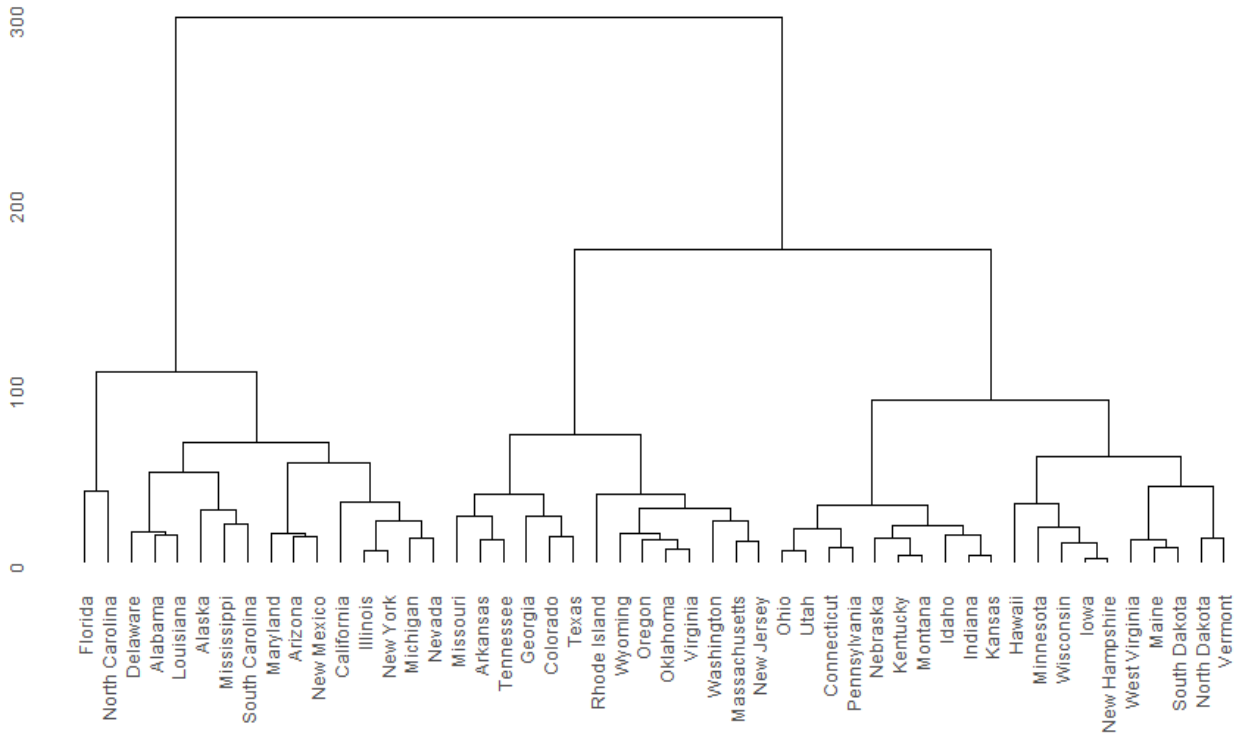
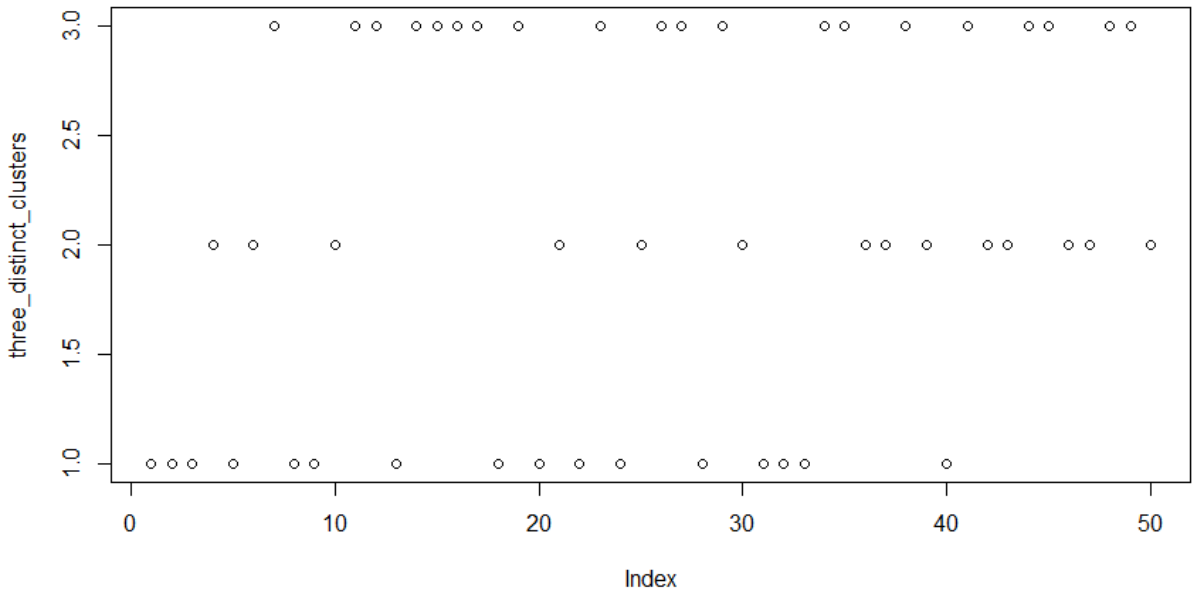
1.)

