## KHAN MOHD OWAIS RAZA 20BCD7138

```
Q1. Create a vector as x < c(9:20, 1:5, 3:7, 0:8)
1] Use duplicated() function to print the logical
vector indicating the duplicate values present in x
2| Observe the output of duplicated(x, fromLast = TRUE)
3| What is the difference between duplicated(x) and duplicated(x,fromLast=TRUE)?
4] Extract duplicate elements from x
5] Extract unique elements from x
6| Print duplicate elements from x in different
order (Hint: Use duplicated(x, fromLast = TRUE))
7] Extract unique elements from x in different order
(Hint: Use duplicated(x, fromLast = TRUE))
8| Print the indices of duplicate elements
9] Print the indices of unique elements
10] How many unique elements are in x?
11] How many duplicate elements are in x?
# Create the vector x
x \leftarrow c(9:20, 1:5, 3:7, 0:8)
# 1] Use duplicated() function to
# print logical vector indicating duplicate values
dup vector <- duplicated(x)</pre>
print(dup vector)
# 2] Use duplicated(x, fromLast = TRUE) to observe the output
dup vector from last <- duplicated(x, fromLast = TRUE)</pre>
print(dup vector from last)
# 3] The difference between duplicated(x)
# and duplicated(x, fromLast = TRUE)
# is the direction of checking for duplicates.
# duplicated(x) checks for duplicates from the first occurrence,
```

- # while duplicated(x, fromLast = TRUE) checks from the last occurrence.
- # 4] Extract duplicate elements from x
  duplicate\_elements <- x[dup\_vector]
  print(duplicate\_elements)</pre>
- # 5] Extract unique elements from x
  unique\_elements <- x[!dup\_vector]
  print(unique\_elements)</pre>
- # 6] Print duplicate elements from x in a different order
  # duplicate\_elements\_reverse <- x[dup\_vector\_from\_last]
  print(duplicate elements reverse)</pre>
- # 8] Extract unique elements from x in a different order
  unique\_elements\_reverse <- x[!dup\_vector\_from\_last]
  print(unique\_elements\_reverse)</pre>
- # 9] Print the indices of duplicate elements
  duplicate\_indices <- which(dup\_vector)
  print(duplicate\_indices)</pre>
- # 10] Print the indices of unique elements
  unique\_indices <- which(!dup\_vector)
  print(unique indices)</pre>
- # Count the number of unique elements in x
  num\_unique\_elements <- length(unique\_elements)
  print(num\_unique\_elements)</pre>
- # 11] Count the number of duplicate elements in x
  num\_duplicate\_elements <- length(duplicate\_elements)
  print(num\_duplicate\_elements)</pre>

```
R Console
> # Create the vector x
> x <- c(9:20, 1:5, 3:7, 0:8)
 [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 6
[30] 7 8
> # 1] Use duplicated() function to
> # print logical vector indicating duplicate values
> dup vector <- duplicated(x)
> print(dup vector)
 [1] FALSE FALSE
[15] FALSE FALSE FALSE TRUE TRUE TRUE FALSE FALSE TRUE TRUE TRUE TRUE TRUE
[29] TRUE TRUE FALSE
> # 2] Use duplicated(x, fromLast = TRUE) to observe the output
> dup vector from last <- duplicated(x, fromLast = TRUE)</pre>
> print(dup vector from last)
 [1] FALSE TRUE TRUE
     TRUE TRUE TRUE TRUE TRUE TRUE TRUE FALSE FALSE FALSE FALSE FALSE
[29] FALSE FALSE FALSE
> # 3] The difference between duplicated(x)
> # and duplicated(x, fromLast = TRUE)
> # is the direction of checking for duplicates.
> # duplicated(x) checks for duplicates from the first occurrence,
> # while duplicated(x, fromLast = TRUE) checks from the last occurrence.
> # 4] Extract duplicate elements from x
> duplicate elements <- x[dup vector]
> print(duplicate_elements)
[1] 3 4 5 1 2 3 4 5 6 7
> # 51 Extract unique elements from x
> unique_elements <- x[!dup_vector]
> print(unique_elements)
[1] 9 10 11 12 13 14 15 16 17 18 19 20 1 2 3 4 5 6 7 0 8
> # 6] Print duplicate elements from x in a different order
> # duplicate elements reverse <- x[dup vector from last]
> print(duplicate elements reverse)
 [1] 1 2 3 4 5 3 \overline{4} 5 6 7
> # 8] Extract unique elements from x in a different order
> unique elements reverse <- x[!dup vector from last]
> print(unique_elements_reverse)
[1] 9 10 11 12 13 14 15 16 17 18 19 20 0 1 2 3 4 5 6 7 8
> # 9] Print the indices of duplicate elements
> duplicate indices <- which (dup vector)
> print(duplicate_indices)
[1] 18 19 20 24 25 26 27 28 29 30
> # 10] Print the indices of unique elements
> unique_indices <- which(!dup_vector)
> print(unique_indices)
[1] 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 21 22 23 31
> # Count the number of unique elements in x
> num unique elements <- length(unique elements)
> print(num_unique_elements)
[1] 21
> # 11] Count the number of duplicate elements in x
> num_duplicate_elements <- length(duplicate_elements)
> print(num_duplicate_elements)
[1] 10
>
```

```
Q.2 Create a dataframe df:
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)
1] Use duplicated() function to print the logical
vector indicating the duplicate values present in dataframe "df"
2| Extract duplicate elements from dataframe "df"
3| Extract unique elements from dataframe "df"
4 Print the indices of duplicate elements
5] Print the indices of unique elements
6] How many unique elements are in dataframe "df"
7] How many duplicate elements are in dataframe "df"
# Create the dataframe df
a <- c(rep("A",3), rep("B",3), rep("C",2))
b \leftarrow c(1,1,2,4,1,1,2,2)
df <- data.frame(a,b)</pre>
df
# 1] Use duplicated() function to print
# logical vector indicating duplicate values
dup vector <- duplicated(df)</pre>
print(dup_vector)
# 2] Extract duplicate elements from dataframe df
duplicate rows <- df[dup vector, ]</pre>
print(duplicate rows)
# 3] Extract unique elements from dataframe df
unique rows <- df[!dup vector, ]</pre>
print(unique rows)
# 4] Print the indices of duplicate elements
duplicate indices <- which(dup vector)</pre>
print(duplicate_indices)
# 5] Print the indices of unique elements
unique indices <- which(!dup vector)</pre>
```

```
print(unique_indices)
```

- # 6] Count the number of unique elements in dataframe df
  num\_unique\_elements <- length(unique\_rows)
  print(num\_unique\_elements)</pre>
- # 7] Count the number of duplicate elements in dataframe df
  num\_duplicate\_elements <- length(duplicate\_rows)
  print(num duplicate elements)</pre>

```
R Console
> # Create the dataframe df
> 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)
5 B 1
7 C 2
> # 1] Use duplicated() function to print
> # logical vector indicating duplicate values
> dup vector <- duplicated(df)</pre>
> print(dup_vector)
[1] FALSE TRUE FALSE FALSE TRUE FALSE TRUE
> # 2] Extract duplicate elements from dataframe df
> duplicate rows <- df[dup vector, ]
> print(duplicate rows)
2 A 1
6 B 1
8 C 2
> # 3] Extract unique elements from dataframe df
> unique_rows <- df[!dup_vector, ]
> print(unique rows)
1 A 1
3 A 2
4 B 4
5 B 1
```

```
> # 4] Print the indices of duplicate elements
> duplicate indices <- which(dup vector)
> print(duplicate indices)
[1] 2 6 8
> # 5] Print the indices of unique elements
> unique indices <- which(!dup vector)
> print(unique indices)
[1] 1 3 4 5 7
> # 6] Count the number of unique elements in dataframe df
> num unique elements <- length(unique rows)
> print(num_unique elements)
[1] 2
> # 7] Count the number of duplicate elements in dataframe df
> num duplicate elements <- length(duplicate rows)</pre>
> print(num duplicate elements)
[1] 2
```

- Q.3 Consider a dataset Fisher's Iris Dataset
- 1] Print the dataset iris
- 2] Print the structure of the dataset iris
- 3] Print the summary of all the variables of the dataset iris (Hint: Use function summary())
- 4] How many of the variables (columns) are in the dataset iris?
- 5] How many observations (rows) are in the dataset iris?
- 6] Use duplicated() function to print the logical vector indicating the duplicate values present in the dataset iris
- 7] Extract duplicate elements from the dataset iris
- 8] Extract unique elements from the dataset iris
- 9] Print the indices of duplicate elements in the dataset iris
- 10] Print the indices of unique elements in the dataset iris
- 11] How many unique elements are in the dataset iris?
- 12] How many duplicate elements are in the dataset iris?

```
# 1. Print the dataset iris
print(iris)
# 2. Print the structure of the dataset iris
str(iris)
# 3. Print the summary of all the variables of the dataset iris
summary(iris)
```

```
# 4. How many variables (columns) are in the dataset iris?
num variables <- ncol(iris)</pre>
print(num variables)
# 5. How many observations (rows) are in the dataset iris?
num observations <- nrow(iris)</pre>
print(num observations)
# 6. Use duplicated() function to print the logical vector
indicating duplicate values
dup vector <- duplicated(iris)</pre>
print(dup vector)
# 7. Extract duplicate elements from the dataset iris
duplicate rows <- iris[dup vector, ]</pre>
print(duplicate rows)
# 8. Extract unique elements from the dataset iris
unique rows <- iris[!dup vector, ]</pre>
print(unique rows)
# 9. Print the indices of duplicate elements in the dataset iris
duplicate indices <- which(dup vector)</pre>
print(duplicate indices)
# 10. Print the indices of unique elements in the dataset iris
unique indices <- which(!dup vector)</pre>
print(unique indices)
# 11. How many unique elements are in the dataset iris?
num_unique_elements <- length(unique_rows)</pre>
print(num unique elements)
# 12. How many duplicate elements are in the dataset iris?
num duplicate elements <- length(duplicate rows)</pre>
print(num duplicate elements)
```

