**Clustering Variables with SAS VARCLUS**

|  |
| --- |
| **proc** **varclus** maxeigen = **.7**; var d1-d20; **run**;  |

Oblique Principal Component Cluster Analysis

|  |  |  |  |
| --- | --- | --- | --- |
| **Observations** | 197 | **Proportion** | 0 |
| **Variables** | 20 | **Maxeigen** | 0.7 |

|  |
| --- |
| Clustering algorithm converged. |

| **Cluster Summary for 1 Cluster** |
| --- |
| **Cluster** | **Members** | **ClusterVariation** | **VariationExplained** | **ProportionExplained** | **SecondEigenvalue** |
| **1** | 20 | 20 | 9.184321 | 0.4592 | 1.4037 |

Total variation explained = 9.184321 Proportion = 0.4592

 Cluster 1 will be split because it has the largest second eigenvalue, 1.403711, which is greater than the MAXEIGEN=0.7 value.

|  |
| --- |
| Clustering algorithm converged. |

| **Cluster Summary for 2 Clusters** |
| --- |
| **Cluster** | **Members** | **ClusterVariation** | **VariationExplained** | **ProportionExplained** | **SecondEigenvalue** |
| **1** | 11 | 11 | 5.769299 | 0.5245 | 1.0170 |
| **2** | 9 | 9 | 4.675618 | 0.5195 | 0.8508 |

Total variation explained = 10.44492 Proportion = 0.5222

| **2 Clusters** | **R-squared with** | **1-R\*\*2Ratio** | **VariableLabel** |
| --- | --- | --- | --- |
| **Cluster** | **Variable** | **OwnCluster** | **NextClosest** |
| **Cluster 1** | **d1** | 0.5174 | 0.2801 | 0.6703 | d1 |
|  | **d2** | 0.6046 | 0.2653 | 0.5383 | d2 |
|  | **d3** | 0.5417 | 0.2611 | 0.6203 | d3 |
|  | **d4** | 0.4421 | 0.3219 | 0.8228 | d4 |
|  | **d5** | 0.6368 | 0.3856 | 0.5911 | d5 |
|  | **d6** | 0.5955 | 0.3576 | 0.6297 | d6 |
|  | **d7** | 0.6253 | 0.3762 | 0.6006 | d7 |
|  | **d8** | 0.3677 | 0.1703 | 0.7620 | d8 |
|  | **d10** | 0.5324 | 0.3606 | 0.7314 | d10 |
|  | **d11** | 0.5476 | 0.2978 | 0.6443 | d11 |
|  | **d19** | 0.3582 | 0.2144 | 0.8169 | d19 |
| **Cluster 2** | **d9** | 0.4782 | 0.3545 | 0.8084 | d9 |
|  | **d12** | 0.4385 | 0.2551 | 0.7538 | d12 |
|  | **d13** | 0.5016 | 0.3393 | 0.7543 | d13 |
|  | **d14** | 0.6029 | 0.3121 | 0.5774 | d14 |
|  | **d15** | 0.5924 | 0.3951 | 0.6737 | d15 |
|  | **d16** | 0.5409 | 0.3099 | 0.6653 | d16 |
|  | **d17** | 0.5861 | 0.2940 | 0.5863 | d17 |
|  | **d18** | 0.4502 | 0.1986 | 0.6860 | d18 |
|  | **d20** | 0.4848 | 0.2142 | 0.6556 | d20 |

 The second cluster consists of items measuring Lack of Pleasure and Asociality

| **Cluster Structure** |
| --- |
| **Cluster** |  | **1** | **2** |
| **d1** | **d1** | 0.719337 | 0.529269 |
| **d2** | **d2** | 0.777531 | 0.515113 |
| **d3** | **d3** | 0.736015 | 0.511026 |
| **d4** | **d4** | 0.664905 | 0.567392 |
| **d5** | **d5** | 0.798002 | 0.620955 |
| **d6** | **d6** | 0.771699 | 0.598028 |
| **d7** | **d7** | 0.790779 | 0.613341 |
| **d8** | **d8** | 0.606382 | 0.412624 |
| **d9** | **d9** | 0.595438 | 0.691517 |
| **d10** | **d10** | 0.729631 | 0.600525 |
| **d11** | **d11** | 0.739973 | 0.545716 |
| **d12** | **d12** | 0.505100 | 0.662218 |
| **d13** | **d13** | 0.582475 | 0.708237 |
| **d14** | **d14** | 0.558698 | 0.776435 |
| **d15** | **d15** | 0.628530 | 0.769708 |
| **d16** | **d16** | 0.556647 | 0.735429 |
| **d17** | **d17** | 0.542252 | 0.765590 |
| **d18** | **d18** | 0.445654 | 0.670995 |
| **d19** | **d19** | 0.598505 | 0.463014 |
| **d20** | **d20** | 0.462766 | 0.696255 |

