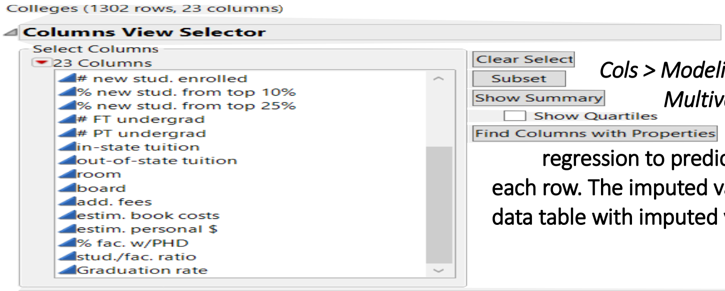
OPIM 5604 B15 – Predictive Modeling Assignment   Meghana Kasula (Net ID=mek15120)

“The work contained and presented here is my work and my work alone.”

14.4 University Rankings.

a. Use the *Columns Viewer* to produce numeric summaries of all of the variables. Note that many observations are missing some measurements. Clustering methods in JMP omit records with missing values. For the purposes of this exercise, we will assume that the values are missing purely at random (not that this may in fact not be the case). So our first goal is to estimate (impute) these missing values.

Here, we can see the number of missing values in each. Most are continuous values.



Colleges (1302 rows, 23 columns)

Columns View Selector

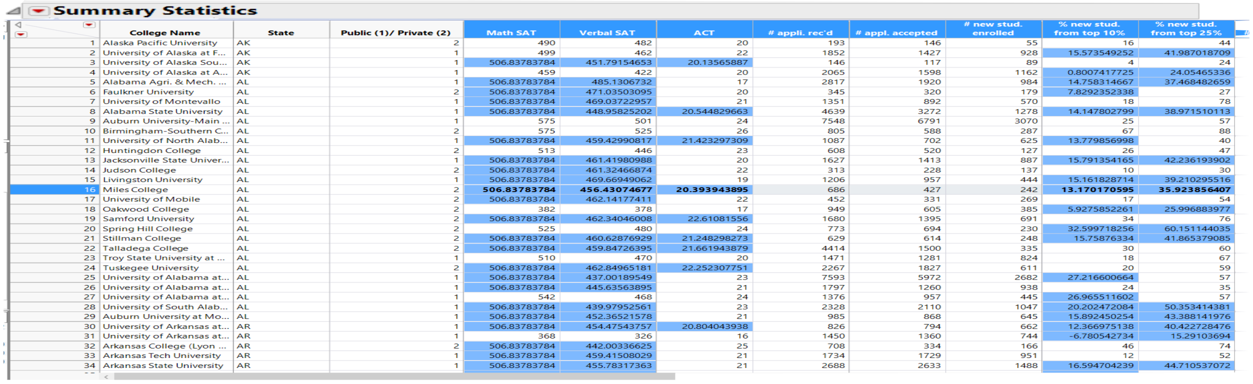
Select Columns

23 Columns

- # new stud. enrolled
- % new stud. from top 10%
- % new stud. from top 25%
- # FT undergrad
- # PT undergrad
- in-state tuition
- out-of-state tuition
- room
- board
- add. fees
- estim. book costs
- estim. personal $
- % fac. w/PHD
- stud./fac. ratio
- Graduation rate

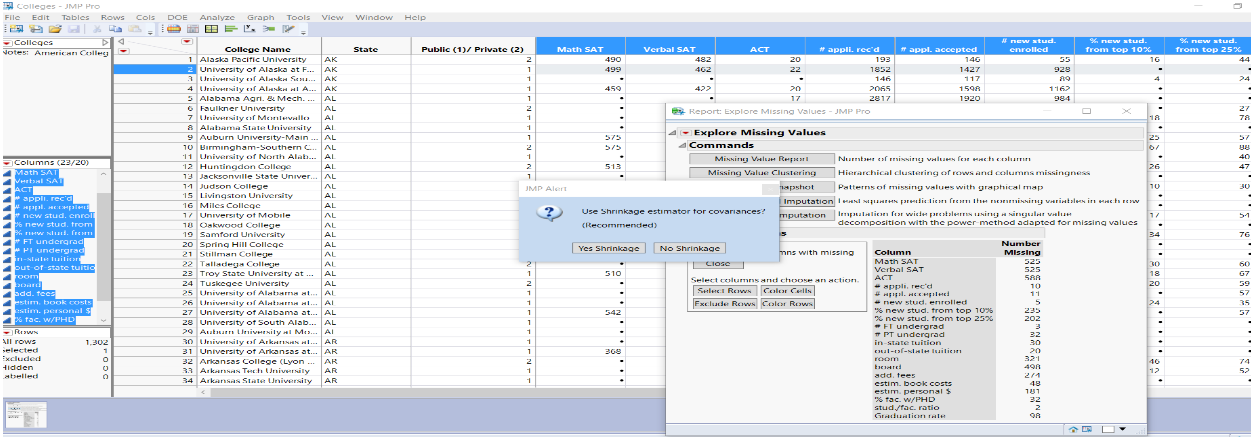
b. Select all of the continuous columns, and go to *Cols > Modeling Utilities >Explore Missing Values*. Select the option *Multivariate Normal Imputation*,and click *Yes Shrinkage*. Multivariate normal imputation uses least squares regression to predict the missing values from the nonmissing variables in each row. The imputed values will be highlighted in the data table. Save the data table with imputed values under a new name.

Using the imputation method, we successfully filled the missing values with normalizations.



