Question 1.

A factor analysis was formed on the results of a questionnaire on ten automobiles by

303 MBA students.

The basic description of the questionnaire result is as follows:

	Mean	Std. Deviation	Analysis N
01 Exciting	3.21	1.218	294
02 Dependable	3.65	1.020	294
03 Luxurious	3.48	1.107	294
04 Outdoorsy	2.68	1.398	294
05 Powerful	3.60	1.016	294
06 Stylish	3.44	1.237	294
07 Comfortable	3.70	.851	294
08 Rugged	2.53	1.329	294
09 Fun	3.48	1.263	294
10 Safe	3.75	.979	294
11 Performance	3.44	1.181	294
12 Family	3.46	1.286	294
13 Versatile	3.08	1.093	294
14 Sports	3.03	1.318	294
15 Status	3.57	1.183	294
16 Practical	3.35	1.106	294

Descriptive Statistics

To ensure that it is appropriate to use factor analysis, the anti-image correlation matrix, Barlett's test of sphericity, and measure of sampling adequacy tests are conducted.

The Barlett's test of sphericity indicates that the correlations among the variables are significant, with approximate Chi-square of 3364.72. The MSA index of 0.880 also indicates high correlations among the variables.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of	Kaiser-Meyer-Olkin Measure of Sampling Adequacy.					
Bartlett's Test of Sphericity	Approx. Chi-Square df	3364.722 120				
	.000					

The anti-image correlation matrix table below indicates that all variables have relatively low anti-image correlations with the other variables, indicating that the data is not unsuitable for factor analysis. A review of the anti-image covariance and anti-image correlation indicates that most anti-image covariance and anti-image correlation are less than 0.10. The only extreme observations are the anti-image correlations between (a) rugged and outdoorsy, and (b) family and practical with -0.608 and -0.390 respectively. The high anti-image correlations might be due to their close association in the description of the vehicles.

		01 Exciting	02 Dependable	03 Luxurious	04 Outdoorsy	05 Powerful	06 Stylish	07 Comfortable	08 Rugged	09 Fun	10 Safe	11 Performance	12 Family	13 Vetsatile	14 Sports	15 Status	16 Practical
Anti-image Covariance	01 Exciting	.227	.018	025	039	030	053	.032	007	104	.023	030	.023	.020	011	002	010
Covariance	02 Dependable	.018	.586	095	.017	005	007	014	024	023	147	042	031	.050	.019	.004	084
	03 Luxurious	- 025	095	356	.039	051	062	- 113	.028	.010	031	.024	011	.005	.013	078	.050
1	04 Outdoorsy	039	.017	.039	.313	077	.029	020	186	.004	.023	.036	018	040	015	012	005
	05 Powerful	030	005	051	077	.405	013	021	028	032	007	112	.010	022	012	.014	.008
	06 Stylish	053	007	062	.029	013	.233	042	016	026	.042	017	.023	015	033	078	020
	07 Comfortable	.032	014	113	020	021	042	.480	004	041	149	.007	023	035	.076	010	041
	08 Rugged	007	024	.028	186	028	016	004	.299	.009	052	.060	019	052	088	.006	.023
	09 Fun	104	023	.010	.004	032	026	041	.009	.239	003	.000	.023	018	071	021	.015
	10 Safe	.023	147	031	.023	007	.042	149	052	003	.461	064	044	019	.031	025	036
	11 Performance	030	042	.024	.036	112	017	.007	.060	.000	064	.322	015	.014	063	095	.029
	12 Family	.023	031	011	018	.010	.023	023	019	.023	044	015	.280	102	.055	.039	133
	13 Versatile	.020	.050	.005	040	022	015	035	052	018	019	.014	102	.471	045	.000	120
	14 Sports	011	.019	.013	015	012	033	.076	088	071	.031	063	.055	045	. 329	.003	006
	15 Status	002	.004	078	012	.014	078	010	.006	021	025	095	.039	.000	. 003	.266	013
	16 Practical	010	084	.050	005	.008	020	041	.023	.015	036	.029	133	120	006	013	.419
Anti-image Correlation	01 Exciting	.916(a)	.050	088	148	100	232	.096	029	448	.073	110	.092	.062	039	007	034
	02 Dependable	.050	.839(a)	207	.039	011	020	027	056	062	283	097	077	.095	.044	.010	169
	03 Luxurious	088	207	.890(a)	.118	134	213	274	.084	.035	077	.071	036	.011	.037	255	.129
	04 Outdoorsy	148	.039	.118	.710(a)	217	.108	052	608	.015	.061	.113	061	103	048	041	013
	05 Powerful	100	011	134	217	.931(a)	043	047	080	102	016	310	.029	050	032	.044	.019
	06 Stylish	232	020	213	.108	043	.928(a)	124	059	112	.129	063	.092	044	119	313	065
	07 Comfortable	.096	027	274	052	047	124	.816(a)	010	121	318	.019	062	074	.192	027	091
	08 Rugged	029	056	.084	608	080	059	010	.695(a)	.033	141	.194	065	138	280	.021	.066
	09 Fun	448	062	.035	.015	102	112	121	.033	.917(a)	010	.001	.089	053	254	083	.048
	10 Safe	.073	283	077	.061	016	.129	318	141	010	.810(a)	165	123	041	.080	072	082
	11 Performance	110	097	.071	.113	310	063	.019	.194	.001	165	.896(a)	049	.036	194	324	.080
	12 Family	.092	077	036	061	.029	.092	062	065	.089	123	049	.893(a)	280	.182	.142	390
	13 Versatile	.062	.095	.011	103	050	044	074	138	053	041	.036	280	.858(a)	114	001	271
	14 Sports	039	.044	.037	048	032	119	.192	280	254	.080	194	.182	114	.902(a)	.010	017
	15 Status	007	.010	255	041	.044	313	027	.021	083	072	324	.142	001	.010	.919(a)	038
	16 Practical	- 034	- 169	190	- 013	010	- 065	- 091	066	048	- 082	080	- 300	- 971	- 017	- 038	857(a)

