

## Task1: IRIS\_FLOWER\_CLASSIFICATION

### OUTPUT:

petal\_length: [1.4 1.4 1.3 1.5 1.4 1.7 1.4 1.5 1.4 1.5 1.5 1.6 1.4 1.1 1.2 1.5 1.3 1.4  
1.7 1.5 1.7 1.5 1. 1.7 1.9 1.6 1.6 1.5 1.4 1.6 1.6 1.5 1.5 1.4 1.5 1.2  
1.3 1.5 1.3 1.5 1.3 1.3 1.3 1.6 1.9 1.4 1.6 1.4 1.5 1.4 4.7 4.5 4.9 4.  
4.6 4.5 4.7 3.3 4.6 3.9 3.5 4.2 4. 4.7 3.6 4.4 4.5 4.1 4.5 3.9 4.8 4.  
4.9 4.7 4.3 4.4 4.8 5. 4.5 3.5 3.8 3.7 3.9 5.1 4.5 4.5 4.7 4.4 4.1 4.  
4.4 4.6 4. 3.3 4.2 4.2 4.2 4.3 3. 4.1 6. 5.1 5.9 5.6 5.8 6.6 4.5 6.3  
5.8 6.1 5.1 5.3 5.5 5. 5.1 5.3 5.5 6.7 6.9 5. 5.7 4.9 6.7 4.9 5.7 6.  
4.8 4.9 5.6 5.8 6.1 6.4 5.6 5.1 5.6 6.1 5.6 5.5 4.8 5.4 5.6 5.1 5.1 5.9  
5.7 5.2 5. 5.2 5.4 5.1]

sepal\_length: [5.1 4.9 4.7 4.6 5. 5.4 4.6 5. 4.4 4.9 5.4 4.8 4.8 4.3 5.8 5.7 5.4 5.1  
5.7 5.1 5.4 5.1 4.6 5.1 4.8 5. 5. 5.2 5.2 4.7 4.8 5.4 5.2 5.5 4.9 5.  
5.5 4.9 4.4 5.1 5. 4.5 4.4 5. 5.1 4.8 5.1 4.6 5.3 5. 7. 6.4 6.9 5.5  
6.5 5.7 6.3 4.9 6.6 5.2 5. 5.9 6. 6.1 5.6 6.7 5.6 5.8 6.2 5.6 5.9 6.1  
6.3 6.1 6.4 6.6 6.8 6.7 6. 5.7 5.5 5.5 5.8 6. 5.4 6. 6.7 6.3 5.6 5.5  
5.5 6.1 5.8 5. 5.6 5.7 5.7 6.2 5.1 5.7 6.3 5.8 7.1 6.3 6.5 7.6 4.9 7.3  
6.7 7.2 6.5 6.4 6.8 5.7 5.8 6.4 6.5 7.7 7.7 6. 6.9 5.6 7.7 6.3 6.7 7.2  
6.2 6.1 6.4 7.2 7.4 7.9 6.4 6.3 6.1 7.7 6.3 6.4 6. 6.9 6.7 6.9 5.8 6.8  
6.7 6.7 6.3 6.5 6.2 5.9]

petal\_width: [0.2 0.2 0.2 0.2 0.2 0.4 0.3 0.2 0.2 0.1 0.2 0.2 0.1 0.1 0.2 0.4 0.4 0.3  
0.3 0.3 0.2 0.4 0.2 0.5 0.2 0.2 0.4 0.2 0.2 0.2 0.2 0.4 0.1 0.2 0.1 0.2  
0.2 0.1 0.2 0.2 0.3 0.3 0.2 0.6 0.4 0.3 0.2 0.2 0.2 0.2 1.4 1.5 1.5 1.3  
1.5 1.3 1.6 1. 1.3 1.4 1. 1.5 1. 1.4 1.3 1.4 1.5 1. 1.5 1.1 1.8 1.3  
1.5 1.2 1.3 1.4 1.4 1.7 1.5 1. 1.1 1. 1.2 1.6 1.5 1.6 1.5 1.3 1.3 1.3  
1.2 1.4 1.2 1. 1.3 1.2 1.3 1.3 1.1 1.3 2.5 1.9 2.1 1.8 2.2 2.1 1.7 1.8  
1.8 2.5 2. 1.9 2.1 2. 2.4 2.3 1.8 2.2 2.3 1.5 2.3 2. 2. 1.8 2.1 1.8  
1.8 1.8 2.1 1.6 1.9 2. 2.2 1.5 1.4 2.3 2.4 1.8 1.8 2.1 2.4 2.3 1.9 2.3