Summary Statistics

	College Name	State	Public (1)/ Private (2)	Math SAT	Verbal SAT	ACT	# appli. rec'd	# appl. accepted	# new stud. enrolled	% new stud. from top 10%	% new stud. from top 25%
1	Alaska Pacific University	AK	2	490	482	20	193	146	55	16	44
2	University of Alaska at F...	AK	1	499	462	22	1852	1427	928	15.573549252	41.987018709
3	University of Alaska Sou...	AK	1	506.83783784	451.79154653	20.13565887	146	117	89	4	24
4	University of Alaska at A...	AK	1	459	422	20	2065	1598	1162	0.8007417725	24.05465336
5	Alabama Agri. & Mech. ...	AL	1	506.83783784	485.1306732	17	2817	1920	984	14.758314667	37.468482659
6	Faulkner University	AL	2	506.83783784	471.03503095	20	345	320	179	7.8292352338	27
7	University of Montevallo	AL	1	506.83783784	469.03722957	21	1351	892	570	18	78
8	Alabama State University	AL	1	506.83783784	448.95825202	20.544829663	4639	3272	1278	14.147802799	38.971510113
9	Auburn University-Main ...	AL	1	575	501	24	7548	6791	3070	25	57
10	Birmingham-Southern C...	AL	2	575	525	26	805	588	287	67	88
11	University of North Alab...	AL	1	506.83783784	459.42990817	21.423297309	1087	702	625	13.779856998	40
12	Huntingdon College	AL	2	513	446	23	608	520	127	26	47
13	Jacksonville State Univer...	AL	1	506.83783784	461.41980988	20	1627	1413	887	15.791354165	42.236193902
14	Judson College	AL	2	506.83783784	461.32466874	22	313	228	137	10	30
15	Livingston University	AL	1	506.83783784	469.66949062	19	1206	957	444	15.161828714	39.210295516
16	Miles College	AL	2	**506.83783784**	**456.43074677**	**20.393943895**	686	427	242	**13.170170595**	**35.923856407**
17	University of Mobile	AL	2	506.83783784	462.14177411	22	452	331	269	17	54
18	Oakwood College	AL	2	382	378	17	949	605	385	5.9275852261	25.996883977
19	Samford University	AL	2	506.83783784	462.34046008	22.61081556	1680	1395	691	34	76
20	Spring Hill College	AL	2	525	480	24	773	694	230	32.599718256	60.151144035
21	Stillman College	AL	2	506.83783784	460.62876929	21.248298273	629	614	248	15.75876334	41.865379085
22	Talladega College	AL	2	506.83783784	459.84726395	21.661943879	4414	1500	335	30	60
23	Troy State University at ...	AL	1	510	470	20	1471	1281	824	18	67
24	Tuskegee University	AL	2	506.83783784	462.84965181	22.252307751	2267	1827	611	20	59
25	University of Alabama at...	AL	1	506.83783784	437.00189549	23	7593	5972	2682	27.216600664	57
26	University of Alabama at...	AL	1	506.83783784	445.63563895	21	1797	1260	938	24	35
27	University of Alabama at...	AL	1	542	468	24	1376	957	445	26.965511602	57
28	University of South Alab...	AL	1	506.83783784	439.97952561	23	2328	2110	1047	20.202472084	50.353414381
29	Auburn University at Mo...	AL	1	506.83783784	452.36521578	21	985	868	645	15.892450254	43.388141976
30	University of Arkansas at...	AR	1	506.83783784	454.47543757	20.804043938	826	794	662	12.366975138	40.422728476
31	University of Arkansas at...	AR	1	368	326	16	1450	1360	744	-6.780542734	15.29103694
32	Arkansas College (Lyon ...	AR	2	506.83783784	442.00336625	25	708	334	166	46	74
33	Arkansas Tech University	AR	1	506.83783784	459.41508029	21	1734	1729	951	12	52
34	Arkansas State University	AR	1	506.83783784	455.78317363	21	2688	2633	1488	16.594704239	44.710537072



Colleges

Notes: American Colleg

Columns (23/20)

- Math SAT
- Verbal SAT
- ACT
- # appli. rec'd
- # appl. accepted
- # new stud. enroll
- % new stud. from
- % new stud. from
- # FT undergrad
- # PT undergrad
- in-state tuition
- out-of-state tuitio
- room
- board
- add. fees
- estim. book costs
- estim. personal $
- % fac. w/PHD

Rows

All rows	1,302
Selected	1
Excluded	0
Hidden	0
Labelled	0

	College Name	State	Public (1)/ Private (2)	Math SAT	Verbal SAT	ACT	# appli. rec'd	# appl. accepted	# new stud. enrolled	% new stud. from top 10%	% new stud. from top 25%
1	Alaska Pacific University	AK	2	490	482	20	193	146	55	16	44
2	University of Alaska at F...	AK	1	499	462	22	1852	1427	928	•	•
3	University of Alaska Sou...	AK	1	•	•	•	146	117	89	4	24
4	University of Alaska at A...	AK	1	459	422	20	2065	1598	1162	•	•
5	Alabama Agri. & Mech. ...	AL	1	•	•	17	2817	1920	984	•	•

Report: Explore Missing Values - JMP Pro

Explore Missing Values

Commands

Missing Value Report	Number of missing values for each column
Missing Value Clustering	Hierarchical clustering of rows and columns missingness
...napshot	Patterns of missing values with graphical map
...Imputation	Least squares prediction from the nonmissing variables in each row
...mputation	Imputation for wide problems using a singular value decomposition with the power-method adapted for missing values

...mns with missing

Close

Select columns and choose an action.