## > # 1. Print the dataset iris

	1. Print the	dataset iris	5		
> pr	rint(iris)	g1 mideb	D-4-1 T+h	Date 1 militar	g
1	Sepal.Length 5.1	Sepal.width	Petal.Length 1.4	0.2	Species 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 14	4.8 4.3	3.0 3.0	1.4 1.1	0.1	setosa 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 30	5.2 4.7	3.4 3.2	1.4 1.6	0.2	setosa 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 44	4.4 5.0	3.2 3.5	1.3 1.6	0.2	setosa 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		versicolor
53	6.9	3.1	4.9		versicolor
54	5.5	2.3	4.0		versicolor
55	6.5	2.8	4.6		versicolor
56	5.7	2.8	4.5		versicolor
57	6.3	3.3	4.7		versicolor
58 59	4.9	2.4	3.3 4.6		versicolor versicolor
60	6.6 5.2	2.9	3.9		versicolor
61	5.0	2.0	3.5		versicolor
62	5.9	3.0	4.2		versicolor
63	6.0	2.2	4.0		versicolor
64	6.1	2.9	4.7		versicolor
65	5.6	2.9	3.6		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 70 5.6 2.5 3.9 1.1 versicolor 70 5.6 2.5 3.9 1.1 versicolor 71 5.9 3.2 4.8 1.8 versicolor 71 5.9 3.2 4.8 1.8 versicolor 72 6.1 2.8 4.0 1.3 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 74 6.1 2.8 4.7 1.2 versicolor 75 6.4 2.9 4.3 1.3 versicolor 76 6.6 6.6 3.0 4.4 1.4 versicolor 77 6.8 2.8 4.8 1.8 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 80 5.5 2.4 3.0 1.1 versicolor 80 5.5 2.4 3.0 4.5 1.5 versicolor 80 5.5 2.6 4.0 1.3 versicolor 80 5.5 2.5 4.0 1.3 versicolor 90 5.5 5.6 2.7 4.2 1.3 versicolor 90 5.5 5.6 2.7 4.2 1.3 versicolor 90 5.7 2.9 4.2 1.3 v					
68					
69	67	5.6	3.0	4.5	1.5 versicolor
70	68	5.8	2.7	4.1	1.0 versicolor
70	69	6.2			1.5 versicolor
171					
172					
73					
74					
75					
76	74	6.1	2.8	4.7	1.2 versicolor
77	75	6.4	2.9	4.3	1.3 versicolor
77	76	6.6	3.0	4.4	1.4 versicolor
78					
79					
80					
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 1.3 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 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 5.9 2.1 virginica 107 4.9 2.5 4.5 1.7 virginica 108 7.3 2.9 6.3 1.8 virginica 109 7.2 3.6 6.1 2.5 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 2.9 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 2.7 5.3 2.9 virginica 117 6.5 3.0 5.5 2.1 virginica 118 7.7 2.8 6.9 2.3 virginica 119 7.7 2.6 6.9 2.3 virginica 110 7.2 3.6 6.9 2.3 virginica 111 6.5 3.0 5.5 2.1 virginica 112 6.4 2.7 5.3 2.9 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 2.1 virginica 118 7.7 2.8 6.9 2.3 virginica 129 6.0 2.2 virginica 120 6.0 2.2 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 2.2 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 1.5 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 6.4 2.0 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					
82 5.5 2.4 3.7 1.0 versicolor 84 6.0 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 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 92 6.1 3.0 4.6 1.2 versicolor 94 5.0 2.3 3.3 1.0 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 96 5.7 3.0 4.2 1.2 versicolor 97 5.7 2.9 4.2 1.3 versicolor 99 5.1 2.5 3.0 1.1 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 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 110 7.2 3.6 6.1 2.5 virginica 111 6.5 3.2 9 5.5 1.8 virginica 112 6.4 2.7 5.3 1.9 virginica 113 6.8 3.0 5.5 1.8 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 2.1 virginica 118 7.7 2.5 5.0 2.0 virginica 119 7.7 2.6 6.9 2.3 virginica 110 7.2 3.6 6.7 2.2 virginica 111 6.5 3.2 2.8 4.9 2.0 virginica 112 6.4 3.2 5.3 2.3 virginica 113 6.8 3.0 5.5 1.8 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 2.1 virginica 118 7.7 2.6 6.9 2.3 virginica 119 7.7 2.6 6.9 3.2 virginica 112 6.9 3.2 5.7 2.3 virginica 112 6.9 3.2 5.7 2.3 virginica 113 6.9 3.2 5.7 2.3 virginica 114 5.7 2.5 5.0 2.0 virginica 115 5.8 2.8 5.1 2.4 virginica 112 6.9 3.2 5.7 2.8 4.9 2.0 virginica 112 6.9 3.2 5.7 2.3 virginica 113 6.9 3.2 5.7 2.3 virginica 114 5.7 2.5 5.0 2.0 virginica 115 5.8 2.8 5.1 2.4 virginica 112 6.9 3.2 5.7 2.3 virginica 113 6.9 3.2 5.7 2.3 virginica 114 5.7 2.5 5.0 2.0 virginica 115 5.8 2.2 2.2 2.2 2.2 2.2 2.2 2.2 2.2 2.2 2					
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           90         5.5         2.6         4.4         1.2 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	81			3.8	1.1 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           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         1.3 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	82	5.5	2.4	3.7	1.0 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           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         1.3 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	83	5.8	2.7	3.9	1.2 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           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	84				
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           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					
87 6.7 3.1 4.7 1.5 versicolor 88 6.3 2.3 4.4 1.3 versicolor 90 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 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 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 2.1 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 3.8 6.7 2.2 virginica 127 6.2 2.8 4.9 1.0 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 1.8 virginica 122 5.6 2.8 4.9 2.0 virginica 123 7.7 2.8 6.1 1.9 virginica 124 6.3 2.7 1.9 1.8 virginica 125 6.7 3.3 5.7 2.1 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					
88         6.3         2.3         4.4         1.3 versicolor           90         5.5         2.5         4.0         1.3 versicolor           91         5.5         2.5         4.0         1.3 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         1.2 versicolor           96         5.7         3.0         4.2         1.2 versicolor           97         5.7         2.9         4.2         1.2 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					
89         5.6         3.0         4.1         1.3 versicolor           90         5.5         2.5         4.0         1.3 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           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         6.6         2.1 virginica           107					
90					
90	89	5.6	3.0	4.1	1.3 versicolor
91		5.5		4.0	1.3 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 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 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 2.9 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 110 6.9 3.2 5.7 2.3 virginica 111 6.5 3.2 5.1 2.4 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 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 2.2 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	91				
93					
94					
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         1.2 versicolor           98         6.2         2.9         4.3         1.3 versicolor           100         5.7         2.8         4.1         1.3 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					
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 5.8 2.2 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 109 6.7 2.5 5.8 1.8 virginica 101 6.5 3.2 5.1 2.0 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 2.5 5.0 2.0 virginica 119 7.7 2.6 6.9 2.3 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 2.2 virginica 122 5.6 2.8 4.9 2.0 virginica 123 7.7 2.8 6.7 2.2 virginica 124 6.3 2.7 4.9 1.8 virginica 125 6.7 2.2 virginica 127 6.2 2.8 4.9 2.0 virginica 128 6.1 3.0 4.9 1.8 virginica 129 6.4 2.8 5.6 2.1 virginica 129 6.4 2.8 5.6 2.1 virginica 130 7.2 3.0 5.8 1.6 virginica 129 6.4 2.8 5.6 2.1 virginica 131 7.4 2.8 6.1 3.0 4.9 1.8 virginica 132 7.9 3.8 6.4 2.0 virginica 133 6.4 2.8 5.6 2.1 virginica 133 6.4 2.8 5.6 2.2 virginica 134 6.3 2.8 5.1 1.5 virginica 134 6.3 2.8 5.1 1.5 virginica 135 6.4 2.8 5.6 2.2 virginica 134 6.3 2.8 5.1 1.5 virginica 134 6.3 2.8 5.1 1.5 virginica 135 6.4 2.8 5.6 2.2 virginica 135 6.4 2.8 5.6 2.2 virginica 136 6.4 2.8 5.6 2.2 virginica 137 6.4 2.8 5.6 2.2 virginica 133 6.4 2.8 5.6 2.2 virginica 134 6.3 2.8 5.1 1.5 virginica 134 6.3 2.8 5.1 1.5 virginica 135 6.4 2.8 5.6 2.2 virginica 136 6.4 2.8 5.6 2.2 virginica 137 6.4 2.8 5.6 2.2 virginica 138 6.4 2.2 virginica 139 6.4 2.8 5.6 2.2 virginica 130 6.4 2.8 5.1 1.5 virginica 130 6.4 2.8 5.6 1.1 5 virginica 130 6.4 2.8	94	5.0		3.3	1.0 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 5.8 2.2 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 109 6.7 2.5 5.8 1.8 virginica 101 6.5 3.2 5.1 2.0 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 2.5 5.0 2.0 virginica 119 7.7 2.6 6.9 2.3 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 2.2 virginica 122 5.6 2.8 4.9 2.0 virginica 123 7.7 2.8 6.7 2.2 virginica 124 6.3 2.7 4.9 1.8 virginica 125 6.7 2.2 virginica 127 6.2 2.8 4.9 2.0 virginica 128 6.1 3.0 4.9 1.8 virginica 129 6.4 2.8 5.6 2.1 virginica 129 6.4 2.8 5.6 2.1 virginica 130 7.2 3.0 5.8 1.6 virginica 129 6.4 2.8 5.6 2.1 virginica 131 7.4 2.8 6.1 3.0 4.9 1.8 virginica 132 7.9 3.8 6.4 2.0 virginica 133 6.4 2.8 5.6 2.1 virginica 133 6.4 2.8 5.6 2.2 virginica 134 6.3 2.8 5.1 1.5 virginica 134 6.3 2.8 5.1 1.5 virginica 135 6.4 2.8 5.6 2.2 virginica 134 6.3 2.8 5.1 1.5 virginica 134 6.3 2.8 5.1 1.5 virginica 135 6.4 2.8 5.6 2.2 virginica 135 6.4 2.8 5.6 2.2 virginica 136 6.4 2.8 5.6 2.2 virginica 137 6.4 2.8 5.6 2.2 virginica 133 6.4 2.8 5.6 2.2 virginica 134 6.3 2.8 5.1 1.5 virginica 134 6.3 2.8 5.1 1.5 virginica 135 6.4 2.8 5.6 2.2 virginica 136 6.4 2.8 5.6 2.2 virginica 137 6.4 2.8 5.6 2.2 virginica 138 6.4 2.2 virginica 139 6.4 2.8 5.6 2.2 virginica 130 6.4 2.8 5.1 1.5 virginica 130 6.4 2.8 5.6 1.1 5 virginica 130 6.4 2.8	95	5.6	2.7	4.2	1.3 versicolor
97 5.7 2.9 4.2 1.3 versicolor 98 6.2 2.9 4.3 1.3 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 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 100 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 2.2 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 1.5 virginica 127 6.2 2.8 4.9 2.0 virginica 128 6.1 3.0 4.9 1.8 virginica 129 6.4 2.8 5.6 2.1 virginica 130 7.2 3.8 6.7 2.0 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 1.5 virginica 127 6.2 2.8 4.8 1.8 virginica 128 6.1 3.0 4.9 1.8 virginica 130 7.2 3.2 6.0 1.9 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					
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 100 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 124 6.3 2.7 4.9 1.8 virginica 125 6.7 3.3 5.7 2.1 virginica 126 7.2 3.8 6.7 2.0 virginica 127 6.2 2.8 4.9 2.0 virginica 128 6.1 3.0 4.9 1.8 virginica 129 6.4 2.8 5.6 2.1 virginica 130 7.2 3.8 6.4 2.9 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 133 7.9 3.8 6.4 2.0 virginica 134 6.3 2.8 5.1 1.5 virginica					
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 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 119 7.7 2.6 6.9 2.3 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 1.5 virginica 127 6.2 2.8 4.9 2.0 virginica 128 6.1 3.0 4.9 2.0 virginica 129 6.4 2.8 5.6 2.1 virginica 129 6.4 2.8 5.6 2.1 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 133 6.4 2.8 5.6 2.2 virginica 133 6.4 2.8 5.6 2.2 virginica 134 6.3 2.8 5.1 1.5 virginica					
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           114         5.7         2.5         5.0         2.0 virginica           115         5.8         2.8         5.1         2.4 virginica           126				4.3	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 100 7.2 3.6 6.1 2.5 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 133 6.4 2.8 5.6 2.2 virginica 134 6.3 2.8 5.1 1.5 virginica	99	5.1	2.5	3.0	1.1 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 100 7.2 3.6 6.1 2.5 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 133 6.4 2.8 5.6 2.2 virginica 134 6.3 2.8 5.1 1.5 virginica	100				
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           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         <					
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         <					_
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         120       6.0       2.2       5.0					
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           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         <	103	7.1	3.0	5.9	<pre>2.1 virginica</pre>
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         <	104	6.3	2.9	5.6	1.8 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         2.6         6.9         2.3         virginica           120         6.0         2.2         <	105				
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       5.7       2.3 virginica         121       6.9       3.2       5.7       2.3 virginica         122       5.6       2.8       4.9       2.0 virginica         124       6.3					
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         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					
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         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					
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	108	7.3	2.9	6.3	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	109	6.7	2.5	5.8	1.8 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	110				
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         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         129       6.4       2.8       5.6					
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					
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		6.4			_
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         129       6.4       2.8       5.6       2.1       virginica         130       7.2       3.0       5.8	113	6.8	3.0	5.5	<pre>2.1 virginica</pre>
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         129       6.4       2.8       5.6       2.1       virginica         130       7.2       3.0       5.8	114	5.7	2.5	5.0	2.0 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         130       7.2       3.0       5.8       1.6       virginica         131       7.4       2.8       6.1					_
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         134       6.3					_
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         134       6.3       2.8       5.6       2.2 virginica         134       6.3					
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         134       6.3       2.8       5.6       2.2 virginica         15       virginica       1.5 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         134       6.3       2.8       5.6       2.2 virginica         15       virginica       1.5 virginica	118	7.7	3.8	6.7	2.2 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					
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					
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					
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					
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					
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	123	7.7	2.8	6.7	2.0 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	124	6.3		4.9	
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					
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					
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					
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					
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	128	6.1	3.0	4.9	1.8 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	129			5.6	
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					
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					
133 6.4 2.8 5.6 2.2 virginica 134 6.3 2.8 5.1 1.5 virginica					
134 6.3 2.8 5.1 1.5 virginica					
	134	6.3	2.8	5.1	1.5 virginica
	135				_

```
7.7 3.0 6.1
6.3 3.4 5.6
6.4 3.1 5.5
6.0 3.0 4.8
6.9 3.1 5.4
6.7 3.1 5.6
6.9 3.1 5.1
5.8 2.7 5.1
6.8 3.2 5.9
6.7 3.3 5.7
6.7 3.0 5.2
6.3 2.5 5.0
6.5 3.0 5.2
6.2 3.4 5.4
5.9 3.0 5.1
136
                                                                                                                                                                                                                                  2.3 virginica
                                                                                                                                                                                                                                  2.4 virginica
137
                                                                                                                                                                                                                                1.8 virginica
138
139
                                                                                                                                                                                                                                1.8 virginica
140
                                                                                                                                                                                                                                 2.1 virginica
141
                                                                                                                                                                                                                                 2.4 virginica
142
                                                                                                                                                                                                                                 2.3 virginica
                                                                                                                                                                                                                            2.3 virginica
1.9 virginica
2.3 virginica
2.5 virginica
2.3 virginica
1.9 virginica
2.0 virginica
2.3 virginica
2.3 virginica
143
144
145
 146
 147
 148
149
                                                                                                                                                                                                                                  1.8 virginica
150
> # 2. Print the structure of the dataset iris
> 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 ...
> # 3. Print the summary of all the variables of the dataset iris
> 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
> # 4. How many variables (columns) are in the dataset iris?
> num_variables <- ncol(iris)</pre>
 > print(num_variables)
[1] 5
> # 5. How many observations (rows) are in the dataset iris?
> num observations <- nrow(iris)
> print(num observations)
[1] 150
> # 6. Use duplicated() function to print the logical vector indicating duplicate values
> dup vector <- duplicated(iris)
> print(dup vector)
          [1] FALSE FALSE
    [19] FALSE F
    [37] FALSE F
    [55] FALSE F
    [73] FALSE F
     [91] FALSE F
  [109] FALSE FALSE
  [127] FALSE FALSE
 [145] FALSE FALSE FALSE FALSE FALSE
> # 7. Extract duplicate elements from the dataset iris
> duplicate_rows <- iris[dup_vector, ]</pre>
 > print(duplicate rows)
                Sepal.Length Sepal.Width Petal.Length Petal.Width Species
                                                                                                              2.7 5.1
143
                                                                                                                                                                                                       1.9 virginica
> # 8. Extract unique elements from the dataset iris
> unique_rows <- iris[!dup_vector, ]
> print(unique rows)
                Sepal.Length Sepal.Width Petal.Length Petal.Width Species
143
                                                                                                    2.7
                                                                                                                                                                      5.1
                                                                                                                                                                                                                             1.9 virginica
> # 8. Extract unique elements from the dataset iris
> unique_rows <- iris[!dup_vector, ]
> print(unique rows)
```