2.5 2.3 1.9 2. 2.3 1.8]

sepal\_width: [3.5 3. 3.2 3.1 3.6 3.9 3.4 3.4 2.9 3.1 3.7 3.4 3. 3. 4. 4.4 3.9 3.5

3.8 3.8 3.4 3.7 3.6 3.3 3.4 3. 3.4 3.5 3.4 3.2 3.1 3.4 4.1 4.2 3.1 3.2

3.5 3.1 3. 3.4 3.5 2.3 3.2 3.5 3.8 3. 3.8 3.2 3.7 3.3 3.2 3.2 3.1 2.3

2.8 2.8 3.3 2.4 2.9 2.7 2. 3. 2.2 2.9 2.9 3.1 3. 2.7 2.2 2.5 3.2 2.8

2.5 2.8 2.9 3. 2.8 3. 2.9 2.6 2.4 2.4 2.7 2.7 3. 3.4 3.1 2.3 3. 2.5

2.6 3. 2.6 2.3 2.7 3. 2.9 2.9 2.5 2.8 3.3 2.7 3. 2.9 3. 3. 2.5 2.9

2.5 3.6 3.2 2.7 3. 2.5 2.8 3.2 3. 3.8 2.6 2.2 3.2 2.8 2.8 2.7 3.3 3.2

2.8 3. 2.8 3. 2.8 3.8 2.8 2.8 2.6 3. 3.4 3.1 3. 3.1 3.1 3.1 2.7 3.2

3.3 3. 2.5 3. 3.4 3. ]

min petal length: 1.0

sum: 563.8

min index: 22

max index: 118

variance: 3.092424888888889

median: 4.35

mean: 3.7586666666666666

max petal length: 6.9

75th percentile: 5.1

Relational Operations:

sepal\_length < 3: [False False False False False False False False False False False False

False False False False False False False False False False False False

False False False False False False False False False False False False

False False False False False False False False False False False False

False False False False False False False False False False False False

[illegible]

```
sepal_length <= 6: [ True True True True True True True True True True True True True
True True True True True True True True True True True True True True True
True True True True True True True True True True True True True True
True True False False False True False True False True False True False
True True True False True False True True False True True False
False False False False False False True True True True True True
True True False False True True True False True True True True
True False True True False True False False False False True False
False False False False False True True False False False False True
False True False False False False False False False False False False
False False False False False False True False False False True False
False False False False False True]
```

[illegible]



[illegible]

Adding 3 to sepal\_length: [ 8.1 7.9 7.7 7.6 8. 8.4 7.6 8. 7.4 7.9 8.4 7.8 7.8 7.3

8.8 8.7 8.4 8.1 8.7 8.1 8.4 8.1 7.6 8.1 7.8 8. 8. 8.2  
8.2 7.7 7.8 8.4 8.2 8.5 7.9 8. 8.5 7.9 7.4 8.1 8. 7.5  
7.4 8. 8.1 7.8 8.1 7.6 8.3 8. 10. 9.4 9.9 8.5 9.5 8.7  
9.3 7.9 9.6 8.2 8. 8.9 9. 9.1 8.6 9.7 8.6 8.8 9.2 8.6  
8.9 9.1 9.3 9.1 9.4 9.6 9.8 9.7 9. 8.7 8.5 8.5 8.8 9.  
8.4 9. 9.7 9.3 8.6 8.5 8.5 9.1 8.8 8. 8.6 8.7 8.7 9.2  
8.1 8.7 9.3 8.8 10.1 9.3 9.5 10.6 7.9 10.3 9.7 10.2 9.5 9.4  
9.8 8.7 8.8 9.4 9.5 10.7 10.7 9. 9.9 8.6 10.7 9.3 9.7 10.2  
9.2 9.1 9.4 10.2 10.4 10.9 9.4 9.3 9.1 10.7 9.3 9.4 9. 9.9  
9.7 9.9 8.8 9.8 9.7 9.7 9.3 9.5 9.2 8.9]