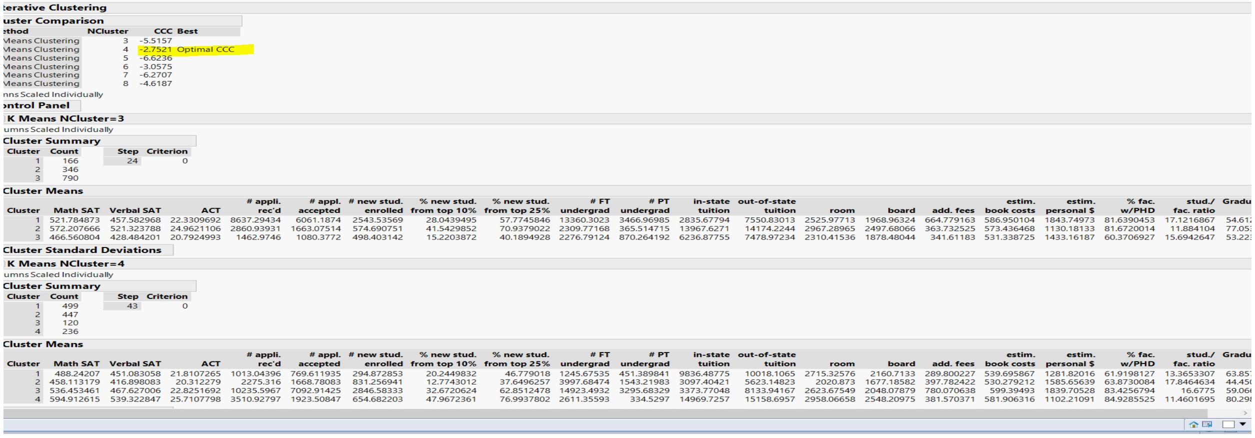
Column	Number Missing
Math SAT	525
Verbal SAT	525
ACT	588
# appli. rec'd	10
# appl. accepted	11
# new stud. enrolled	5
% new stud. from top 10%	235
% new stud. from top 25%	202
# FT undergrad	3
# PT undergrad	32
in-state tuition	30
out-of-state tuition	20
room	321
board	498
add. fees	274
estim. book costs	48
estim. personal $	181
% fac. w/PHD	32
stud./fac. ratio	2
Graduation rate	98

JMP Alert

Use Shrinkage estimator for covariances?

(Recommended)

c. Use *k*-means clustering, with only the continuous variables. Use College Name as the label. Form clusters starting with 3 and ending with 8. What is the optimal number of clusters based on the Cubic Clustering Criterion (under *Cluster Comparison*)?



ːerative Clustering

ːuster Comparison

ːethod	NCluster	CCC	Best
ːMeans Clustering	3	-5.5157	
ːMeans Clustering	4	-2.7521	Optimal CCC
ːMeans Clustering	5	-6.6236	
ːMeans Clustering	6	-3.0575	
ːMeans Clustering	7	-6.2707	
ːMeans Clustering	8	-4.6187	

ːnns Scaled Individually

ːontrol Panel

K Means NCluster=3

ːumns Scaled Individually

Cluster Summary

Cluster	Count	Step	Criterion
1	166	24	0
2	346		
3	790		

Cluster Means

Cluster	Math SAT	Verbal SAT	ACT	# appli. rec'd	# appl. accepted	# new stud. enrolled	% new stud. from top 10%	% new stud. from top 25%	# FT undergrad	# PT undergrad	in-state tuition	out-of-state tuition	room	board	add. fees	estim. book costs	estim. personal $	% fac. w/PHD	stud./ fac. ratio	Gradu
1	521.784873	457.582968	22.3309692	8637.29434	6061.1874	2543.53569	28.0439495	57.7745846	13360.3023	3466.96985	2835.67794	7550.83013	2525.97713	1968.96324	664.779163	586.950104	1843.74973	81.6390453	17.1216867	54.61
2	572.207666	521.323788	24.9621106	2860.93931	1663.07514	574.690751	41.5429852	70.9379022	2309.77168	365.514715	13967.6271	14174.2244	2967.28965	2497.68066	363.732525	573.436468	1130.18133	81.6720014	11.884104	77.05
3	466.560804	428.484201	20.7924993	1462.9746	1080.3772	498.403142	15.2203872	40.1894928	2276.79124	870.264192	6236.87755	7478.97234	2310.41536	1878.48044	341.61183	531.338725	1433.16187	60.3706927	15.6942647	53.22

Cluster Standard Deviations

K Means NCluster=4

ːumns Scaled Individually

Cluster Summary

Cluster	Count	Step	Criterion
1	499	43	0
2	447		
3	120		
4	236		

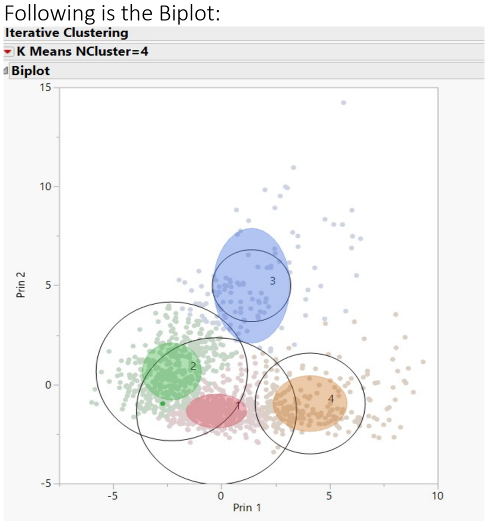
Cluster Means

Cluster	Math SAT	Verbal SAT	ACT	# appli. rec'd	# appl. accepted	# new stud. enrolled	% new stud. from top 10%	% new stud. from top 25%	# FT undergrad	# PT undergrad	in-state tuition	out-of-state tuition	room	board	add. fees	estim. book costs	estim. personal $	% fac. w/PHD	stud./ fac. ratio	Gradu
1	488.24207	451.083058	21.8107265	1013.04396	769.611935	294.872853	20.2449832	46.779018	1245.67535	451.389841	9836.48775	10018.1065	2715.32576	2160.7133	289.800227	539.695867	1281.82016	61.9198127	13.3653307	63.85
2	458.113179	416.898083	20.312279	2275.316	1668.78083	831.256941	12.7743012	37.6496257	3997.68474	1543.21983	3097.40421	5623.14823	2020.873	1677.18582	397.782422	530.279212	1585.65639	63.8730084	17.8464634	44.45
3	536.453461	467.627006	22.8251692	10235.5967	7092.91425	2846.58333	32.6720624	62.8512478	14923.4932	3295.68329	3373.77048	8133.94167	2623.67549	2048.07879	780.070638	599.39493	1839.70528	83.4256794	16.6775	59.06
4	594.912615	539.322847	25.7107798	3510.92797	1923.50847	654.682203	47.9672361	76.9937802	2611.35593	334.5297	14969.7257	15158.6957	2958.06658	2548.20975	381.570371	581.906316	1102.21091	84.9285525	11.4601695	80.29