| **Inter-Cluster Correlations** |
| --- |
| **Cluster** | **1** | **2** |
| **1** | 1.00000 | 0.75329 |
| **2** | 0.75329 | 1.00000 |

Cluster 1 will be split because it has the largest second eigenvalue, 1.017045, which is greater than the MAXEIGEN=0.7 value.

|  |
| --- |
| Clustering algorithm converged. |

| **Cluster Summary for 3 Clusters** |
| --- |
| **Cluster** | **Members** | **ClusterVariation** | **VariationExplained** | **ProportionExplained** | **SecondEigenvalue** |
| **1** | 7 | 7 | 4.021209 | 0.5745 | 0.8848 |
| **2** | 9 | 9 | 4.675618 | 0.5195 | 0.8508 |
| **3** | 4 | 4 | 2.72684 | 0.6817 | 0.5974 |

Total variation explained = 11.42367 Proportion = 0.5712

| **3 Clusters** | **R-squared with** | **1-R\*\*2Ratio** | **VariableLabel** |
| --- | --- | --- | --- |
| **Cluster** | **Variable** | **OwnCluster** | **NextClosest** |
| **Cluster 1** | **d5** | 0.6796 | 0.3856 | 0.5214 | d5 |
|  | **d6** | 0.6435 | 0.3576 | 0.5549 | d6 |
|  | **d7** | 0.6872 | 0.3762 | 0.5014 | d7 |
|  | **d8** | 0.4238 | 0.1773 | 0.7004 | d8 |
|  | **d10** | 0.5679 | 0.3606 | 0.6758 | d10 |
|  | **d11** | 0.5840 | 0.3069 | 0.6002 | d11 |
|  | **d19** | 0.4351 | 0.2144 | 0.7190 | d19 |
| **Cluster 2** | **d9** | 0.4782 | 0.3109 | 0.7572 | d9 |
|  | **d12** | 0.4385 | 0.2307 | 0.7298 | d12 |
|  | **d13** | 0.5016 | 0.3400 | 0.7551 | d13 |
|  | **d14** | 0.6029 | 0.3044 | 0.5709 | d14 |
|  | **d15** | 0.5924 | 0.4113 | 0.6923 | d15 |
|  | **d16** | 0.5409 | 0.2885 | 0.6454 | d16 |
|  | **d17** | 0.5861 | 0.2573 | 0.5572 | d17 |
|  | **d18** | 0.4502 | 0.1806 | 0.6709 | d18 |
|  | **d20** | 0.4848 | 0.2056 | 0.6486 | d20 |
| **Cluster 3** | **d1** | 0.6824 | 0.3190 | 0.4664 | d1 |
|  | **d2** | 0.7332 | 0.3980 | 0.4432 | d2 |
|  | **d3** | 0.7014 | 0.3396 | 0.4521 | d3 |
|  | **d4** | 0.6098 | 0.3219 | 0.5755 | d4 |