a.) Clustering of states (hierarchical):

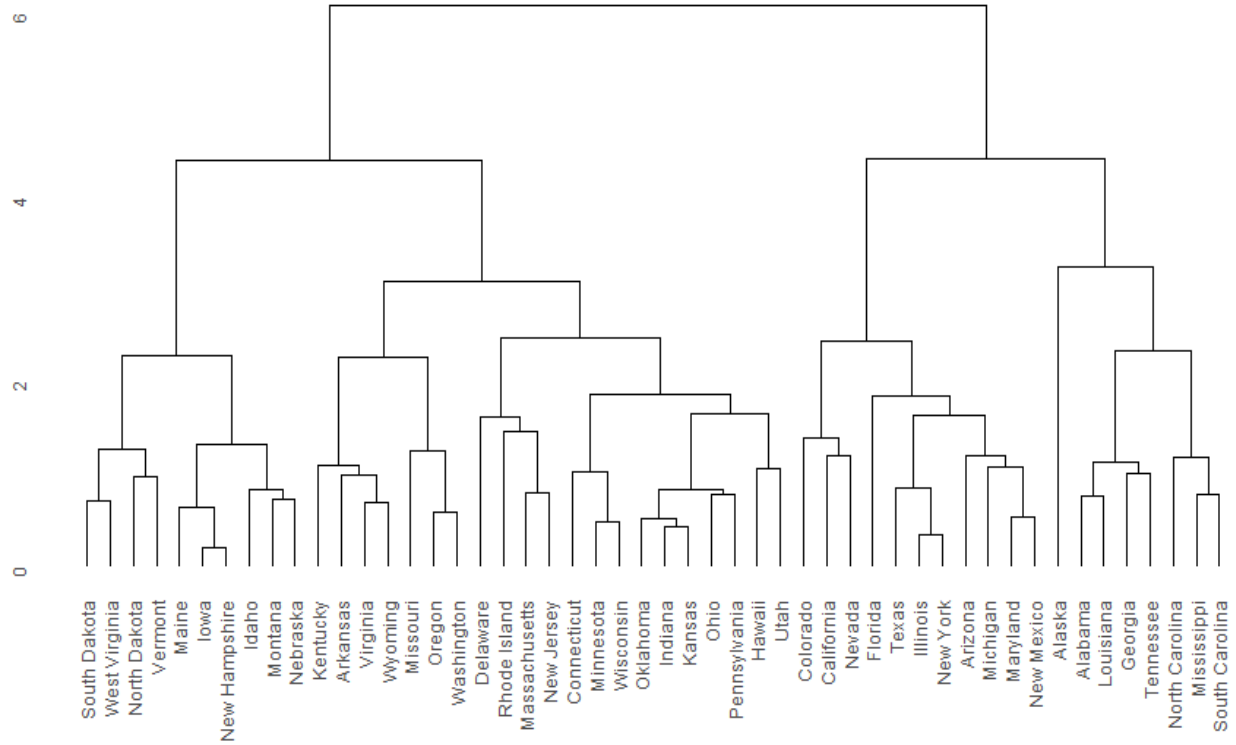


b.) Cutting the dendrogram at a height that results in three distinct clusters:

```
> three_distinct_clusters
       Alabama         Alaska        Arizona       Arkansas     California       Colorado    Connecticut
             1              1              1              2              1              2              3
      Delaware        Florida        Georgia         Hawaii          Idaho       Illinois        Indiana
             1              1              2              3              3              1              3
          Iowa         Kansas       Kentucky      Louisiana          Maine       Maryland  Massachusetts
             3              3              3              1              3              1              2
      Michigan      Minnesota    Mississippi       Missouri        Montana       Nebraska         Nevada
             1              3              1              2              3              3              1
 New Hampshire     New Jersey     New Mexico       New York North Carolina   North Dakota           Ohio