	Sepal.Length	Sepal.Width	Petal.Length	Petal.Width	Species
1		3.5	1.4	0.2	setosa
2		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		3.6	1.4	0.2	setosa
6		3.9	1.7	0.4	setosa
7		3.4	1.4	0.3	setosa
8		3.4	1.5	0.2	setosa
9		2.9	1.4	0.2	setosa
	.0 4.9	3.1	1.5	0.1	setosa
	.1 5.4	3.7	1.5	0.2	setosa
	.2 4.8	3.4	1.6	0.2	setosa
	.3 4.8	3.0	1.4	0.1	setosa
	4.3	3.0	1.1	0.1	setosa
	.5 5.8	4.0	1.2	0.2	setosa
	.6 5.7	4.4	1.5	0.4	setosa
	.7 5.4	3.9	1.3	0.4	setosa
	.8 5.1 .9 5.7	3.5 3.8	1.4 1.7	0.3 0.3	setosa
	0 5.1	3.8	1.5	0.3	setosa setosa
	1 5.4	3.4	1.7	0.3	setosa
	2 5.1	3.7	1.5	0.4	setosa
	3 4.6	3.6	1.0	0.2	setosa
	4 5.1	3.3	1.7	0.5	setosa
	5 4.8	3.4	1.9	0.2	setosa
	6 5.0	3.0	1.6	0.2	setosa
	7 5.0	3.4	1.6	0.4	setosa
2	8 5.2	3.5	1.5	0.2	setosa
	9 5.2	3.4	1.4	0.2	setosa
	4.7	3.2	1.6	0.2	setosa
	1 4.8	3.1	1.6	0.2	setosa
	5.4	3.4	1.5	0.4	setosa
	5.2 4 5.5	4.1 4.2	1.5 1.4	0.1	setosa setosa
	5 4.9	3.1	1.5	0.2	setosa
	5.0	3.2	1.2	0.2	setosa
	5.5	3.5	1.3	0.2	setosa
3	8 4.9	3.6	1.4	0.1	setosa
	9 4.4	3.0	1.3	0.2	setosa
	0 5.1	3.4	1.5	0.2	setosa
	1 5.0	3.5	1.3	0.3	setosa
	2 4.5	2.3 3.2	1.3 1.3	0.3	setosa setosa
	4 5.0	3.5	1.6	0.6	setosa
	5 5.1	3.8	1.9	0.4	setosa
	6 4.8	3.0	1.4	0.3	setosa
4	7 5.1	3.8	1.6	0.2	setosa
	8 4.6	3.2	1.4	0.2	setosa
	9 5.3	3.7	1.5	0.2	setosa
	5.0	3.3	1.4	0.2	setosa
	7.0 2 6.4	3.2 3.2	4.7 4.5		versicolor versicolor
	3 6.9	3.1	4.9		versicolor
	5.5	2.3	4.0		versicolor
	6.5	2.8	4.6		versicolor
5	5.7	2.8	4.5	1.3	versicolor
	6.3	3.3	4.7		versicolor
	8 4.9	2.4	3.3		versicolor
	6.6	2.9	4.6		versicolor
	5.2	2.7	3.9		versicolor
	5.0	2.0	3.5		versicolor
	52 5.9 53 6.0	3.0 2.2	4.2 4.0		versicolor versicolor
	6.1	2.9	4.7		versicolor
	5 5.6	2.9	3.6		versicolor
	3.0	2.0	2.0	2.0	

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				1.0 versicolor
	5.5	2.4	3.7	
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
				1.5 versicolor
87	6.7	3.1	4.7	
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	
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	<pre>2.1 virginica</pre>
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
100	6.0	0 0	F 0	4 5
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
133		2.0	5.0	1.4 Virginica

```
6.1 2.3 virginica
5.6 2.4 virginica
5.5 1.8 virginica
4.8 1.8 virginica
5.4 2.1 virginica
5.6 2.4 virginica
5.6 2.3 virginica
5.7 2.3 virginica
5.7 2.5 virginica
5.2 2.3 virginica
5.0 1.9 virginica
5.2 2.0 virginica
5.4 2.3 virginica
5.4 2.3 virginica
5.4 2.3 virginica
             7.7
6.3
3.4
6.4
3.1
6.0
3.0
6.9
3.1
6.7
3.1
6.9
3.1
6.7
3.1
6.8
3.2
6.7
3.3
6.7
3.0
6.3
2.5
136
137
139
140
141
142
144
145
146
147
                6.3
6.5
6.2
148
                               3.4
                                                5.4
149
                                                              2.3 virginica
                                                5.1
150
                5.9
                               3.0
> # 9. Print the indices of duplicate elements in the dataset iris
> duplicate_indices <- which(dup_vector)
> print(duplicate_indices)
[1] 143
> # 10. Print the indices of unique elements in the dataset iris
> unique_indices <- which(!dup_vector)
> print(unique_indices)
                                                  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
              2
                  3 4
                                   6
 [28] 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 [55] 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81
 [82] 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108
[109] 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135
[136] 136 137 138 139 140 141 142 144 145 146 147 148 149 150
> # 11. How many unique elements are in the dataset iris?
> num_unique_elements <- length(unique_rows)
> print(num_unique_elements)
[1] 5
> # 12. How many duplicate elements are in the dataset iris?
> num_duplicate_elements <- length(duplicate_rows)
> print(num_duplicate_elements)
[1] 5
>
```

- Q.4 Consider a vector x < -c(1,5,9,67,NA,32,NA,NA,12)
- 1] Check for missing values using is.na() and completecases()
- 2] Count missing values as sum, colSums functions
- 3| Handling missing values using omit, replace with

0 and replace with previous element and mean, median, Sum values

```
# Define the vector
x <- c(1, 5, 9, 67, NA, 32, NA, NA, 12)
x
# 1. Check for missing values using is.na() and complete.cases()
missing_values_isna <- is.na(x)
missing_values_completecases <- !complete.cases(x)
print(missing_values_isna)
print(missing_values_completecases)
# 2. Count missing values using sum() and colSums() functions
count_missing_values_sum <- sum(is.na(x))
count_missing_values_colsums <- colSums(is.na(x))
print(count_missing_values_sum)
print(count_missing_values_colsums)</pre>
```

```
# 3. Handling missing values
# Option 1: Omit missing values
x_omitted <- na.omit(x)</pre>
print(x omitted)
# Option 2: Replace missing values with 0
x_zero_filled <- replace(x, is.na(x), 0)</pre>
print(x zero filled)
# Option 3: Replace missing values with previous element
x previous filled <- zoo::na.locf(x)</pre>
print(x previous filled)
# Option 4: Replace missing values with mean
x_mean_filled <- replace(x, is.na(x), mean(x, na.rm = TRUE))</pre>
print(x_mean_filled)
# Option 5: Replace missing values with median
x median filled <- replace(x, is.na(x), median(x, na.rm = TRUE))
print(x median filled)
# Option 6: Replace missing values with sum
x_sum_filled <- replace(x, is.na(x), sum(x, na.rm = TRUE))</pre>
print(x sum filled)
```

```
R Console
> # Define the vector
> x < -c(1, 5, 9, 67, NA, 32, NA, NA, 12)
[1]
    1 5 9 67 NA 32 NA NA 12
> # 1. Check for missing values using is.na() and complete.cases()
> missing_values_isna <- is.na(x)</pre>
> missing_values_completecases <- !complete.cases(x)
> print(missing values isna)
[1] FALSE FALSE FALSE TRUE FALSE TRUE TRUE FALSE
> print(missing_values_completecases)
[1] FALSE FALSE FALSE TRUE FALSE TRUE TRUE FALSE
> # 2. Count missing values using sum() and colSums() functions
> count missing values sum <- sum(is.na(x))
> count_missing_values_colsums <- colSums(is.na(x))
Error in colSums(is.na(x)) :
  'x' must be an array of at least two dimensions
> print(count missing values sum)
> print(count missing values colsums)
Error in print(count_missing_values_colsums) :
  object 'count missing values colsums' not found
> # 3. Handling missing values
> # Option 1: Omit missing values
> x omitted <- na.omit(x)</pre>
> print(x omitted)
[1] 1 5 9 67 32 12
attr(, "na.action")
```

```
[1] 5 7 8
 attr(,"class")
  [1] "omit"
 > # Option 2: Replace missing values with 0
 > x zero filled <- replace(x, is.na(x), 0)
 > print(x_zero_filled)
 [1] 1 5 9 67 0 32 0 0 12
 > # Option 3: Replace missing values with previous element
 > x_previous_filled <- zoo::na.locf(x)
 Error in loadNamespace(name) : there is no package called 'zoo'
 > print(x previous filled)
 Error in print(x previous filled) : object 'x previous filled' not found
 > # Option 4: Replace missing values with mean
 > x mean filled <- replace(x, is.na(x), mean(x, na.rm = TRUE))
 > print(x mean filled)
 [1] 1 5 9 67 21 32 21 21 12
 > # Option 5: Replace missing values with median
 > x median filled <- replace(x, is.na(x), median(x, na.rm = TRUE))
 > print(x median filled)
 [1] 1.0 5.0 9.0 67.0 10.5 32.0 10.5 10.5 12.0
 > # Option 6: Replace missing values with sum
 > x_sum_filled <- replace(x, is.na(x), sum(x, na.rm = TRUE))</pre>
 > print(x_sum_filled)
                9 67 126 32 126 126 12
 [1]
            5
Q.5 Create a dataframe with missing values
df <- data.frame(
ID = c(1, 2, 3, NA, 5),
Name = c("John", "Alice", NA, "Bob", "Jane")
)
1 | Check for missing values using is.na() and completecases()
2| Count missing values as sum, colSums functions
3 Handling missing values using omit, replace with
 0 and replace with previous element and mean, median, Sum values.
```

# Create the dataframe with missing values

Name = c("John", "Alice", NA, "Bob", "Jane")

missing values completecases <- !complete.cases(df)</pre>

# 1. Check for missing values using is.na() and complete.cases()

df <- data.frame(</pre>

) df

ID = c(1, 2, 3, NA, 5),

print(missing values isna)

missing values isna <- is.na(df)</pre>

```
print(missing values completecases)
# 2. Count missing values using sum() and colSums() functions
count missing values sum <- sum(is.na(df))</pre>
count missing values colsums <- colSums(is.na(df))</pre>
print(count missing values sum)
print(count missing values colsums)
# 3. Handling missing values
# Option 1: Omit rows with missing values
df omitted <- na.omit(df)</pre>
print(df omitted)
# Option 2: Replace missing values with 0
df_zero_filled <- replace(df, is.na(df), 0)</pre>
print(df zero filled)
# Option 3: Replace missing values with previous element
df previous filled <- zoo::na.locf(df)</pre>
print(df_previous_filled)
# Option 4: Replace missing values with mean
df mean filled <- replace(df, is.na(df), mean(df, na.rm = TRUE))</pre>
print(df mean filled)
# Option 5: Replace missing values with median
df_median_filled <- replace(df, is.na(df), median(df, na.rm =</pre>
TRUE))
print(df median filled)
# Option 6: Replace missing values with sum
df sum filled <- replace(df, is.na(df), sum(df, na.rm = TRUE))</pre>
df sum filled
```

```
R Console
> # Create the dataframe with missing values
> df <- data.frame(
  ID = c(1, 2, 3, NA, 5),
  Name = c("John", "Alice", NA, "Bob", "Jane")
+ )
> df
  ID Name
1
  1
     John
  2 Alice
2
3
  3 <NA>
4 NA
       Bob
     Jane
> # 1. Check for missing values using is.na() and complete.cases()
> missing values isna <- is.na(df)</pre>
> missing values completecases <- !complete.cases(df)</pre>
> print(missing values isna)
        ID Name
[1,] FALSE FALSE
[2,] FALSE FALSE
[3,] FALSE TRUE
[4,] TRUE FALSE
[5,] FALSE FALSE
> print(missing values completecases)
[1] FALSE FALSE TRUE TRUE FALSE
> # 2. Count missing values using sum() and colSums() functions
> count missing values sum <- sum(is.na(df))</pre>
> count missing values colsums <- colSums(is.na(df))</pre>
> print(count_missing_values_sum)
[1] 2
> print(count missing values colsums)
  ID Name
> # 3. Handling missing values
> # Option 1: Omit rows with missing values
> df omitted <- na.omit(df)</pre>
> print(df_omitted)
  ID Name
1 1 John
  2 Alice
  5 Jane
> # Option 2: Replace missing values with 0
> df zero filled <- replace(df, is.na(df), 0)
> print(df_zero_filled)
  ID Name
1
  1
     John
  2 Alice
3
  3
         0
  0
       Bob
     Jane
> # Option 3: Replace missing values with previous element
> df previous filled <- zoo::na.locf(df)</pre>
Error in loadNamespace(name) : there is no package called 'zoo'
```

```
> df previous filled <- zoo::na.locf(df)</pre>
Error in loadNamespace(name) : there is no package called 'zoo'
> print(df previous filled)
Error in print(df previous filled) :
  object 'df previous filled' not found
> # Option 4: Replace missing values with mean
> df mean filled <- replace(df, is.na(df), mean(df, na.rm = TRUE))</pre>
Warning message:
In mean.default(df, na.rm = TRUE) :
  argument is not numeric or logical: returning NA
> print(df mean filled)
  ID Name
  1 John
1
  2 Alice
  3 <NA>
4 NA
     Bob
  5 Jane
> # Option 5: Replace missing values with median
> df median filled <- replace(df, is.na(df), median(df, na.rm = TRUE))
Error in median.default(df, na.rm = TRUE) : need numeric data
> print(df median filled)
Error in print(df median filled) : object 'df median filled' not found
> # Option 6: Replace missing values with sum
> df sum filled <- replace(df, is.na(df), sum(df, na.rm = TRUE))</pre>
Error in FUN(X[[i]], ...):
  only defined on a data frame with all numeric variables
> df sum filled
```

- Q.6 Consider a dataset airquality
- 1] Print the dataset airquality
- 2] Print the structure of the dataset airquality
- 3] Print the summary of all the variables of the dataset airquality (Hint: Use function summary())
- 4] How many of the variables (columns) are in the dataset airquality
- 5] How many observations (rows) are in the dataset airquality
- 6] Use the function is.na() to find whether any missing values are in the dataset airquality
- 7] Print the indices of the missing values in the dataset airquality in column major representation
- 8] Print the indices of the missing values in the dataset airquality in row major representation
- 9] Print indices of the missing values in row and column numberwise (Hint: Use function which() and argument arr.ind = TRUE)
- 10] How many missing values are in the dataset airquality?

- 11] Which variables are the missing values concentrated in?
- 12] How would you omit all rows containing missing values?
- 13] Print the records without missing values in the dataset airquality using the function complete.cases()
- 14] Print the records without missing values in the dataset airquality using the function na.omit()
- 15] Print the records without missing values in the dataset airquality using the function na.exclude()
- 16] Print the records containing missing values in the dataset airquality using the function complete.cases()
- # 1. Print the dataset airquality
  print(airquality)
- # 2. Print the structure of the dataset airquality
  str(airquality)
- # 3. Print the summary of all the variables of the dataset airquality summary(airquality)
- # 4. How many variables (columns) are in the dataset airquality num\_variables <- ncol(airquality) print(num variables)
- # 5. How many observations (rows) are in the dataset airquality
  num\_observations <- nrow(airquality)
  print(num\_observations)</pre>
- # 6. Use the function is.na() to find whether any missing values
  are in the dataset airquality
  has\_missing\_values <- any(is.na(airquality))
  print(has\_missing\_values)</pre>
- # 7. Print the indices of the missing values in the dataset airquality in column major representation

```
missing values indices col <- which(is.na(airquality), arr.ind =
TRUE)
print(missing_values_indices_col)
# 8. Print the indices of the missing values in the dataset
airquality in row major representation
missing values indices row <- which(t(is.na(airquality)), arr.ind
= TRUE)
print(missing values indices row)
# 9. Print indices of the missing values in row and column
numberwise
missing values indices <- which(is.na(airquality), arr.ind =
TRUE)
print(missing values indices)
# 10. How many missing values are in the dataset airquality
num missing values <- sum(is.na(airquality))</pre>
print(num missing values)
# 11. Which variables are the missing values concentrated in
variables with missing values <-
colnames(airquality)[colSums(is.na(airquality)) > 0]
print(variables_with_missing_values)
# 12. Omit all rows containing missing values
airquality no missing <- na.omit(airquality)</pre>
print(airquality no missing)
# 13. Print the records without missing values using
complete.cases()
complete cases <- airquality[complete.cases(airquality), ]</pre>
print(complete cases)
# 14. Print the records without missing values using na.omit()
omit_records <- na.omit(airquality)</pre>
print(omit records)
```

```
# 15. Print the records without missing values using na.exclude()
exclude_records <- na.exclude(airquality)</pre>
print(exclude records)
# 16. Print the records containing missing values using
complete.cases()
missing value records <- airquality[!complete.cases(airquality),</pre>
print(missing_value_records)
> # 1. Print the dataset airquality
> print(airquality)
  Ozone Solar.R Wind Temp Month Day
         190 7.4 67
         118 8.0 72
    36
         149 12.6 74 5 3
         313 11.5 62
NA 14.3 56
    18
    NA
    28
          NA 14.9 66 5 6
    23
         299 8.6 65
    19
          99 13.8
                 59
          19 20.1
                 61
     8
  NA
        194 8.6 69 5 10
                     5 11
         NA 6.9 74
11
    7
12
    16
         256 9.7
         290 9.2 66 5 13
   11
13
   14
         274 10.9 68
                     5 14
                     5 15
5 16
15
    18
          65 13.2
                 58
   14
                 64
         334 11.5
16
        307 12.0 66 5 17
                     5 18
18
          78 18.4 57
         322 11.5 68
44 9.7 62
    30
19
                     5 20
   11
20
21
          8 9.7 59
                     5 22
   11
        320 16.6 73
22
23
          25 9.7
                 61
24
   32
         92 12.0 61
25
   NA
          66 16.6 57
26
    NA
         266 14.9
                 58
         NA 8.0 57
27
    NA
   23
         13 12.0 67
                     5 29
29
    45
         252 14.9 81
30
   115
          223 5.7
                 79
                     5 31
         279 7.4
                 76
31
    37
   NA
         286 8.6 78
    NA
33
         287 9.7
                 74
34
    NA
         242 16.1
                 67
         186 9.2
35
    NA
                 84
36
    NA
         220 8.6 85
37
    NA
         264 14.3
                 79
38
    29
          127 9.7
                 82
39
   NA
         273 6.9
   71
40
         291 13.8 90
         323 11.5
         259 10.9 93
                     6 11
42
    NA
   NA
         250 9.2 92
   23
         148 8.0 82
332 13.8 80
                     6 13
44
45
    NA
                      6 14
         322 11.5 79 6 15
46 NA
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 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		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
110	.5	213 0.0		0 20

```
153 5.7 88
                           8 27
            203 9.7
120
      76
                       97
121
            225 2.3
                            8 29
     118
                      94
            237 6.3
122
      84
                      96
                                30
123
      85
            188 6.3
                      94
                            8
                                31
124
      96
            167 6.9
                       91
125
      78
            197 5.1
                      92
                                 2
126
      73
            183 2.8
                      93
                                 3
127
      91
            189 4.6
                      93
                             9
                                 4
             95 7.4
128
      47
                      87
                             9
                                 5
129
      32
             92 15.5
                      84
                                 6
130
      20
            252 10.9
                      80
                                7
131
      23
            220 10.3
                       78
            230 10.9
132
      21
                      75
                            9
                                 9
133
      24
            259 9.7
                           9 10
                      73
            236 14.9
134
      44
                      81
                            9 11
135
      21
            259 15.5
                       76
                            9
                                12
            238 6.3
                      77
136
      28
                            9 13
137
       9
            24 10.9
                      71
                           9 14
138
      13
            112 11.5
                            9 15
                      71
139
      46
            237 6.9
                      78
                            9 16
            224 13.8
140
      18
                      67
                            9 17
141
      13
            27 10.3 76
                           9 18
            238 10.3
142
      24
                      68
                            9 19
143
      16
            201 8.0
                      82
                            9 20
144
      13
            238 12.6
                           9 21
                      64
                           9 22
      23
            14 9.2
                      71
145
146
      36
            139 10.3
                      81
                            9 23
            49 10.3
                           9 24
147
      7
                      69
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
> # 2. Print the structure of the dataset airquality
> 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 ...
> # 3. Print the summary of all the variables of the dataset airquality
> summary(airquality)
   Ozone
                  Solar.R
                                   Wind
                                                   Temp
                                                                Month
                                                                               Day
Min. : 1.00
               Min. : 7.0 Min. : 1.700 Min. :56.00 Min. :5.000 Min. : 1.0
1st Qu.: 18.00
                1st Ou.:115.8
                              1st Qu.: 7.400 1st Qu.:72.00 1st Qu.:6.000 1st Qu.: 8.0
Median : 31.50
                Median :205.0
                              Median: 9.700 Median: 79.00 Median: 7.000
                                                                           Median :16.0
Mean : 42.13
                Mean :185.9
                              Mean : 9.958
                                              Mean :77.88
                                                             Mean :6.993
                                                                            Mean :15.8
                              3rd Qu.:11.500 3rd Qu.:85.00 3rd Qu.:8.000
3rd Qu.: 63.25
                3rd Ou.:258.8
                                                                           3rd Ou.:23.0
Max. :168.00 Max. :334.0 Max. :20.700 Max. :97.00 Max. :9.000 Max. :31.0
NA's :37
                NA's
                      : 7
> # 4. How many variables (columns) are in the dataset airquality
> num_variables <- ncol(airquality)</pre>
> print(num_variables)
[1] 6
> # 5. How many observations (rows) are in the dataset airquality
> num observations <- nrow(airquality)
> print(num_observations)
[1] 153
> # 6. Use the function is.na() to find whether any missing values are in the dataset airquality
> has_missing_values <- any(is.na(airquality))</pre>
> print(has_missing_values)
[1] TRUE
```

119

NA

```
> # 7. Print the indices of the missing values in the dataset airquality in column major representation
> missing_values_indices_col <- which(is.na(airquality), arr.ind = TRUE)
> print(missing_values_indices_col)
     row col
 [1,] 5 1
[2,] 10
           1
[3,] 25
[4,] 26
           1
 [5,] 27
           1
[6,] 32
           1
 [7,] 33
 [8,] 34
[9,] 35
           1
[10,] 36
[11,] 37
           1
[12,] 39
[13,] 42
           1
[14,] 43
[15,] 45
           1
[16,] 46
           1
[17,] 52
[18,] 53
[19,] 54
           1
[20,] 55
           1
[21,] 56
[22,] 57
           1
[23,] 58
           1
[24,] 59
[25,] 60
[26,] 61
           1
[27,] 65
           1
[28,] 72
[29,] 75
           1
[30,] 83
[31,] 84
           1
[32,] 102
[33,] 103
[34,] 107
[35,] 115
           1
[36,] 119
[37,] 150
           1
[38,] 5
           2
[39,] 6
[40,] 11
           2
[41,] 27
[42,] 96
           2
[43,] 97
[44,] 98 2
> # 8. Print the indices of the missing values in the dataset airquality in row major representation
> missing values indices row <- which(t(is.na(airquality)), arr.ind = TRUE)
> print(missing_values_indices_row)
       row col
Ozone
        1 5
Solar.R 2 5
Solar.R 2 6
         1 10
Ozone
Solar.R 2 11
Ozone
         1 25
Ozone
         1 26
         1 27
Ozone
Solar.R 2 27
        1 32
Ozone
Ozone
         1 33
        1 34
Ozone
Ozone
        1 35
Ozone
        1 36
        1 37
Ozone
Ozone
       1 39
       1 42
Ozone
```

```
1 43
Ozone
         1 45
Ozone
         1 46
Ozone
Ozone
         1 52
         1 53
Ozone
Ozone
         1
Ozone
         1 55
Ozone
         1 56
         1 57
Ozone
Ozone
         1 58
Ozone
         1 59
Ozone
         1 60
Ozone
            61
         1 65
Ozone
Ozone
            72
Ozone
         1 75
Ozone
            83
         1 84
Ozone
Solar.R
         2 96
Solar.R
         2 97
Solar.R
         2 98
         1 102
Ozone
Ozone
         1 103
         1 107
Ozone
Ozone
         1 115
Ozone
         1 119
         1 150
Ozone
> # 9. Print indices of the missing values in row and column numberwise
> missing_values_indices <- which(is.na(airquality), arr.ind = TRUE)</pre>
> print(missing_values_indices)
     row col
[1,] 5
[2,] 10
           1
 [3,] 25
 [4,] 26
           1
 [5,] 27
 [6,] 32
 [7,]
      33
 [8,] 34
           1
[9,] 35
[10,] 36
           1
[11,]
      37
           1
[12,] 39
[13,] 42
[14,] 43
           1
[15,] 45
           1
[16,] 46
[17,] 52
           1
[18,]
      53
[19,] 54
           1
[20,] 55
[21,]
      56
           1
[22,] 57
           1
[23,] 58
           1
[24,] 59
[25,]
      60
[26,] 61
           1
[27,] 65
[28,] 72
           1
[29,]
      75
[30,] 83
[31,] 84
[32,] 102
[33,] 103
[34,] 107
[35,] 115
[36,] 119
[37,] 150
           1
[38,] 5
[39,] 6
```