Multiplying sepal\_length by 3: [15.3 14.7 14.1 13.8 15. 16.2 13.8 15. 13.2 14.7 16.2 14.4 14.4 12.9

17.4 17.1 16.2 15.3 17.1 15.3 16.2 15.3 13.8 15.3 14.4 15. 15. 15.6  
15.6 14.1 14.4 16.2 15.6 16.5 14.7 15. 16.5 14.7 13.2 15.3 15. 13.5  
13.2 15. 15.3 14.4 15.3 13.8 15.9 15. 21. 19.2 20.7 16.5 19.5 17.1  
18.9 14.7 19.8 15.6 15. 17.7 18. 18.3 16.8 20.1 16.8 17.4 18.6 16.8  
17.7 18.3 18.9 18.3 19.2 19.8 20.4 20.1 18. 17.1 16.5 16.5 17.4 18.

16.2 18. 20.1 18.9 16.8 16.5 16.5 18.3 17.4 15. 16.8 17.1 17.1 18.6  
 15.3 17.1 18.9 17.4 21.3 18.9 19.5 22.8 14.7 21.9 20.1 21.6 19.5 19.2  
 20.4 17.1 17.4 19.2 19.5 23.1 23.1 18. 20.7 16.8 23.1 18.9 20.1 21.6  
 18.6 18.3 19.2 21.6 22.2 23.7 19.2 18.9 18.3 23.1 18.9 19.2 18. 20.7  
 20.1 20.7 17.4 20.4 20.1 20.1 18.9 19.5 18.6 17.7]

Selecting petal\_length values greater than 1.5: [1.7 1.6 1.7 1.7 1.7 1.9 1.6 1.6 1.6 1.6 1.6 1.9 1.6 4.7  
 4.5 4.9 4. 4.6

4.5 4.7 3.3 4.6 3.9 3.5 4.2 4. 4.7 3.6 4.4 4.5 4.1 4.5 3.9 4.8 4. 4.9  
 4.7 4.3 4.4 4.8 5. 4.5 3.5 3.8 3.7 3.9 5.1 4.5 4.5 4.7 4.4 4.1 4. 4.4  
 4.6 4. 3.3 4.2 4.2 4.2 4.3 3. 4.1 6. 5.1 5.9 5.6 5.8 6.6 4.5 6.3 5.8  
 6.1 5.1 5.3 5.5 5. 5.1 5.3 5.5 6.7 6.9 5. 5.7 4.9 6.7 4.9 5.7 6. 4.8  
 4.9 5.6 5.8 6.1 6.4 5.6 5.1 5.6 6.1 5.6 5.5 4.8 5.4 5.6 5.1 5.1 5.9 5.7  
 5.2 5. 5.2 5.4 5.1]

Randomly selected flowers:	sepal_length	sepal_width	petal_length	petal_width	species
122	7.7	2.8	6.7	2.0	Iris-virginica
43	5.0	3.5	1.6	0.6	Iris-setosa
132	6.4	2.8	5.6	2.2	Iris-virginica
144	6.7	3.3	5.7	2.5	Iris-virginica
6	4.6	3.4	1.4	0.3	Iris-setosa

[4.3 4.48947368 4.67894737 4.86842105 5.05789474 5.24736842  
 5.43684211 5.62631579 5.81578947 6.00526316 6.19473684 6.38421053  
 6.57368421 6.76315789 6.95263158 7.14210526 7.33157895 7.52105263

```
7.71052632 7.9    ]
```

Sepal DataFrame:

```
    sepal_length
0         5.1
1         4.9
2         4.7
3         4.6
4         5.0
..         ...
145        6.7
146        6.3
147        6.5
148        6.2
149        5.9
```

[150 rows x 1 columns]

Petal DataFrame:

```
    petal_length
0         1.4
1         1.4
2         1.3
3         1.5
4         1.4
..         ...
145        5.2
146        5.0
147        5.2
148        5.4
149        5.1
```

[150 rows x 1 columns]

Joined DataFrame:    sepal\_length   petal\_length

0	5.1	1.4
1	4.9	1.4
2	4.7	1.3
3	4.6	1.5
4	5.0	1.4
..	...	...
145	6.7	5.2
146	6.3	5.0
147	6.5	5.2
148	6.2	5.4
149	5.9	5.1