             3              2              1              1              1              3              3
      Oklahoma         Oregon   Pennsylvania   Rhode Island South Carolina   South Dakota      Tennessee
             2              2              3              2              1              3              2
         Texas           Utah        Vermont       Virginia     Washington  West Virginia      Wisconsin
             2              3              3              2              2              3              3
       Wyoming
             2
> plot(three_distinct_clusters)
> table(three_distinct_clusters)
three_distinct_clusters
 1  2  3
16 14 20
```

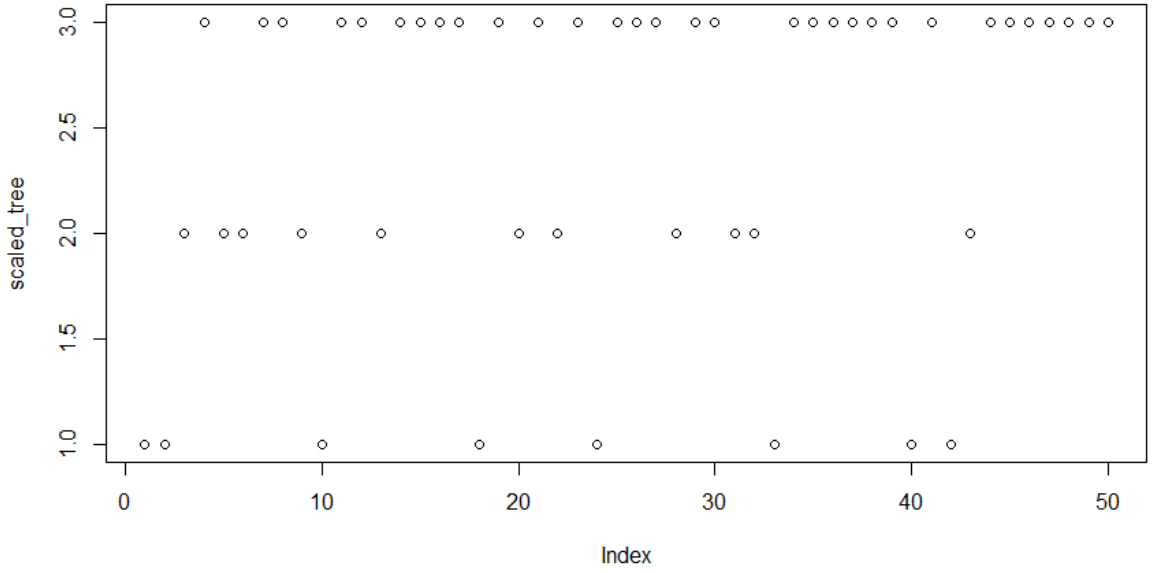


c.) <u>Hierarchically clustering the states after scaling the variables:</u>



d.) Effect of scaling the variables on hierarchical clustering:

```
scaled_tree
 1  2  3
 8 11 31
```



Scaling the variables effects the maximum height of the dendogram obtained from hierarchical clustering. It also affects the clusters obtained from cutting the dendogram into 3 clusters. In my opinion, Scaling should be done if the units of measure of variables are different.