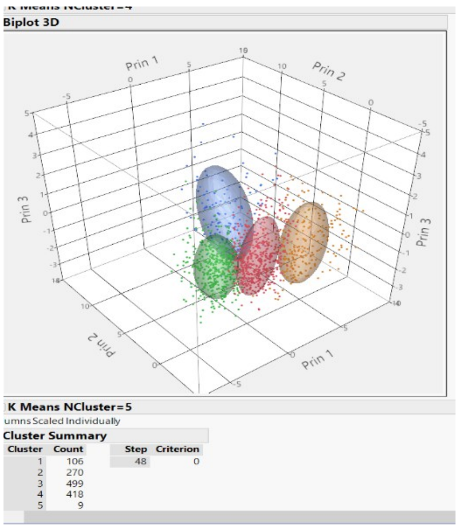
As we can see, the optimal number of clusters are 4.

d. Use the biplot, the parallel plot, and other built-in graphical and numeric summaries to explore the clusters. Save the clusters to the data table and use other graphical tools to compare and characterize the clusters. Summarize the key characteristics of each of the four clusters, and try label or name the clusters.

Following is the Biplot:



Biplot

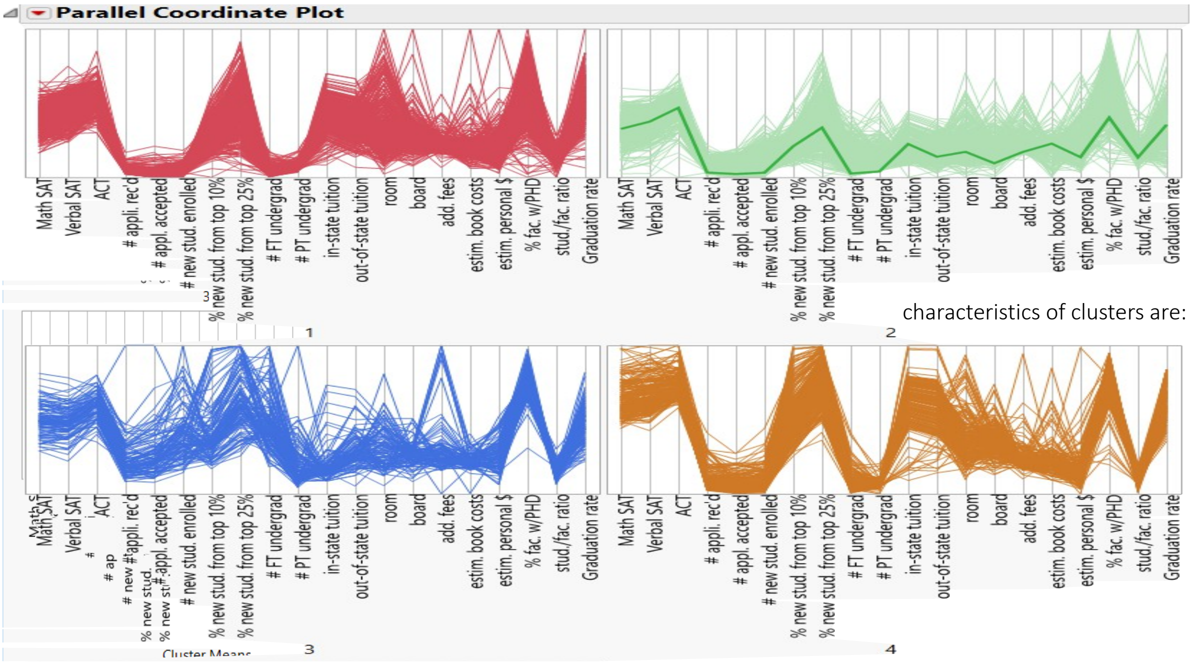


K Means NCluster=5

ːumns Scaled Individually

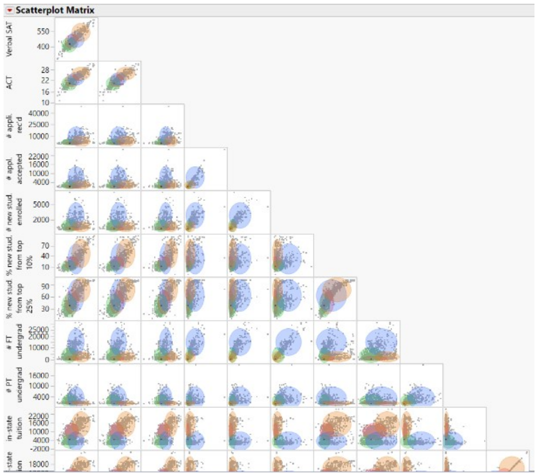
Cluster Summary

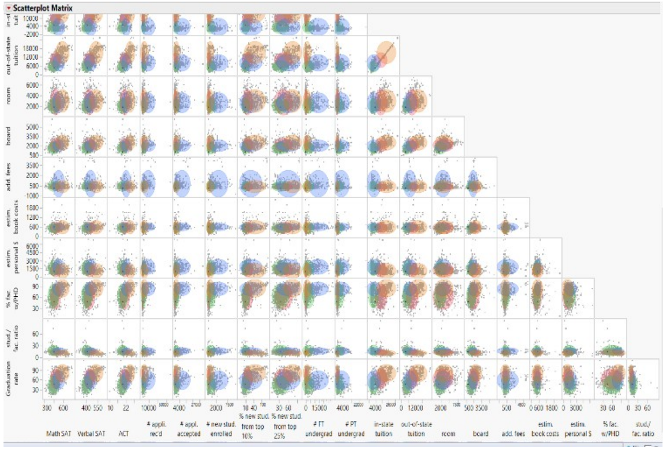
Cluster	Count	Step	Criterion
1	106	48	0
2	270		
3	499		
4	418		
5	9		

