[37,] TRUE FALSE FALSE FALSE FALSE FALSE  
[38,] FALSE FALSE FALSE FALSE FALSE FALSE  
[39,] TRUE FALSE FALSE FALSE FALSE FALSE  
[40,] FALSE FALSE FALSE FALSE FALSE FALSE  
[41,] FALSE FALSE FALSE FALSE FALSE FALSE  
[42,] TRUE FALSE FALSE FALSE FALSE FALSE  
[43,] TRUE FALSE FALSE FALSE FALSE FALSE  
[44,] FALSE FALSE FALSE FALSE FALSE FALSE  
[45,] TRUE FALSE FALSE FALSE FALSE FALSE  
[46,] TRUE FALSE FALSE FALSE FALSE FALSE  
[47,] FALSE FALSE FALSE FALSE FALSE FALSE  
[48,] FALSE FALSE FALSE FALSE FALSE FALSE

[49,] FALSE FALSE FALSE FALSE FALSE FALSE  
[50,] FALSE FALSE FALSE FALSE FALSE FALSE  
[51,] FALSE FALSE FALSE FALSE FALSE FALSE  
[52,] TRUE FALSE FALSE FALSE FALSE FALSE  
[53,] TRUE FALSE FALSE FALSE FALSE FALSE  
[54,] TRUE FALSE FALSE FALSE FALSE FALSE  
[55,] TRUE FALSE FALSE FALSE FALSE FALSE  
[56,] TRUE FALSE FALSE FALSE FALSE FALSE  
[57,] TRUE FALSE FALSE FALSE FALSE FALSE  
[58,] TRUE FALSE FALSE FALSE FALSE FALSE  
[59,] TRUE FALSE FALSE FALSE FALSE FALSE  
[60,] TRUE FALSE FALSE FALSE FALSE FALSE  
[61,] TRUE FALSE FALSE FALSE FALSE FALSE  
[62,] FALSE FALSE FALSE FALSE FALSE FALSE  
[63,] FALSE FALSE FALSE FALSE FALSE FALSE  
[64,] FALSE FALSE FALSE FALSE FALSE FALSE  
[65,] TRUE FALSE FALSE FALSE FALSE FALSE  
[66,] FALSE FALSE FALSE FALSE FALSE FALSE  
[67,] FALSE FALSE FALSE FALSE FALSE FALSE  
[68,] FALSE FALSE FALSE FALSE FALSE FALSE  
[69,] FALSE FALSE FALSE FALSE FALSE FALSE  
[70,] FALSE FALSE FALSE FALSE FALSE FALSE  
[71,] FALSE FALSE FALSE FALSE FALSE FALSE  
[72,] TRUE FALSE FALSE FALSE FALSE FALSE  
[73,] FALSE FALSE FALSE FALSE FALSE FALSE  
[74,] FALSE FALSE FALSE FALSE FALSE FALSE  
[75,] TRUE FALSE FALSE FALSE FALSE FALSE  
[76,] FALSE FALSE FALSE FALSE FALSE FALSE  
[77,] FALSE FALSE FALSE FALSE FALSE FALSE  
[78,] FALSE FALSE FALSE FALSE FALSE FALSE  
[79,] FALSE FALSE FALSE FALSE FALSE FALSE  
[80,] FALSE FALSE FALSE FALSE FALSE FALSE