 These are the Anxiety items

| **Cluster Structure** |
| --- |
| **Cluster** |  | **1** | **2** | **3** |
| **d1** | **d1** | 0.564809 | 0.529269 | 0.826081 |
| **d2** | **d2** | 0.630899 | 0.515113 | 0.856259 |
| **d3** | **d3** | 0.582753 | 0.511026 | 0.837524 |
| **d4** | **d4** | 0.514992 | 0.567392 | 0.780899 |
| **d5** | **d5** | 0.824398 | 0.620955 | 0.597334 |
| **d6** | **d6** | 0.802215 | 0.598028 | 0.572104 |
| **d7** | **d7** | 0.828991 | 0.613341 | 0.575767 |
| **d8** | **d8** | 0.650965 | 0.412624 | 0.421036 |
| **d9** | **d9** | 0.557572 | 0.691517 | 0.542206 |
| **d10** | **d10** | 0.753594 | 0.600525 | 0.546970 |
| **d11** | **d11** | 0.764206 | 0.545716 | 0.553988 |
| **d12** | **d12** | 0.480267 | 0.662218 | 0.445776 |
| **d13** | **d13** | 0.583074 | 0.708237 | 0.469650 |
| **d14** | **d14** | 0.551708 | 0.776435 | 0.461939 |
| **d15** | **d15** | 0.641340 | 0.769708 | 0.484694 |
| **d16** | **d16** | 0.537159 | 0.735429 | 0.479049 |
| **d17** | **d17** | 0.507214 | 0.765590 | 0.494001 |
| **d18** | **d18** | 0.424935 | 0.670995 | 0.393245 |
| **d19** | **d19** | 0.659645 | 0.463014 | 0.392876 |
| **d20** | **d20** | 0.453470 | 0.696255 | 0.388778 |

| **Inter-Cluster Correlations** |
| --- |
| **Cluster** | **1** | **2** | **3** |
| **1** | 1.00000 | 0.73205 | 0.69568 |
| **2** | 0.73205 | 1.00000 | 0.64153 |
| **3** | 0.69568 | 0.64153 | 1.00000 |

Cluster 1 will be split because it has the largest second eigenvalue, 0.884766, which is greater than the MAXEIGEN=0.7 value.

|  |
| --- |
| Clustering algorithm converged. |

| **Cluster Summary for 4 Clusters** |
| --- |
| **Cluster** | **Members** | **ClusterVariation** | **VariationExplained** | **ProportionExplained** | **SecondEigenvalue** |
| **1** | 5 | 5 | 2.98692 | 0.5974 | 0.6607 |
| **2** | 7 | 7 | 3.881786 | 0.5545 | 0.7250 |
| **3** | 4 | 4 | 2.72684 | 0.6817 | 0.5974 |
| **4** | 4 | 4 | 2.759388 | 0.6898 | 0.6013 |

Total variation explained = 12.35493 Proportion = 0.6177

| **4 Clusters** | **R-squared with** | **1-R\*\*2Ratio** | **VariableLabel** |
| --- | --- | --- | --- |
| **Cluster** | **Variable** | **OwnCluster** | **NextClosest** |
| **Cluster 1** | **d10** | 0.7262 | 0.3040 | 0.3934 | d10 |
|  | **d11** | 0.6460 | 0.3329 | 0.5306 | d11 |
|  | **d12** | 0.5879 | 0.2938 | 0.5835 | d12 |
|  | **d13** | 0.5498 | 0.3509 | 0.6936 | d13 |
|  | **d19** | 0.4770 | 0.2469 | 0.6944 | d19 |
| **Cluster 2** | **d9** | 0.5482 | 0.3405 | 0.6851 | d9 |
|  | **d14** | 0.6436 | 0.2965 | 0.5067 | d14 |
|  | **d15** | 0.5824 | 0.3774 | 0.6707 | d15 |
|  | **d16** | 0.5292 | 0.3088 | 0.6812 | d16 |
|  | **d17** | 0.6202 | 0.2519 | 0.5076 | d17 |
|  | **d18** | 0.4449 | 0.2285 | 0.7194 | d18 |
|  | **d20** | 0.5133 | 0.2141 | 0.6193 | d20 |
| **Cluster 3** | **d1** | 0.6824 | 0.2791 | 0.4406 | d1 |
|  | **d2** | 0.7332 | 0.3832 | 0.4326 | d2 |
|  | **d3** | 0.7014 | 0.3102 | 0.4328 | d3 |
|  | **d4** | 0.6098 | 0.3236 | 0.5769 | d4 |
| **Cluster 4** | **d5** | 0.7198 | 0.3861 | 0.4564 | d5 |
|  | **d6** | 0.6926 | 0.3485 | 0.4718 | d6 |
|  | **d7** | 0.7850 | 0.3715 | 0.3422 | d7 |
|  | **d8** | 0.5620 | 0.1845 | 0.5371 | d8 |