```
[40,] 11 2
[41,] 27
[42,] 96
[43,] 97
[44,] 98
> # 10. How many missing values are in the dataset airquality
> num_missing_values <- sum(is.na(airquality))</pre>
> print(num_missing_values)
[1] 44
> # 11. Which variables are the missing values concentrated in
> variables with missing values <- colnames(airquality)[colSums(is.na(airquality)) > 0]
> print(variables_with_missing_values)
[1] "Ozone" "Solar.R"
> # 12. Omit all rows containing missing values
> airquality_no_missing <- na.omit(airquality)</pre>
> print(airquality_no_missing)
   Ozone Solar.R Wind Temp Month Day
            190 7.4 67
      41
                           5 1
             118 8.0
      36
                      72
3
      12
             149 12.6 74
                                 3
             313 11.5
      18
                       62
      23
             299 8.6
                      65
             99 13.8
                       59
                           5
             19 20.1
                       61
                                9
      8
12
      16
             256 9.7
                       69
                             5 12
            290 9.2
                           5 13
13
      11
                       66
14
      14
             274 10.9
                       68
                           5 14
      18
             65 13.2
                       58
                             5 15
15
16
      14
             334 11.5
                       64
                             5 16
17
      34
            307 12.0
                       66
                            5 17
                            5 18
18
      6
             78 18.4
                      57
19
      30
             322 11.5
             44 9.7
                             5 20
20
      11
                       62
21
              8 9.7
                       59
                            5 21
            320 16.6
                            5 22
22
                       73
      11
23
             25 9.7
                       61
                             5
                                23
      32
             92 12.0
24
                             5 24
                       61
28
      23
             13 12.0
                       67
                            5 28
29
      45
             252 14.9
                       81
                             5
                                29
30
     115
             223 5.7
                       79
                             5
                                30
             279 7.4
31
      37
                       76
                            5 31
             127 9.7
38
      29
                       82
                                7
40
      71
             291 13.8
                       90
                             6 10
41
             323 11.5
                       87
      39
44
      23
             148 8.0
                       82
                           6 13
            191 14.9
                       77
                            6 16
47
      21
48
      37
             284 20.7
                       72
                                17
49
      20
             37 9.2
                       65
                             6 18
50
      12
             120 11.5
                      73
                             6 19
51
      13
             137 10.3
                       76
                                20
62
     135
             269 4.1
                       84
                                 1
             248 9.2
63
      49
                       85
64
      32
             236 9.2
                       81
      64
             175 4.6
                       83
66
             314 10.9
67
      40
                       83
                                 6
68
      77
             276 5.1
69
      97
             267 6.3
                       92
                             7
                                 8
70
      97
             272 5.7
                       92
                                 9
             175 7.4
                             7 10
71
      85
                       89
73
      10
             264 14.3
                       73
                            7 12
74
      27
             175 14.9
                             7 13
                       81
                             7 15
76
       7
             48 14.3
                       80
                            7 16
77
             260 6.9
      48
                       81
78
      35
             274 10.3 82
                            7 17
79
      61
             285 6.3
                       84
                             7 18
             187 5.1 87
                             7 19
80
      79
81
      63
            220 11.5 85
                           7 20
             7 6.9 74
82
      16
                           7 21
```

```
294 8.6
                                7 24
85
      80
                         86
      108
              223 8.0
86
                         85
                                    25
               81 8.6
                                7
                                    26
87
       20
                         82
88
       52
               82 12.0
                                7
                                    27
              213 7.4
89
       82
                         88
                                7
                                    28
90
       50
              275
                   7.4
                         86
                                    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
                                     3
                         82
                                 8
99
      122
              255 4.0
                         89
                                     7
100
              229 10.3
                         90
                                     8
      89
              207 8.0
                                     9
101
      110
                         90
                                8
104
       44
              192 11.5
                                   12
                         86
105
       28
              273 11.5
                         82
                                8
                                   13
106
       65
              157 9.7
                         80
                                    14
               71 10.3
                                   16
108
       22
                         77
                                8
109
       59
               51 6.3
                         79
                                 8
                                    17
       23
              115 7.4
                                8
110
                         76
                                    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
                                    22
114
       9
               36 14.3
                         72
                                    24
116
       45
              212 9.7
                         79
                                 8
117
      168
              238 3.4
                                    25
      73
118
              215 8.0
                         86
                                 8
                                    26
120
       76
              203 9.7
                         97
                                 8
                                    28
              225 2.3
                                    29
121
      118
                         94
                                 8
122
       84
              237 6.3
                         96
                                    30
123
       85
              188 6.3
                                    31
                         94
                                 8
124
       96
              167 6.9
                         91
                                 9
                                    1
125
       78
              197 5.1
                         92
                                     2
126
       73
              183 2.8
                         93
                                     3
127
       91
              189 4.6
                         93
                                 9
               95 7.4
128
       47
                         87
                                 9
                                     5
129
       32
               92 15.5
                         84
                                     6
                                     7
              252 10.9
                                9
130
       20
                         80
131
       23
              220 10.3
                         78
                                 9
                                     8
              230 10.9
132
       21
                                     9
                         75
                                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
                                   13
137
       9
               24 10.9
                         71
                                 9 14
138
       13
              112 11.5
                         71
                                    15
              237 6.9
139
       46
                                 9
                                   16
                         78
140
       18
              224 13.8
                         67
                                   17
              27 10.3
                                9
141
       13
                         76
                                   18
142
       24
              238 10.3
                         68
                                 9
                                    19
143
       16
              201 8.0
                         82
                                9
                                    20
144
       13
              238 12.6
                                 9
                                    21
145
       23
               14 9.2
                         71
                                 9
                                    22
              139 10.3
146
       36
                         81
                                 9
                                    23
147
       7
               49 10.3
                                   24
                         69
148
       14
               20 16.6
                         63
                                 9
                                    25
149
       30
              193 6.9
                         70
                                    26
              191 14.3
151
      14
                         75
                                 9
                                   28
152
       18
              131 8.0
                         76
                                 9 29
153
       20
              223 11.5
                         68
                                9 30
> # 13. Print the records without missing values using complete.cases()
> complete_cases <- airquality[complete.cases(airquality), ]</pre>
> print(complete_cases)
    Ozone Solar.R Wind Temp Month Day
              190 7.4
       41
                         67
                                5
                                    1
2
       36
              118 8.0
                         72
3
       12
              149 12.6
                         74
                                     3
4
      18
              313 11.5
                         62
                                 5
                                     4
7
       23
              299 8.6
                         65
                                     7
      19
              99 13.8
                         59
                                     8
```

9	8	19 20.1	61	5	9
12	16	256 9.7	69	5	12
13	11	290 9.2 274 10.9	66	5	13
14 15	14 18	274 10.9 65 13.2	68	5 5	14 15
16	14	334 11.5	58 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
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
38	29	127 9.7	82	6	7
40	71	291 13.8	90	6	9
41	39	323 11.5	87	6	10
44	23	148 8.0	82	6	13
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
62	135	269 4.1	84	7	1
63	49	248 9.2	85	7	2
64	32	236 9.2	81	7	3
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
73	10	264 14.3	73	7	12
74	27	175 14.9	81	7	13
76	7	48 14.3	80	7	15
77 78	48 35	260 6.9 274 10.3	81 82	7 7	16 17
78 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
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
99	122	255 4.0	89	8	7
100	89	229 10.3	90	8	8
101	110	207 8.0	90	8	9
104	44	192 11.5	86	8	12
105	28	273 11.5	82	8	13
106	65	157 9.7	80	8	14
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
116	45	212 9.7	79 01	8	24
117	168	238 3.4	81	8	25

```
118
      73
             215 8.0
                               8 26
                        86
120
       76
             203 9.7
                        97
121
             225 2.3
                                  29
      118
                        94
                               8
122
      84
             237 6.3
                                  30
123
                               8
                                  31
      85
             188 6.3
                        94
124
       96
             167
                  6.9
                        91
                               9
125
       78
             197 5.1
                        92
                                   2
126
       73
             183 2.8
                        93
                                   3
127
       91
                               9
                                   4
             189 4.6
                        93
              95 7.4
128
       47
                        87
                               9
                                   5
129
              92 15.5
      32
                        84
                                   6
130
             252 10.9
                                   7
      20
                        80
131
       23
             220 10.3
                        78
                                   8
132
      21
             230 10.9
                        75
                               9
                                   9
133
       24
             259 9.7
                        73
                               9 10
                               9 11
             236 14.9
134
       44
                        81
135
       21
             259 15.5
                        76
                               9
                                  12
             238 6.3
                                  13
136
      28
                        77
              24 10.9
137
       9
                        71
                               9 14
             112 11.5
                               9
138
      13
                        71
                                  15
             237 6.9
139
       46
                        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
                                  19
             201 8.0
                                 20
143
      16
                        82
144
      13
             238 12.6
                        64
                                  21
                               9 22
145
      23
              14 9.2
                        71
146
       36
             139 10.3
                        81
                               9
                                  23
              49 10.3
147
       7
                               9 24
                        69
148
      14
              20 16.6
                        63
                               9
                                  25
149
      30
             193 6.9
                        70
                               9
                                 26
151
                                 28
      14
             191 14.3
                        75
                               9
152
      18
             131 8.0
                        76
                               9 29
153
      20
             223 11.5
                               9 30
                        68
```

> # 14. Print the records without missing values using na.omit()

> omit records <- na.omit(airquality)</pre>

> print(omit\_records)

_	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
7	23	299	8.6	65	5	7
8	19	99	13.8	59	5	8
9	8	19	20.1	61	5	9
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
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
38	29	127	9.7	82	6	7
40	71	291	13.8	90	6	9
41	39	323	11.5	87	6	10
44	23	148	8.0	82	6	13
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
62	135	269 4.1	84	7	1
63	49	248 9.2	85	7	2
64	32	236 9.2	81	7	3
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
73	10	264 14.3	73	7	12
74	27	175 14.9	81	7	13
76	7	48 14.3	80	7	15
				7	
77	48	260 6.9	81		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
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
99	122	255 4.0	89	8	7
100	89	229 10.3	90	8	8
101	110	207 8.0	90	8	9
104	44	192 11.5	86	8	12
105	28	273 11.5	82	8	13
106	65	157 9.7			14
	22		80	8	
108		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
116	45	212 9.7	79	8	24
117	168	238 3.4	81	8	25
118	73	215 8.0	86	8	26
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	76	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

```
14 9.2 71
145
                          9 22
      23
146
      36
            139 10.3
                      81
             49 10.3
                     69
                            9 24
147
       7
148
      14
             20 16.6 63
                             9 25
            193 6.9
                      70
                            9 26
149
      30
151
      14
            191 14.3
                      75
                             9
                               28
152
      18
            131 8.0
                     76
                            9 29
153
      20
            223 11.5 68
                             9 30
> # 15. Print the records without missing values using na.exclude()
> exclude records <- na.exclude(airquality)</pre>
> print(exclude_records)
   Ozone Solar.R Wind Temp Month Day
            190 7.4 67
      41
                           5 1
2
      36
            118 8.0
                      72
            149 12.6
3
      12
                      74
                             5
                                3
      18
            313 11.5
                      62
            299 8.6
                                7
      23
                           5
                      65
             99 13.8
      19
                      59
                                8
9
             19 20.1
                      61
                            5
                                9
      8
12
      16
            256 9.7
                      69
                            5
                               12
            290 9.2
                          5 13
13
      11
                      66
14
      14
            274 10.9
                      68
                           5 14
      18
             65 13.2
                      58
15
                               15
16
      14
            334 11.5
                      64
                            5 16
17
      34
            307 12.0
                           5 18
             78 18.4
18
      6
                      57
19
      30
            322 11.5
                      68
                            5 19
20
      11
            44 9.7
                           5 20
                      62
21
      1
             8 9.7
                      59
                           5 21
            320 16.6
22
                      73
                            5
                               22
      11
23
       4
             25 9.7
                      61
                            5
                               23
24
      32
             92 12.0
                      61
                            5 24
             13 12.0
                           5 28
28
      23
                      67
29
      45
            252 14.9
                      81
                            5
                               29
            223 5.7
                               30
30
     115
                      79
                            5
31
      37
            279 7.4
                      76
                           5 31
38
      29
            127 9.7
                      82
                           6
                                7
40
      71
            291 13.8
                      90
                            6
                                9
            323 11.5
                            6 10
41
      39
                      87
44
      23
            148 8.0
                      82
                           6 13
47
      21
            191 14.9
                      77
                            6 16
48
      37
            284 20.7
                      72
                            6
                               17
49
      20
             37 9.2
                      65
                           6 18
            120 11.5
50
      12
                      73
                           6 19
51
      13
            137 10.3
                      76
                               20
            269 4.1
62
     135
                      84
                                1
63
      49
            248 9.2
                      85
                            7
                                2
            236 9.2
                            7
64
      32
                      81
                                3
66
      64
            175 4.6
                      83
                                5
67
      40
            314 10.9
                      83
                            7
                                6
68
      77
            276 5.1
                      88
                            7
                                7
69
      97
            267 6.3
                      92
                                8
            272 5.7
                            7
70
      97
                      92
                                9
            175 7.4
71
      85
                      89
                           7 10
            264 14.3
73
      10
                      73
                           7 12
74
      27
            175 14.9
                      81
                               13
                           7 15
76
             48 14.3
      7
                      80
77
      48
            260 6.9
                            7 16
            274 10.3
78
      35
                      82
                            7 17
79
      61
            285 6.3
                      84
                               18
            187 5.1
                            7 19
80
      79
                      87
81
      63
            220 11.5
                      85
                            7 20
82
      16
             7 6.9
                      74
                            7
                               21
85
      80
            294 8.6
                      86
                               24
            223 8.0
86
     108
                      85
87
      20
             81 8.6
                      82
                            7 26
88
      52
             82 12.0
                      86
            213 7.4
                            7 28
```

7 29

7 30

275 7.4 86

253 7.4 83

```
254 9.2
92
       59
                         81
                                7
                                   31
93
       39
               83 6.9
                         81
                                    1
               24 13.8
94
                                     2
       9
                         81
                                8
               77 7.4
95
       16
                                     7
99
      122
              255 4.0
                                8
                         89
100
       89
              229 10.3
                         90
                                8
                                     8
101
      110
              207 8.0
                         90
                                8
                                     9
104
       44
              192 11.5
                         86
                                8 12
105
       28
              273 11.5
                         82
                                8
                                   13
              157 9.7
106
       65
                         80
                                8
                                   14
108
       22
               71 10.3
                         77
                                   16
                                8
109
       59
              51 6.3
                         79
                                8
                                   17
110
       23
              115 7.4
                         76
                                   18
              244 10.9
111
       31
                         78
                                8
                                   19
112
              190 10.3
                         78
                                   20
113
       21
              259 15.5
                         77
                                8
                                   21
114
       9
               36 14.3
                         72
                                8
                                   22
                                   24
       45
              212 9.7
116
                         79
                                8
117
      168
              238 3.4
                         81
                                8
                                   25
       73
              215 8.0
                                   26
118
                         86
                                8
120
       76
              203 9.7
                         97
                                8
                                   28
              225 2.3
                                   29
121
      118
                         94
                                8
122
       84
              237 6.3
                         96
                                8
                                   30
123
       85
                                   31
              188
                  6.3
                         94
              167 6.9
124
       96
                         91
                                    1
125
       78
              197 5.1
                                     2
       73
                                9
126
              183 2.8
                         93
                                     3
127
       91
              189 4.6
                         93
                                9
                                     4
128
              95 7.4
                                     5
       47
                         87
129
       32
               92 15.5
                         84
                                     6
       20
              252 10.9
                         80
                                9
                                     7
130
131
       23
              220 10.3
                         78
                                9
                                     8
132
       21
              230 10.9
                         75
                                     9
133
       24
              259 9.7
                         73
                                9
                                   10
134
       44
              236 14.9
                         81
                                9
                                   11
              259 15.5
135
       21
                         76
                                9
                                   12
136
       28
              238 6.3
                         77
                                   13
              24 10.9
                                9
137
       9
                         71
                                   14
138
       13
              112 11.5
                         71
                                9
                                   15
              237 6.9
139
                                   16
       46
                         78
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
                                   20
144
       13
              238 12.6
                         64
                                9
                                   21
145
       23
                         71
                                   22
               14 9.2
              139 10.3
                                   23
146
                                9
       36
                         81
147
               49 10.3
                                   24
148
              20 16.6
                         63
                                9
                                   25
       14
149
       30
              193 6.9
                         70
                                9
                                   26
151
       14
              191 14.3
                         75
                                   28
152
       18
              131 8.0
                         76
                                9 29
153
       20
              223 11.5
                         68
                                9 30
> # 16. Print the records containing missing values using complete.cases()
> missing_value_records <- airquality[!complete.cases(airquality), ]</pre>
> print(missing_value_records)
    Ozone Solar.R Wind Temp Month Day
       NA
               NA 14.3
6
       28
               NA 14.9
                         66
                                5
                                     6
10
       NA
              194 8.6
                         69
                                   10
               NA 6.9
11
       7
                         74
                                5
                                   11
25
       NA
               66 16.6
                         57
                                5
                                   25
26
              266 14.9
                                5
                                   26
       NA
                         58
27
       NA
               NA 8.0
                         57
                                5
                                   27
              286 8.6
32
       NA
                         78
                                    1
33
       NA
              287 9.7
                         74
34
       NA
              242 16.1
                                     3
                         67
35
       NA
              186 9.2
                         84
                                6
                                     4
36
       NA
              220 8.6
                         85
37
      NA
              264 14.3
                         79
                                     6
```

```
6 8
39
          273 6.9 87
     NA
42
     NA
          259 10.9
                   93
                      6 12
                        6 11
          250 9.2
                  92
43
     NA
          332 13.8 80 6 14
          322 11.5 79
                       6 15
46
     NA
52
     NA
          150 6.3
                   77
                       6 22
53
     NA
          59 1.7
                   76
54
     NA
           91 4.6
                  76
                       6 23
                       6 24
          250 6.3
                   76
55
     NA
56
     NA
          135 8.0
                   75
                        6 25
          127 8.0
                   78
                       6 26
57
     NA
           47 10.3
                   73
                       6 27
58
     NA
59
     NA
           98 11.5
                   80
                        6 28
                        6 29
60
     NA
           31 14.9
                   77
61
     NA
          138 8.0
                       7
          101 10.9
                   84
65
     NA
                           4
72
     NA
          139 8.6
                   82
                         7 11
                       7 14
75
          291 14.9
                   91
     NA
                       7 22
83
     NA
          258 9.7
                   81
                       7 23
8 4
          295 11.5
84
     NA
                   82
96
     78
           NA 6.9
                   86
97
     35
          NA 7.4
                  85
98
     66
           NA 4.6 87
102
     NA
          222 8.6
                   92
                        8 10
                      8 11
8 11
                  86
          137 11.5
103
    NA
107
    NA
           64 11.5 79
                      8 23
8 27
9 27
          255 12.6 75
115
    NA
119
     NA
          153 5.7
                   88
                        9 27
150
     NA
         145 13.2
                   77
```

Screenshots were too large to be pasted so I pasted the output text from R console.