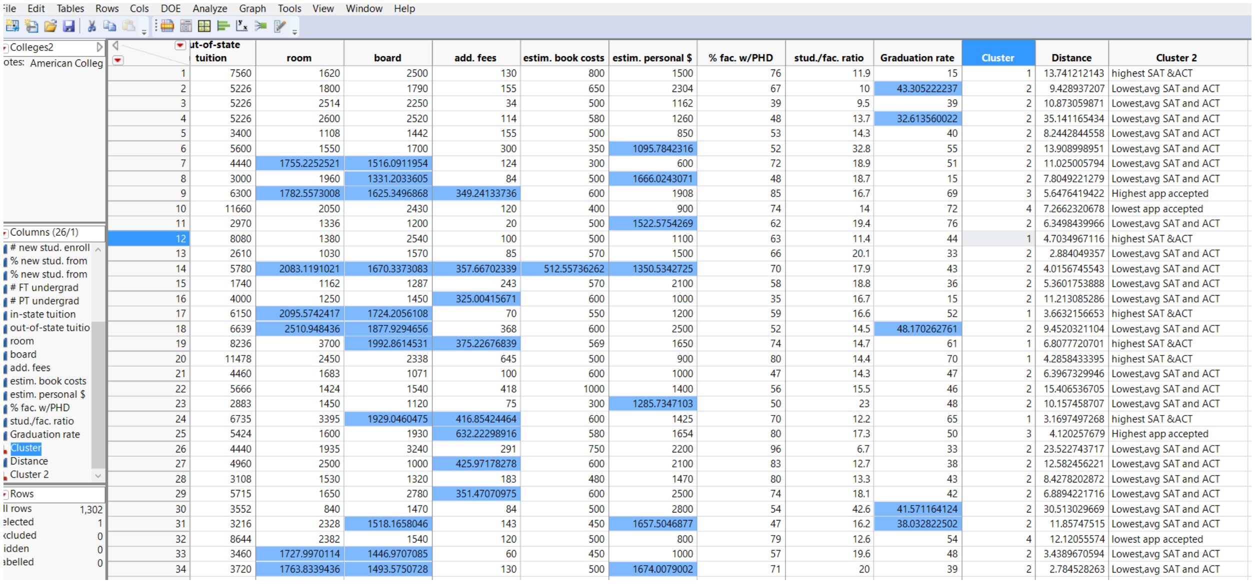


The four key characteristics of clusters are:

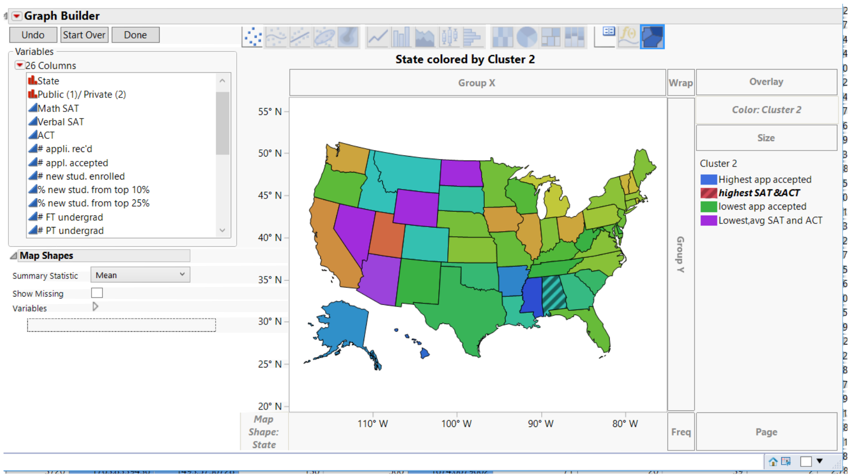
1.Cluster 4 is having highest SAT and ACT scores, also high Graduation rate.
2.cluster 2 is relatively low or average in every field starting from Sat score to graduation rate.
3.Cluster 3 has high application accepted and enrolled.
4.Cluster 1has lowest application received, accepted and enrolled.