[81,] FALSE FALSE FALSE FALSE FALSE FALSE  
[82,] FALSE FALSE FALSE FALSE FALSE FALSE  
[83,] TRUE FALSE FALSE FALSE FALSE FALSE  
[84,] TRUE FALSE FALSE FALSE FALSE FALSE  
[85,] FALSE FALSE FALSE FALSE FALSE FALSE  
[86,] FALSE FALSE FALSE FALSE FALSE FALSE  
[87,] FALSE FALSE FALSE FALSE FALSE FALSE  
[88,] FALSE FALSE FALSE FALSE FALSE FALSE  
[89,] FALSE FALSE FALSE FALSE FALSE FALSE  
[90,] FALSE FALSE FALSE FALSE FALSE FALSE  
[91,] FALSE FALSE FALSE FALSE FALSE FALSE  
[92,] FALSE FALSE FALSE FALSE FALSE FALSE  
[93,] FALSE FALSE FALSE FALSE FALSE FALSE  
[94,] FALSE FALSE FALSE FALSE FALSE FALSE  
[95,] FALSE FALSE FALSE FALSE FALSE FALSE  
[96,] FALSE TRUE FALSE FALSE FALSE FALSE  
[97,] FALSE TRUE FALSE FALSE FALSE FALSE  
[98,] FALSE TRUE FALSE FALSE FALSE FALSE  
[99,] FALSE FALSE FALSE FALSE FALSE FALSE  
[100,] FALSE FALSE FALSE FALSE FALSE FALSE  
[101,] FALSE FALSE FALSE FALSE FALSE FALSE  
[102,] TRUE FALSE FALSE FALSE FALSE FALSE  
[103,] TRUE FALSE FALSE FALSE FALSE FALSE  
[104,] FALSE FALSE FALSE FALSE FALSE FALSE  
[105,] FALSE FALSE FALSE FALSE FALSE FALSE  
[106,] FALSE FALSE FALSE FALSE FALSE FALSE  
[107,] TRUE FALSE FALSE FALSE FALSE FALSE  
[108,] FALSE FALSE FALSE FALSE FALSE FALSE  
[109,] FALSE FALSE FALSE FALSE FALSE FALSE  
[110,] FALSE FALSE FALSE FALSE FALSE FALSE  
[111,] FALSE FALSE FALSE FALSE FALSE FALSE  
[112,] FALSE FALSE FALSE FALSE FALSE FALSE