[150 rows x 2 columns]

	sepal_length
0	5.1
1	4.9
2	4.7
3	4.6
4	5.0
..	...
145	6.7
146	6.3
147	6.5
148	6.2
149	5.9



[150 rows x 1 columns]

	petal_length
0	1.4
1	1.4
2	1.3
3	1.5
4	1.4
..	...
145	5.2
146	5.0
147	5.2
148	5.4
149	5.1

[150 rows x 1 columns]

Pivot table-Average Sepal Length by Sepal Width:

	sepal_length
sepal_width	
2.0	5.000000
2.2	6.066667
2.3	5.325000
2.4	5.300000
2.5	5.762500
2.6	6.160000
2.7	5.855556
2.8	6.335714
2.9	6.060000

3.0	6.015385
3.1	5.941667
3.2	5.884615
3.3	6.016667
3.4	5.316667
3.5	5.150000
3.6	5.600000
3.7	5.266667
3.8	6.100000
3.9	5.400000
4.0	5.800000
4.1	5.200000
4.2	5.500000
4.4	5.700000

Rows swapped in reverse order:

	sepal_length	sepal_width	petal_length	petal_width	species
149	5.9	3.0	5.1	1.8	Iris-virginica
148	6.2	3.4	5.4	2.3	Iris-virginica
147	6.5	3.0	5.2	2.0	Iris-virginica
146	6.3	2.5	5.0	1.9	Iris-virginica
145	6.7	3.0	5.2	2.3	Iris-virginica
..	...	...	...	...	...
4	5.0	3.6	1.4	0.2	Iris-setosa
3	4.6	3.1	1.5	0.2	Iris-setosa
2	4.7	3.2	1.3	0.2	Iris-setosa
1	4.9	3.0	1.4	0.2	Iris-setosa
0	5.1	3.5	1.4	0.2	Iris-setosa

[150 rows x 5 columns]

Columns swapped in reverse order:

	species	petal_width	petal_length	sepal_width	sepal_length
0	Iris-setosa	0.2	1.4	3.5	5.1
1	Iris-setosa	0.2	1.4	3.0	4.9
2	Iris-setosa	0.2	1.3	3.2	4.7
3	Iris-setosa	0.2	1.5	3.1	4.6
4	Iris-setosa	0.2	1.4	3.6	5.0
..	...	...	...	...	...
145	Iris-virginica	2.3	5.2	3.0	6.7
146	Iris-virginica	1.9	5.0	2.5	6.3
147	Iris-virginica	2.0	5.2	3.0	6.5
148	Iris-virginica	2.3	5.4	3.4	6.2
149	Iris-virginica	1.8	5.1	3.0	5.9

[150 rows x 5 columns]

Both rows and columns swapped in reverse order:

	species	petal_width	petal_length	sepal_width	sepal_length
149	Iris-virginica	1.8	5.1	3.0	5.9
148	Iris-virginica	2.3	5.4	3.4	6.2
147	Iris-virginica	2.0	5.2	3.0	6.5
146	Iris-virginica	1.9	5.0	2.5	6.3
145	Iris-virginica	2.3	5.2	3.0	6.7
..	...	...	...	...	...
4	Iris-setosa	0.2	1.4	3.6	5.0
3	Iris-setosa	0.2	1.5	3.1	4.6
2	Iris-setosa	0.2	1.3	3.2	4.7
1	Iris-setosa	0.2	1.4	3.0	4.9
0	Iris-setosa	0.2	1.4	3.5	5.1

[150 rows x 5 columns]

Lowercase:

0 5.1

1 4.9

2 4.7

3 4.6

4 5.0

...

145 6.7

146 6.3

147 6.5

148 6.2

149 5.9

Name: sepal\_length\_str, Length: 150, dtype: object

Length:

0 3

1 3

2 3

3 3

4 3

..