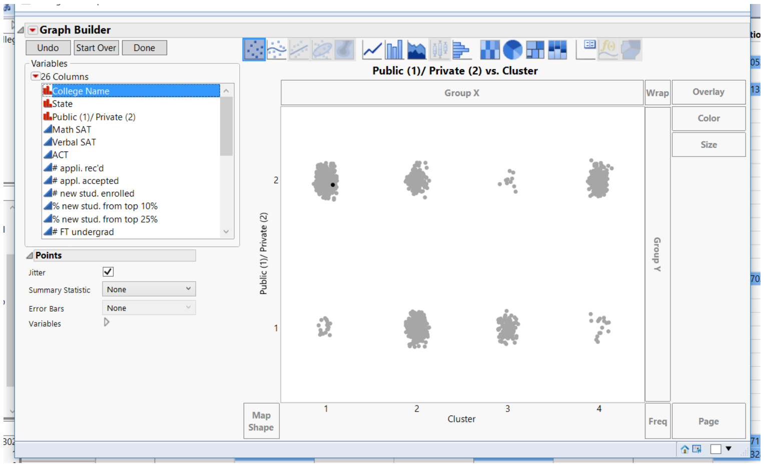


	ut-of-state tuition	room	board	add. fees	estim. book costs	estim. personal $	% fac. w/PHD	stud./fac. ratio	Graduation rate	Cluster	Distance	Cluster 2
1	7560	1620	2500	130	800	1500	76	11.9	15	1	13.741212143	highest SAT &ACT
2	5226	1800	1790	155	650	2304	67	10	43.305222237	2	9.428937207	Lowest,avg SAT and ACT
3	5226	2514	2250	34	500	1162	39	9.5	39	2	10.873059871	Lowest,avg SAT and ACT
4	5226	2600	2520	114	580	1260	48	13.7	32.613560022	2	35.141165434	Lowest,avg SAT and ACT
5	3400	1108	1442	155	500	850	53	14.3	40	2	8.2442844558	Lowest,avg SAT and ACT
6	5600	1550	1700	300	350	1095.7842316	52	32.8	55	2	13.908998951	Lowest,avg SAT and ACT
7	4440	1755.2252521	1516.0911954	124	300	600	72	18.9	51	2	11.025005794	Lowest,avg SAT and ACT
8	3000	1960	1331.2033605	84	500	1666.0243071	48	18.7	15	2	7.8049221279	Lowest,avg SAT and ACT
9	6300	1782.5573008	1625.3496868	349.24133736	600	1908	85	16.7	69	3	5.6476419422	Highest app accepted
10	11660	2050	2430	120	400	900	74	14	72	4	7.2662320678	lowest app accepted
11	2970	1336	1200	20	500	1522.5754269	62	19.4	76	2	6.3498439966	Lowest,avg SAT and ACT
12	8080	1380	2540	100	500	1100	63	11.4	44	1	4.7034967116	highest SAT &ACT
13	2610	1030	1570	85	570	1500	66	20.1	33	2	2.884049357	Lowest,avg SAT and ACT
14	5780	2083.1191021	1670.3373083	357.66702339	512.55736262	1350.5342725	70	17.9	43	2	4.0156745543	Lowest,avg SAT and ACT
15	1740	1162	1287	243	570	2100	58	18.8	36	2	5.3601753888	Lowest,avg SAT and ACT
16	4000	1250	1450	325.00415671	600	1000	35	16.7	15	2	11.213085286	Lowest,avg SAT and ACT
17	6150	2095.5742417	1724.2056108	70	550	1200	59	16.6	52	1	3.6632156653	highest SAT &ACT
18	6639	2510.948436	1877.9294656	368	600	2500	52	14.5	48.170262761	2	9.4520321104	Lowest,avg SAT and ACT
19	8236	3700	1992.8614531	375.22676839	569	1650	74	14.7	61	1	6.8077720701	highest SAT &ACT
20	11478	2450	2338	645	500	900	80	14.4	70	1	4.2858433395	highest SAT &ACT
21	4460	1683	1071	100	600	1000	47	14.3	47	2	6.3967329946	Lowest,avg SAT and ACT
22	5666	1424	1540	418	1000	1400	56	15.5	46	2	15.406536705	Lowest,avg SAT and ACT
23	2883	1450	1120	75	300	1285.7347103	50	23	48	2	10.157458707	Lowest,avg SAT and ACT
24	6735	3395	1929.0460475	416.85424464	600	1425	70	12.2	65	1	3.1697497268	highest SAT &ACT
25	5424	1600	1930	632.22298916	580	1654	80	17.3	50	3	4.120257679	Highest app accepted
26	4440	1935	3240	291	750	2200	96	6.7	33	2	23.522743717	Lowest,avg SAT and ACT
27	4960	2500	1000	425.97178278	600	2100	83	12.7	38	2	12.582456221	Lowest,avg SAT and ACT
28	3108	1530	1320	183	480	1470	80	13.3	43	2	8.4278202872	Lowest,avg SAT and ACT
29	5715	1650	2780	351.47070975	600	2500	74	18.1	42	2	6.8894221716	Lowest,avg SAT and ACT
30	3552	840	1470	84	500	2800	54	42.6	41.571164124	2	30.513029669	Lowest,avg SAT and ACT
31	3216	2328	1518.1658046	143	450	1657.5046877	47	16.2	38.032822502	2	11.85747515	Lowest,avg SAT and ACT
32	8644	2382	1540	120	500	800	79	12.6	54	4	12.12055574	lowest app accepted
33	3460	1727.9970114	1446.9707085	60	450	1000	57	19.6	48	2	3.4389670594	Lowest,avg SAT and ACT
34	3720	1763.8339436	1493.5750728	130	500	1674.0079002	71	20	39	2	2.784528263	Lowest,avg SAT and ACT



e. Use the categorical variables that were not used in the analysis (State and Private/Public) to characterize the different clusters. (Hint: Create a geographic map to explore the clusters geographically.) Is there any relationship between the clusters and the categorical information?

The clusters spread can be viewed in the graph beside.
The legend is rightly mentioned and denoted.



Graph Builder

Variables
26 Columns
College Name
State
Public (1)/ Private (2)
Math SAT
Verbal SAT
ACT
# appli. rec'd
# appl. accepted
# new stud. enrolled
% new stud. from top 10%
% new stud. from top 25%
FT undergrad

Points
Jitter ☑
Summary Statistic: None
Error Bars: None

In general, the amount of observations in private colleges are high and also, clust 1 and 4 dominantly has private institutes.

f. Can you think of other external information that might explain the contents of some or all of these clusters?

1.Private institutes are in general have less rigorous criteria in selection than public institute. That is why we can observe more observations in private institutes.

2. In cluster 1, 2 we observed that low scores of ACT and SAT led to low acceptance rate which is a natural phenomenon.

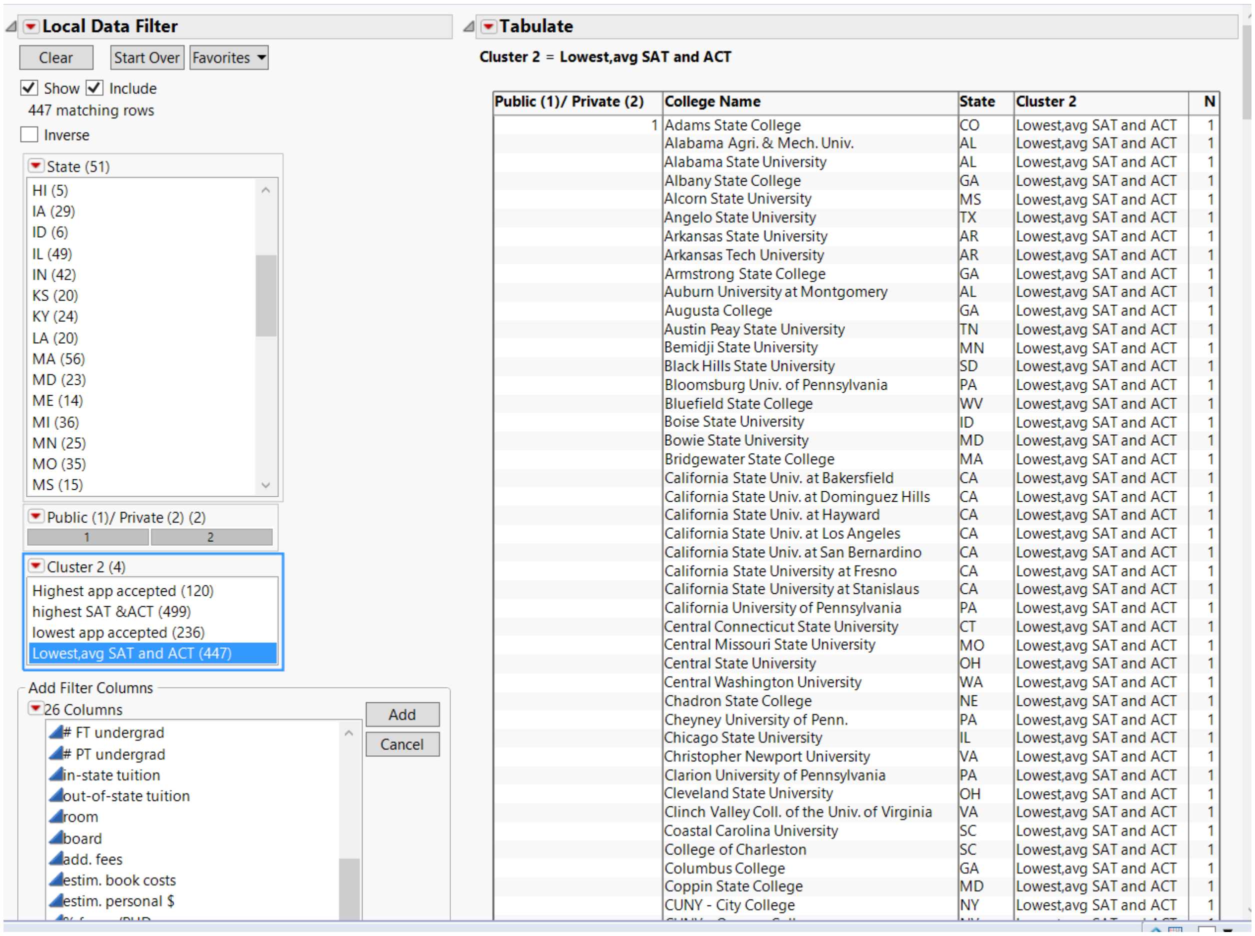
3. Similarly, high score in SAT and ACT led to more acceptance range, observed in cluster 4.

4. Cluster 4, could have the observations of good academicians.

g. Consider Tufts University. Which cluster does Tufts belong to? Which other universities is Tufts similar to, based on the clustering and the categorical variables?

Tufts is from cluster 4.

Hence, using local data filter, following are from the same cluster as Tufts.



Local Data Filter

Clear Start Over Favorites

☑ Show ☑ Include

447 matching rows

☐ Inverse

State (51)

HI (5)
IA (29)
ID (6)
IL (49)
IN (42)
KS (20)
KY (24)
LA (20)
MA (56)
MD (23)
ME (14)
MI (36)
MN (25)
MO (35)
MS (15)

Public (1)/ Private (2) (2)

1 2

Cluster 2 (4)

Highest app accepted (120)
highest SAT &ACT (499)
lowest app accepted (236)
Lowest,avg SAT and ACT (447)

Add Filter Columns

26 Columns

FT undergrad
PT undergrad
in-state tuition
out-of-state tuition
room
board
add. fees
estim. book costs
estim. personal $

Add Cancel

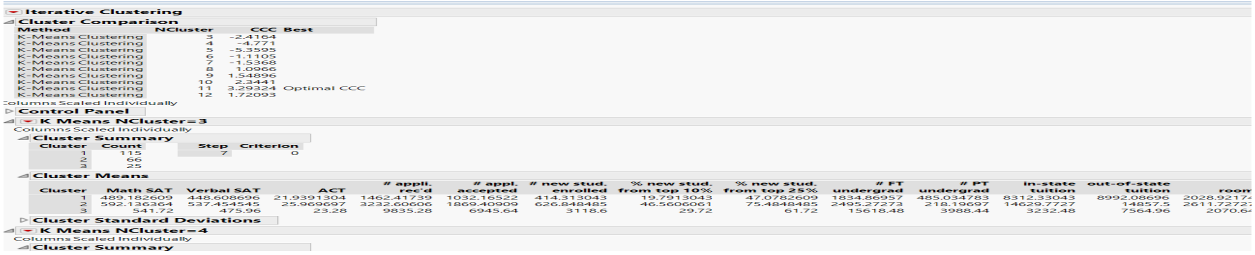
Tabulate

Cluster 2 = Lowest,avg SAT and ACT

Public (1)/ Private (2)	College Name	State	Cluster 2	N
1	Adams State College	CO	Lowest,avg SAT and ACT	1
	Alabama Agri. & Mech. Univ.	AL	Lowest,avg SAT and ACT	1
	Alabama State University	AL	Lowest,avg SAT and ACT	1
	Albany State College	GA	Lowest,avg SAT and ACT	1
	Alcorn State University	MS	Lowest,avg SAT and ACT	1
	Angelo State University	TX	Lowest,avg SAT and ACT	1
	Arkansas State University	AR	Lowest,avg SAT and ACT	1
	Arkansas Tech University	AR	Lowest,avg SAT and ACT	1
	Armstrong State College	GA	Lowest,avg SAT and ACT	1
	Auburn University at Montgomery	AL	Lowest,avg SAT and ACT	1
	Augusta College	GA	Lowest,avg SAT and ACT	1
	Austin Peay State University	TN	Lowest,avg SAT and ACT	1
	Bemidji State University	MN	Lowest,avg SAT and ACT	1
	Black Hills State University	SD	Lowest,avg SAT and ACT	1
	Bloomsburg Univ. of Pennsylvania	PA	Lowest,avg SAT and ACT	1
	Bluefield State College	WV	Lowest,avg SAT and ACT	1
	Boise State University	ID	Lowest,avg SAT and ACT	1
	Bowie State University	MD	Lowest,avg SAT and ACT	1
	Bridgewater State College	MA	Lowest,avg SAT and ACT	1
	California State Univ. at Bakersfield	CA	Lowest,avg SAT and ACT	1
	California State Univ. at Dominguez Hills	CA	Lowest,avg SAT and ACT	1
	California State Univ. at Hayward	CA	Lowest,avg SAT and ACT	1
	California State Univ. at Los Angeles	CA	Lowest,avg SAT and ACT	1
	California State Univ. at San Bernardino	CA	Lowest,avg SAT and ACT	1
	California State University at Fresno	CA	Lowest,avg SAT and ACT	1
	California State University at Stanislaus	CA	Lowest,avg SAT and ACT	1
	California University of Pennsylvania	PA	Lowest,avg SAT and ACT	1
	Central Connecticut State University	CT	Lowest,avg SAT and ACT	1
	Central Missouri State University	MO	Lowest,avg SAT and ACT	1
	Central State University	OH	Lowest,avg SAT and ACT	1
	Central Washington University	WA	Lowest,avg SAT and ACT	1
	Chadron State College	NE	Lowest,avg SAT and ACT	1
	Cheyney University of Penn.	PA	Lowest,avg SAT and ACT	1
	Chicago State University	IL	Lowest,avg SAT and ACT	1
	Christopher Newport University	VA	Lowest,avg SAT and ACT	1
	Clarion University of Pennsylvania	PA	Lowest,avg SAT and ACT	1
	Cleveland State University	OH	Lowest,avg SAT and ACT	1
	Clinch Valley Coll. of the Univ. of Virginia	VA	Lowest,avg SAT and ACT	1
	Coastal Carolina University	SC	Lowest,avg SAT and ACT	1
	College of Charleston	SC	Lowest,avg SAT and ACT	1
	Columbus College	GA	Lowest,avg SAT and ACT	1
	Coppin State College	MD	Lowest,avg SAT and ACT	1
	CUNY - City College	NY	Lowest,avg SAT and ACT	1

h. Return to the original data table (with the missing values). Run the same *k*means cluster analysis using this data.

i. Compare the results to those achieved after imputing missing values in terms of the number of clusters and the characteristics of the clusters? What are the key differences?



Iterative Clustering

Cluster Comparison

```
Method               NCluster      CCC  Best
K-Means Clustering          3  -2.4164
K-Means Clustering          4   -4.771
K-Means Clustering          5  -5.3595
K-Means Clustering          6  -1.1105
K-Means Clustering          7  -1.5368
K-Means Clustering          8   1.0966
K-Means Clustering          9  1.54896
K-Means Clustering         10   2.3441
K-Means Clustering         11  3.29324  Optimal CCC
K-Means Clustering         12  1.72093
```

Columns Scaled Individually

Control Panel

K Means NCluster=3

Columns Scaled Individually

Cluster Summary

```
Cluster  Count      Step  Criterion
      1    115         7          0
      2     66
      3     25
```

Cluster Means

```
                                                    # appli.      # appl.  # new stud.  % new stud.     % new stud.        # FT        # PT     in-state  out-of-state
Cluster   Math SAT  Verbal SAT         ACT           rec'd     accepted     enrolled  from top 10%  from top 25%   undergrad   undergrad      tuition       tuition        room
      1 489.182609  448.608696  21.9391304      1462.41739   1032.16522   414.313043    19.7913043    47.0782609  1834.86957  485.034783   8312.33043    8992.08696  2028.9217
      2 592.136364  537.454545  25.969697       3232.60606   1869.40909   626.848485    46.5606061    75.4848485  2495.27273   218.19697   14629.7727       14857.5  2611.7272
      3     541.72      475.96       23.28         9835.28      6945.64       3118.6         29.72         61.72    15618.48     3988.44      3232.48       7564.96    2070.6
```

Cluster Standard Deviations

K Means NCluster=4

Columns Scaled Individually

Cluster Summary

The main difference is that , the number of optimum clusters has drastically increased to 11.
Also, due to a lot of missing values, the clusters has to be more in lesser observations due to the vagueness and obscurity.
ii. In the initial analysis, we assumed that the values were missing at random and imputed the missing values. Describe why this approach was, or was not, a good strategy.
This approach is good, but the rows with missing values will be not considered for analysis. Hence it would omit some useful data.

Compute the metrics for the following rules: (Please utilize Bank-2.jmp)
a. CKING → SVG
Formula for
Support =P[A intersection B]/Total = (4329/7991) =0.543425
Confidence = P(A intersection B)/P (A) = (4329/7991)/(6855/7991)= 0.634562
Expected Confidence =P(B) = 4944/7991=0.6134
Lift =confidence/extreme confidence =0.63/0.61 =1.02001

b. (CKING,SVG) →CD

Support =P(A intersection B)/Total = (1139/7991) =0.1467
Confidence = P(A intersection B)/P (A) = (1139/7991)/(4329/7991)= 0.2623
Extreme Confidence =P(B) = 1960/7991=0.24345
Lift =confidence/extreme confidence =0.26/0.24 =1.0700