 These are the four of the five Sadness items

| **Cluster Structure** |
| --- |
| **Cluster** |  | **1** | **2** | **3** | **4** |
| **d1** | **d1** | 0.517336 | 0.511034 | 0.826081 | 0.528339 |
| **d2** | **d2** | 0.511376 | 0.507074 | 0.856259 | 0.619003 |
| **d3** | **d3** | 0.556975 | 0.477136 | 0.837524 | 0.535999 |
| **d4** | **d4** | 0.484030 | 0.568872 | 0.780899 | 0.476302 |
| **d5** | **d5** | 0.594894 | 0.621359 | 0.597334 | 0.848415 |
| **d6** | **d6** | 0.582718 | 0.590306 | 0.572104 | 0.832228 |
| **d7** | **d7** | 0.575498 | 0.609526 | 0.575767 | 0.885983 |
| **d8** | **d8** | 0.362009 | 0.429498 | 0.421036 | 0.749674 |
| **d9** | **d9** | 0.423046 | 0.740404 | 0.542206 | 0.583526 |
| **d10** | **d10** | 0.852154 | 0.543792 | 0.546970 | 0.551324 |
| **d11** | **d11** | 0.803737 | 0.500640 | 0.553988 | 0.576952 |
| **d12** | **d12** | 0.766757 | 0.542001 | 0.445776 | 0.334798 |
| **d13** | **d13** | 0.741488 | 0.592365 | 0.469650 | 0.517258 |
| **d14** | **d14** | 0.503636 | 0.802233 | 0.461939 | 0.544536 |
| **d15** | **d15** | 0.606492 | 0.763126 | 0.484694 | 0.614291 |
| **d16** | **d16** | 0.555741 | 0.727437 | 0.479049 | 0.496217 |
| **d17** | **d17** | 0.483486 | 0.787540 | 0.494001 | 0.501859 |
| **d18** | **d18** | 0.478013 | 0.667046 | 0.393245 | 0.380474 |
| **d19** | **d19** | 0.690681 | 0.422742 | 0.392876 | 0.496886 |
| **d20** | **d20** | 0.462763 | 0.716460 | 0.388778 | 0.415477 |

| **Inter-Cluster Correlations** |
| --- |
| **Cluster** | **1** | **2** | **3** | **4** |
| **1** | 1.00000 | 0.67380 | 0.62699 | 0.64179 |
| **2** | 0.67380 | 1.00000 | 0.62350 | 0.68147 |
| **3** | 0.62699 | 0.62350 | 1.00000 | 0.65546 |
| **4** | 0.64179 | 0.68147 | 0.65546 | 1.00000 |

Cluster 2 will be split because it has the largest second eigenvalue, 0.725015, which is greater than the MAXEIGEN=0.7 value.

|  |
| --- |
| Clustering algorithm converged. |

| **Cluster Summary for 5 Clusters** |
| --- |
| **Cluster** | **Members** | **ClusterVariation** | **VariationExplained** | **ProportionExplained** | **SecondEigenvalue** |
| **1** | 5 | 5 | 2.98692 | 0.5974 | 0.6607 |
| **2** | 5 | 5 | 3.083337 | 0.6167 | 0.5975 |
| **3** | 4 | 4 | 2.72684 | 0.6817 | 0.5974 |
| **4** | 4 | 4 | 2.759388 | 0.6898 | 0.6013 |
| **5** | 2 | 2 | 1.444004 | 0.7220 | 0.5560 |