145 3

146 3

147 3

148 3

149 3

Name: sepal\_length\_str, Length: 150, dtype: int64

Starts with '5':

0	True
1	False
2	False
3	False
4	True
...	
145	False
146	False
147	False
148	False
149	True

Name: sepal\_length\_str, Length: 150, dtype: bool

Split:

0	[5.1]
1	[4.9]
2	[4.7]
3	[4.6]
4	[5.0]
...	
145	[6.7]
146	[6.3]
147	[6.5]
148	[6.2]
149	[5.9]

Name: sepal\_length\_str, Length: 150, dtype: object

Extract letters:

```
0    NaN
1    NaN
2    NaN
3    NaN
4    NaN
```

...

```
145   NaN
146   NaN
147   NaN
148   NaN
149   NaN
```

Name: sepal\_length\_str, Length: 150, dtype: object

Find patterns that don't start/end with vowels:

```
0    [5.1]
1    [4.9]
2    [4.7]
3    [4.6]
4    [5.0]
```

...

```
145   [6.7]
146   [6.3]
147   [6.5]
148   [6.2]
149   [5.9]
```

Name: sepal\_length\_str, Length: 150, dtype: object

First 3 characters:

```
0    5.1
1    4.9
2    4.7
```

3 4.6

4 5.0

...

145 6.7

146 6.3

147 6.5

148 6.2

149 5.9

Name: sepal\_length\_str, Length: 150, dtype: object

Last split element:

0 5.1

1 4.9

2 4.7

3 4.6

4 5.0

...

145 6.7

146 6.3

147 6.5

148 6.2

149 5.9

Name: sepal\_length\_str, Length: 150, dtype: object

Mean along the second axis (petal\_width): [0.2 0.2 0.2 0.2 0.2 0.4 0.3 0.2 0.2 0.1 0.2 0.2 0.1 0.1 0.2  
0.4 0.4 0.3

0.3 0.3 0.2 0.4 0.2 0.5 0.2 0.2 0.4 0.2 0.2 0.2 0.2 0.4 0.1 0.2 0.1 0.2

0.2 0.1 0.2 0.2 0.3 0.3 0.2 0.6 0.4 0.3 0.2 0.2 0.2 0.2 1.4 1.5 1.5 1.3

1.5 1.3 1.6 1. 1.3 1.4 1. 1.5 1. 1.4 1.3 1.4 1.5 1. 1.5 1.1 1.8 1.3

1.5 1.2 1.3 1.4 1.4 1.7 1.5 1. 1.1 1. 1.2 1.6 1.5 1.6 1.5 1.3 1.3 1.3  
1.2 1.4 1.2 1. 1.3 1.2 1.3 1.3 1.1 1.3 2.5 1.9 2.1 1.8 2.2 2.1 1.7 1.8  
1.8 2.5 2. 1.9 2.1 2. 2.4 2.3 1.8 2.2 2.3 1.5 2.3 2. 2. 1.8 2.1 1.8  
1.8 1.8 2.1 1.6 1.9 2. 2.2 1.5 1.4 2.3 2.4 1.8 1.8 2.1 2.4 2.3 1.9 2.3  
2.5 2.3 1.9 2. 2.3 1.8]

Median along the second axis (petal\_width): [0.2 0.2 0.2 0.2 0.2 0.4 0.3 0.2 0.2 0.1 0.2 0.2 0.1 0.1 0.2 0.4 0.4 0.3]

0.3 0.3 0.2 0.4 0.2 0.5 0.2 0.2 0.4 0.2 0.2 0.2 0.2 0.4 0.1 0.2 0.1 0.2  
0.2 0.1 0.2 0.2 0.3 0.3 0.2 0.6 0.4 0.3 0.2 0.2 0.2 0.2 1.4 1.5 1.5 1.3  
1.5 1.3 1.6 1. 1.3 1.4 1. 1.5 1. 1.4 1.3 1.4 1.5 1. 1.5 1.1 1.8 1.3  
1.5 1.2 1.3 1.4 1.4 1.7 1.5 1. 1.1 1. 1.2 1.6 1.5 1.6 1.5 1.3 1.3 1.3  
1.2 1.4 1.2 1. 1.3 1.2 1.3 1.3 1.1 1.3 2.5 1.9 2.1 1.8 2.2 2.1 1.7 1.8  
1.8 2.5 2. 1.9 2.1 2. 2.4 2.3 1.8 2.2 2.3 1.5 2.3 2. 2. 1.8 2.1 1.8  
1.8 1.8 2.1 1.6 1.9 2. 2.2 1.5 1.4 2.3 2.4 1.8 1.8 2.1 2.4 2.3 1.9 2.3  
2.5 2.3 1.9 2. 2.3 1.8]

Standard deviation along the second axis (petal\_width): [0. 0.]

[illegible]

Variance along the second axis (petal\_width): [0. 0.]

[illegible]



Column: sepal\_length

Mean: 5.843333333333334

Median: 5.8

Standard Deviation: 0.8253012917851409

Variance: 0.6811222222222223

---

Column: sepal\_width

Mean: 3.0540000000000003

Median: 3.0

Standard Deviation: 0.4321465800705435

Variance: 0.18675066666666668

---

Column: petal\_length

Mean: 3.7586666666666666

Median: 4.35

Standard Deviation: 1.7585291834055212

Variance: 3.092424888888889

---

Column: petal\_width

Mean: 1.1986666666666668

Median: 1.3

Standard Deviation: 0.7606126185881716

Variance: 0.5785315555555555

---

Sorted Dataset by Petal Width:

petal\_width

12	0.1
13	0.1
9	0.1
32	0.1
34	0.1
..	...
136	2.4
114	2.4
109	2.5
100	2.5
144	2.5

[150 rows x 1 columns]

Sorted Dataset by Sepal Length, Sepal Width, Petal Length, and Petal Width:

	sepal_length	sepal_width	petal_length	petal_width
13	4.3	3.0	1.1	0.1
8	4.4	2.9	1.4	0.2
38	4.4	3.0	1.3	0.2
42	4.4	3.2	1.3	0.2
41	4.5	2.3	1.3	0.3
..	...	...	...	...
118	7.7	2.6	6.9	2.3
122	7.7	2.8	6.7	2.0
135	7.7	3.0	6.1	2.3
117	7.7	3.8	6.7	2.2
131	7.9	3.8	6.4	2.0

[150 rows x 4 columns]

Before Handling Missing Data:

sepal length (cm) 0

sepal width (cm) 0

petal length (cm) 0

petal width (cm) 0

target 0

dtype: int64

After Handling Missing Data:

sepal length (cm) 0

sepal width (cm) 0

petal length (cm) 0

petal width (cm) 0

target 0

dtype: int64

Filtered Data (Sepal length > 5):

	sepal length (cm)	sepal width (cm)	petal length (cm)	petal width (cm)	target
0	5.1	3.5	1.4	0.2	0
5	5.4	3.9	1.7	0.4	0
10	5.4	3.7	1.5	0.2	0
14	5.8	4.0	1.2	0.2	0
15	5.7	4.4	1.5	0.4	0

Data After Transformation (Added Sepal Area):

	sepal length (cm)	sepal width (cm)	petal length (cm)	petal width (cm)	target	sepal area (cm^2)
0	5.1	3.5	1.4	0.2	0	17.85
1	4.9	3.0	1.4	0.2	0	14.70
2	4.7	3.2	1.3	0.2	0	15.04
3	4.6	3.1	1.5	0.2	0	14.26
4	5.0	3.6	1.4	0.2	0	18.00

Concatenated Data:

	sepal length (cm)	sepal width (cm)	petal length (cm)	...	petal width (cm)	target	sepal area (cm^2)
0	5.1	3.5	1.4	...	0.2	0	17.85
1	4.9	3.0	1.4	...	0.2	0	14.70
2	4.7	3.2	1.3	...	0.2	0	15.04
3	4.6	3.1	1.5	...	0.2	0	14.26
4	5.0	3.6	1.4	...	0.2	0	18.00

[5 rows x 12 columns]

```
Column Names: Index(['sepal length (cm)', 'sepal width (cm)', 'petal length (cm)',  
                    'petal width (cm)', 'target', 'sepal area (cm^2)'],  
                  dtype='object')
```

First few rows of the dataset: sepal length (cm) sepal width (cm) petal length (cm) petal width (cm) target sepal area (cm^2)

0	5.1	3.5	1.4	0.2	0	17.85
1	4.9	3.0	1.4	0.2	0	14.70
2	4.7	3.2	1.3	0.2	0	15.04
3	4.6	3.1	1.5	0.2	0	14.26
4	5.0	3.6	1.4	0.2	0	18.00

'species' column not found in the dataset.

Data Types After Conversion:

sepal length (cm) float64

sepal width (cm) float64

petal length (cm) float64

petal width (cm) float64

target int64

sepal area (cm<sup>2</sup>) float64

dtype: object