Anti-image Matrice

a Measures of Sampling Adequacy(MSA)

Correlation Matrix

		01 Exciting	02 Dependable	03 Luxurious	04 Outdoorsy	05 Powerful	06 Stylish	07 Comfortable	08 Rugged	09 Fun	10 Safe	11 Performance	12 Family	13 Versatile	14 Sports	15 Status	16 Practical
Correlation	01 Exciting	1.000	.026	.458	.192	.636	.754	.045	.175	.828	148	.614	569	144	.672	.650	351
	02 Dependable	.026	1.000	.402	062	.162	.169	.453	002	.090	.542	.232	.217	.123	086	.225	.298
	03 Luxurious	.458	.402	1.000	191	.438	.639	.470	157	.474	.264	.554	271	131	.210	.675	150
	04 Outdoorsy	.192	062	191	1.000	.324	.003	.018	.798	.148	.018	127	.156	.444	.341	071	.170
	05 Powerful	.636	.162	.438	.324	1.000	.593	.214	.302	.632	.081	.585	311	.066	.550	.539	158
	06 Stylish	.754	.169	.639	.003	.593	1.000	.233	.038	.746	020	.677	522	137	.574	.785	283
	07 Comfortable	.045	.453	.470	.018	.214	.233	1.000	.046	.129	.581	.194	.242	.247	120	.269	.308
	08 Rugged	.175	002	157	.798	.302	.038	.046	1.000	.153	.091	127	.168	.468	.383	060	.179
	09 Fun	.828	.090	.474	.148	.632	.746	.129	.153	1.000	074	.618	545	105	.684	.667	327
	10 Safe	148	.542	.264	.018	.081	020	.581	.091	074	1.000	.106	.418	.303	216	.091	.423
	11 Performance	.614	.232	.554	127	.585	.677	.194	127	.618	.106	1.000	444	202	.470	.735	284
	12 Family	569	.217	271	.156	311	522	.242	.168	545	.418	444	1.000	.546	495	489	.704
	13 Versatile	144	.123	131	.444	.066	137	.247	.468	105	.303	202	.546	1.000	.003	176	.564
	14 Sports	.672	086	.210	.341	.550	.574	120	.383	.684	216	.470	495	.003	1.000	.464	302
	15 Status	.650	.225	.675	071	.539	.785	.269	060	.667	.091	.735	489	176	.464	1.000	270
	16 Practical	351	.298	150	.170	158	283	.308	.179	327	.423	284	.704	.564	302	270	1.000

The correlation matrix of the variables are indicated below.

Based on the scree plot which shows a sharp drop in eigenvalue by the fourth component and the eigenvalue of 5.927, 3.187 and 2.542 for the first three components (and dropping to 0.648 by the fourth component), 3 principal components will be used. Total variance explained by these 3 principal components is 72.8%.



Component Number

		Initial Eigenvalue	2S	Extraction	on Sums of Square	d Loadings	Rotatio	n Sums of Squared	Loadings
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.927	37.042	37.042	5.927	37.042	37.042	5.915	36.966	36.966
2	3.187	19.920	56.961	3.187	19.920	56.961	3.030	18.940	55.906
3	2.542	15.887	72.849	2.542	15.887	72.849	2.711	16.942	72.849
4	.648	4.052	76.901						
5	.589	3.684	80.585						
6	.477	2.983	83.568						
7	.406	2.539	86.107						
8	.369	2.307	88.414						
9	.337	2.107	90.521						
10	.296	1.852	92.373						
11	.277	1.729	94.102						
12	.242	1.510	95.613						
13	.205	1.282	96.895						
14	.185	1.154	98.049						
15	.169	1.054	99.103						
16	.144	.897	100.000						

Total Variance Explained

Extraction Method: Principal Component Analysis.

For the factor analysis, principal component analysis and varimax rotation was used.

		Component	
	1	2	3
01 Exciting	.876		
02 Dependable		.736	
03 Luxurious	.661	.452	
04 Outdoorsy			.892
05 Powerful	.750		
06 Stylish	.887		
07 Comfortable		.785	
08 Rugged			.893
09 Fun	.879		
10 Safe		.825	
11 Performance	.798		
12 Family	648	.526	
13 Versatile			.678
14 Sports	.720		
15 Status	.845		
16 Practical	421	.595	

Rotated Component Matrix(a)

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

a Rotation converged in 6 iterations.

The 3 principal components for the factor analysis can be described as:

(1) Sportiness and Style. This component encompasses the fun, speed and luxurious factors of perception; this component includes the variables of exciting, luxurious, powerful, stylish, fun, performance, sports and status.

- (2) Family. This component encompasses the family aspect of the perception; this component includes dependability, comfortable, safe, family, and practical.
- (3) