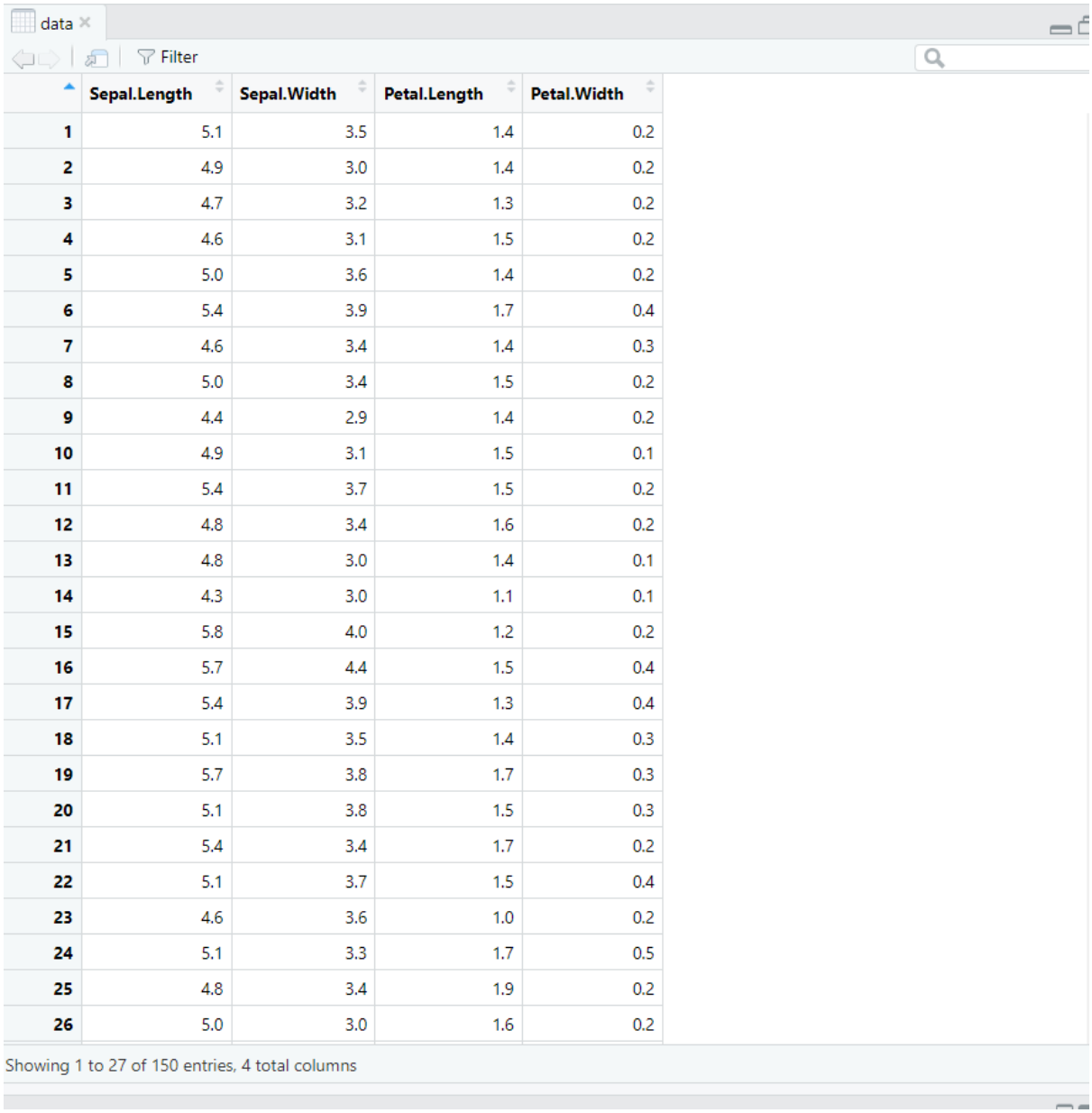
```
data=iris
data= data[,1:4]
View(data)
```



data

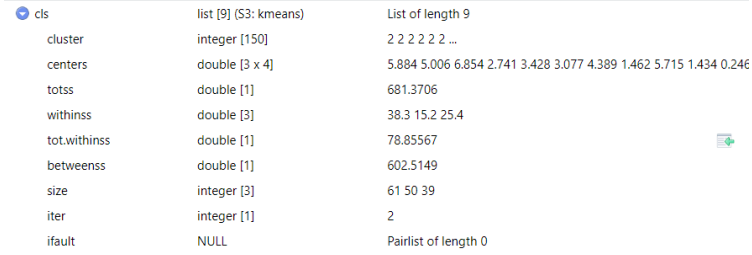
Filter

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

Showing 1 to 27 of 150 entries, 4 total columns

```
dim(data)
[1] 150   4
```

```
cls=kmeans(data,3,algorithm = "MacQueen")
```



| | | |
|---|---|---|
| cls | list [9] (S3: kmeans) | List of length 9 |
| cluster | integer [150] | 2 2 2 2 2 2 ... |
| centers | double [3 x 4] | 5.884 5.006 6.854 2.741 3.428 3.077 4.389 1.462 5.715 1.434 0.246 |
| totss | double [1] | 681.3706 |
| withinss | double [3] | 38.3 15.2 25.4 |
| tot.withinss | double [1] | 78.85567 |
| betweenss | double [1] | 602.5149 |
| size | integer [3] | 61 50 39 |
| iter | integer [1] | 2 |
| ifault | NULL | Pairlist of length 0 |

cls$cluster

(or)

cls[["cluster"]]

```
  [1] 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
 [40] 2 2 2 2 2 2 2 2 2 2 2 3 1 3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 3
 [79] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 3 1 3 3 3 3 1 3 3 3 3 3 3 1 1 3 3
[118] 3 3 1 3 1 3 1 3 3 1 1 3 3 3 3 3 1 3 3 3 1 3 3 3 1 3 3 3 1 3 3 1
```

table(cls$cluster)

```
 1  2  3
61 50 39
```

cls=kmeans(data,3,iter.max=1000,nstart=5,algorithm = "Hartigan-Wong")

| cls | list [9] (S3: kmeans) | List of length 9 |
|---|---|---|
| cluster | integer [150] | 3 3 3 3 3 3 ... |
| centers | double [3 x 4] | 5.902 6.850 5.006 2.748 3.074 3.428 4.394 5.742 1.462 1.434 2.071... |
| totss | double [1] | 681.3706 |
| withinss | double [3] | 39.8 23.9 15.2 |
| tot.withinss | double [1] | 78.85144 |
| betweenss | double [1] | 602.5192 |
| size | integer [3] | 62 38 50 |
| iter | integer [1] | 2 |
| ifault | integer [1] | 0 |

table(cls$cluster)

```
 1  2  3
62 38 50
```

cls$centers

```
  Sepal.Length Sepal.Width Petal.Length Petal.Width
1     5.901613    2.748387     4.393548    1.433871
2     6.850000    3.073684     5.742105    2.071053
3     5.006000    3.428000     1.462000    0.246000
```

cls[["withinss"]]

(or)

cls$withinss

```
[1] 39.82097 23.87947 15.15100
```

cls$totss

```
[1] 681.3706
```

cls$tot.withinss

```
[1] 78.85144
```

cls2=kmeans(data,3,iter.max=1000,nstart=2,algorithm = "Lloyd")

| | | |
|---|---|---|
| cls2 | list [9] (S3: kmeans) | List of length 9 |
| cluster | integer [150] | 2 2 2 2 2 2 ... |
| centers | double [3 x 4] | 5.902 5.006 6.850 2.748 3.428 3.074 4.394 1.462 5.742 1.434 0.246... |
| totss | double [1] | 681.3706 |
| withinss | double [3] | 39.8 15.2 23.9 |
| tot.withinss | double [1] | 78.85144 |
| betweenss | double [1] | 602.5192 |
| size | integer [3] | 62 50 38 |
| iter | integer [1] | 5 |
| ifault | NULL | Pairlist of length 0 |

cls2$withinss

```
[1] 39.82097 15.15100 23.87947
```

cls2$totss

```
[1] 681.3706
```