Total variation explained = 13.00049 Proportion = 0.6500

| **5 Clusters** | **R-squared with** | **1-R\*\*2Ratio** | **VariableLabel** |
| --- | --- | --- | --- |
| **Cluster** | **Variable** | **OwnCluster** | **NextClosest** |
| **Cluster 1** | **d10** | 0.7262 | 0.3040 | 0.3934 | d10 |
|  | **d11** | 0.6460 | 0.3329 | 0.5306 | d11 |
|  | **d12** | 0.5879 | 0.2660 | 0.5614 | d12 |
|  | **d13** | 0.5498 | 0.3322 | 0.6741 | d13 |
|  | **d19** | 0.4770 | 0.2469 | 0.6944 | d19 |
| **Cluster 2** | **d9** | 0.5626 | 0.3405 | 0.6632 | d9 |
|  | **d14** | 0.6542 | 0.3330 | 0.5184 | d14 |
|  | **d15** | 0.6279 | 0.3774 | 0.5977 | d15 |
|  | **d16** | 0.5982 | 0.3088 | 0.5813 | d16 |
|  | **d17** | 0.6404 | 0.3061 | 0.5182 | d17 |
| **Cluster 3** | **d1** | 0.6824 | 0.2791 | 0.4406 | d1 |
|  | **d2** | 0.7332 | 0.3832 | 0.4326 | d2 |
|  | **d3** | 0.7014 | 0.3102 | 0.4328 | d3 |
|  | **d4** | 0.6098 | 0.3111 | 0.5664 | d4 |
| **Cluster 4** | **d5** | 0.7198 | 0.3893 | 0.4588 | d5 |
|  | **d6** | 0.6926 | 0.3620 | 0.4818 | d6 |
|  | **d7** | 0.7850 | 0.3881 | 0.3514 | d7 |
|  | **d8** | 0.5620 | 0.2085 | 0.5533 | d8 |
| **Cluster 5** | **d18** | 0.7220 | 0.2842 | 0.3884 | d18 |
|  | **d20** | 0.7220 | 0.3465 | 0.4254 | d20 |

 These are two of the three Asociality items.

| **Cluster Structure** |
| --- |
| **Cluster** |  | **1** | **2** | **3** | **4** | **5** |
| **d1** | **d1** | 0.517336 | 0.516393 | 0.826081 | 0.528339 | 0.369027 |
| **d2** | **d2** | 0.511376 | 0.513046 | 0.856259 | 0.619003 | 0.363965 |
| **d3** | **d3** | 0.556975 | 0.484276 | 0.837524 | 0.535999 | 0.341828 |
| **d4** | **d4** | 0.484030 | 0.557801 | 0.780899 | 0.476302 | 0.450803 |
| **d5** | **d5** | 0.594894 | 0.623941 | 0.597334 | 0.848415 | 0.456750 |
| **d6** | **d6** | 0.582718 | 0.601686 | 0.572104 | 0.832228 | 0.413679 |
| **d7** | **d7** | 0.575498 | 0.623014 | 0.575767 | 0.885983 | 0.421071 |
| **d8** | **d8** | 0.362009 | 0.456595 | 0.421036 | 0.749674 | 0.250188 |
| **d9** | **d9** | 0.423046 | 0.750062 | 0.542206 | 0.583526 | 0.522869 |
| **d10** | **d10** | 0.852154 | 0.540986 | 0.546970 | 0.551324 | 0.417543 |
| **d11** | **d11** | 0.803737 | 0.496787 | 0.553988 | 0.576952 | 0.386090 |
| **d12** | **d12** | 0.766757 | 0.515726 | 0.445776 | 0.334798 | 0.476903 |
| **d13** | **d13** | 0.741488 | 0.576369 | 0.469650 | 0.517258 | 0.487626 |
| **d14** | **d14** | 0.503636 | 0.808852 | 0.461939 | 0.544536 | 0.577062 |
| **d15** | **d15** | 0.606492 | 0.792375 | 0.484694 | 0.614291 | 0.499928 |
| **d16** | **d16** | 0.555741 | 0.773466 | 0.479049 | 0.496217 | 0.436234 |
| **d17** | **d17** | 0.483486 | 0.800247 | 0.494001 | 0.501859 | 0.553246 |
| **d18** | **d18** | 0.478013 | 0.533130 | 0.393245 | 0.380474 | 0.849707 |
| **d19** | **d19** | 0.690681 | 0.399138 | 0.392876 | 0.496886 | 0.376674 |
| **d20** | **d20** | 0.462763 | 0.588602 | 0.388778 | 0.415477 | 0.849707 |

| **Inter-Cluster Correlations** |
| --- |
| **Cluster** | **1** | **2** | **3** | **4** | **5** |
| **1** | 1.00000 | 0.65578 | 0.62699 | 0.64179 | 0.55359 |
| **2** | 0.65578 | 1.00000 | 0.62602 | 0.69739 | 0.66007 |
| **3** | 0.62699 | 0.62602 | 1.00000 | 0.65546 | 0.46017 |
| **4** | 0.64179 | 0.69739 | 0.65546 | 1.00000 | 0.46837 |
| **5** | 0.55359 | 0.66007 | 0.46017 | 0.46837 | 1.00000 |

No cluster meets the criterion for splitting.

| **NumberofClusters** | **TotalVariationExplainedbyClusters** | **ProportionofVariationExplainedby Clusters** | **MinimumProportionExplainedby aCluster** | **MaximumSecondEigenvaluein aCluster** | **MinimumR-squaredfor aVariable** | **Maximum1-R\*\*2Ratiofor aVariable** |
| --- | --- | --- | --- | --- | --- | --- |
| **1** | 9.184321 | 0.4592 | 0.4592 | 1.403711 | 0.3088 |   |
| **2** | 10.444918 | 0.5222 | 0.5195 | 1.017045 | 0.3582 | 0.8228 |
| **3** | 11.423668 | 0.5712 | 0.5195 | 0.884766 | 0.4238 | 0.7572 |
| **4** | 12.354934 | 0.6177 | 0.5545 | 0.725015 | 0.4449 | 0.7194 |
| **5** | 13.000490 | 0.6500 | 0.5974 | 0.660740 | 0.4770 | 0.6944 |

The items:

Anxiety

1. During the past 24 hours, how anxious have you felt?

2. During the past 24 hours, how worried have your thoughts been?

3. During the past 24 hours, how physically agitated have you been?

4. During the past 24 hours, how avoidant have you been?

Sadness

5. During the past 24 hours, how sad have you felt?

6. During the past 24 hours, how emotionally numb have you felt?

7. During the past 24 hours, how sad have your thoughts been?

8. During the past 24 hours, how suicidal have your thoughts been?

9. During the past 24 hours, how withdrawn have you been?

Anger

10. During the past 24 hours, how angry have you felt?

11. During the past 24 hours, how blaming have your thoughts been?

12. During the past 24 hours, how hostile have you been?

13. During the past 24 hours, how impulsive have you been?

Lack of Pleasure

14. During the past 24 hours, how lacking in pleasure have you felt?

15. During the past 24 hours, how lacking in thoughts have you been?

16. During the past 24 hours, how futile have you been?

17. During the past 24 hours, how lacking in approach have you been?

Asocial

18. During the past 24 hours, how lacking in compassion have you felt?

19. During the past 24 hours, how distrustful have your thoughts been?

20. During the past 24 hours, how asocial have you been?



 Initially all variables are clustered together. As you can see above, the first step was to create two clusters, one with variables 14, 15 , 16, 17, 18, and 20 in one cluster and the remaining variables in a second cluster. The one cluster consists of the Lack of Pleasure items and two of the three Asocial items. Given that most of us get much of our pleasure by interacting with others, this cluster makes sense to me.

 In the next step, items 1, 2, 3, and 4 are segregated out of the original second cluster. These are the Anxiety items.

 In the next step, items 5, 6, 7, & 8 (four of the five Sadness items)are clustered separately from items 10, 11, 12, 13, and 19 (the Anger items and one of the Asocial item). It makes sense to me that item 19 (distrustful) would cluster with the Anger items.

 In the final step, items 18 (lacking compassion) and 20 (asocial) are removed from the cluster consisting of the Lack of Pleasure items.

* [Overview](http://support.sas.com/documentation/cdl/en/statug/63033/HTML/default/viewer.htm#statug_varclus_sect001.htm)
* [Interpreting the Output](https://support.sas.com/documentation/cdl/en/statug/63347/HTML/default/viewer.htm#statug_varclus_sect016.htm)
* [SAS Knowledge Base](http://support.sas.com/rnd/app/stat/procedures/varclus.html)
* [SAS Users’ Manual](https://support.sas.com/documentation/onlinedoc/stat/132/varclus.pdf)
* [Karl L. Wuensch](http://core.ecu.edu/psyc/WuenschK/KLW.htm), December, 2015