[113,] FALSE FALSE FALSE FALSE FALSE FALSE  
[114,] FALSE FALSE FALSE FALSE FALSE FALSE  
[115,] TRUE FALSE FALSE FALSE FALSE FALSE  
[116,] FALSE FALSE FALSE FALSE FALSE FALSE  
[117,] FALSE FALSE FALSE FALSE FALSE FALSE  
[118,] FALSE FALSE FALSE FALSE FALSE FALSE  
[119,] TRUE FALSE FALSE FALSE FALSE FALSE  
[120,] FALSE FALSE FALSE FALSE FALSE FALSE  
[121,] FALSE FALSE FALSE FALSE FALSE FALSE  
[122,] FALSE FALSE FALSE FALSE FALSE FALSE  
[123,] FALSE FALSE FALSE FALSE FALSE FALSE  
[124,] FALSE FALSE FALSE FALSE FALSE FALSE  
[125,] FALSE FALSE FALSE FALSE FALSE FALSE  
[126,] FALSE FALSE FALSE FALSE FALSE FALSE  
[127,] FALSE FALSE FALSE FALSE FALSE FALSE  
[128,] FALSE FALSE FALSE FALSE FALSE FALSE  
[129,] FALSE FALSE FALSE FALSE FALSE FALSE  
[130,] FALSE FALSE FALSE FALSE FALSE FALSE  
[131,] FALSE FALSE FALSE FALSE FALSE FALSE  
[132,] FALSE FALSE FALSE FALSE FALSE FALSE  
[133,] FALSE FALSE FALSE FALSE FALSE FALSE  
[134,] FALSE FALSE FALSE FALSE FALSE FALSE  
[135,] FALSE FALSE FALSE FALSE FALSE FALSE  
[136,] FALSE FALSE FALSE FALSE FALSE FALSE  
[137,] FALSE FALSE FALSE FALSE FALSE FALSE  
[138,] FALSE FALSE FALSE FALSE FALSE FALSE  
[139,] FALSE FALSE FALSE FALSE FALSE FALSE  
[140,] FALSE FALSE FALSE FALSE FALSE FALSE  
[141,] FALSE FALSE FALSE FALSE FALSE FALSE  
[142,] FALSE FALSE FALSE FALSE FALSE FALSE  
[143,] FALSE FALSE FALSE FALSE FALSE FALSE  
[144,] FALSE FALSE FALSE FALSE FALSE FALSE

```
[145,] FALSE FALSE FALSE FALSE FALSE FALSE
[146,] FALSE FALSE FALSE FALSE FALSE FALSE
[147,] FALSE FALSE FALSE FALSE FALSE FALSE
[148,] FALSE FALSE FALSE FALSE FALSE FALSE
[149,] FALSE FALSE FALSE FALSE FALSE FALSE
[150,] TRUE  FALSE FALSE FALSE FALSE FALSE
[151,] FALSE FALSE FALSE FALSE FALSE FALSE
[152,] FALSE FALSE FALSE FALSE FALSE FALSE
[153,] FALSE FALSE FALSE FALSE FALSE FALSE
> which(is.na(airquality))
[1]  5 10 25 26 27 32 33 34 35 36 37 39 42 43 45 46 52 53 54 55 56
[22] 57 58 59 60 61 65 72 75 83 84 102 103 107 115 119 150 158 159 164 180 249
[43] 250 251
> sum(is.na(airquality))
[1] 44
> airquality<-Na
Error: object 'Na' not found
> airquality<-NA
> airquality
[1] NA
> na.omit(airquality)
logical(0)
attr("na.action")
[1] 1
attr("class")
[1] "omit"
> complete.cases(airquality)
[1] FALSE
> na.omit
function (object, ...)
UseMethod("na.omit")
<bytecode: 0x00000220c0c4f2d0>
```

```
<environment: namespace:stats>
> na.omit(airquality)
logical(0)
attr("na.action")
[1] 1
attr("class")
[1] "omit"
> na.exclude(airquality)
logical(0)
attr("na.action")
[1] 1
attr("class")
[1] "exclude"
> complete_records<-airquality[!complete.cases(airquality)]
> complete_records
[1] NA
> x[x<6]<-0
> x
[1] 0 0 0 6 7 8
> x[4:8]<-100
> x
[1] 0 0 0 100 100 100 100 100
> x[x<5|x>6]
[1] 0 0 0 100 100 100 100 100
> x[x<5|x>6]<-50
> x
[1] 50 50 50 50 50 50 50 50
> x[x<6]<-50
> x
[1] 50 50 50 50 50 50 50 50
> x[x<5|x>6]<-NA
>
```

```
> x
```

```
[1] NA NA NA NA NA NA NA NA
```

```
> is.na(x)
```

```
[1] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
```

```
> mean(x)
```

```
[1] NA
```

```
> x<-c(3,4,5,6,7,8)
```

```
> x
```

```
[1] 3 4 5 6 7 8
```

```
> mean(x)
```

```
[1] 5.5
```

```
> median(x)
```

```
[1] 5.5
```

```
> diff(NA&"NA")
```

Error in NA & "NA" :

operations are possible only for numeric, logical or complex types

```
> A<-c(3,2,NA,5,3,7,NA,NA,5,2,6)
```

```
> B<-C(3,2,NA,5,3,7,NA,"NA",5,2,6)
```

Error in C(3, 2, NA, 5, 3, 7, NA, "NA", 5, 2, 6) :

object not interpretable as a factor

```
> B<-c(3,2,NA,5,3,7,NA,"NA",5,2,6)
```

```
> length(A)
```

```
[1] 11
```

```
> length(B)
```

```
[1] 11
```

```
> function sort(A)
```

Error: unexpected symbol in "function sort"

```
> p<-functionsort(A)
```

Error in functionsort(A) : could not find function "functionsort"

```
> p<-sort(a)
```

Error in `[.data.frame`(x, order(x, na.last = na.last, decreasing = decreasing)) :

undefined columns selected

In addition: Warning message:

In xtfrm.data.frame(x) : cannot xtfrm data frames

```
> p<-sort(A)
```

```
> p
```

```
[1] 2 2 3 3 5 5 6 7
```

```
> q<-sort(B)
```

```
> q
```

```
[1] "2" "2" "3" "3" "5" "5" "6" "7" "NA"
```

```
> length(q)
```

```
[1] 9
```

```
> airquality
```

```
[1] NA
```

```
>
```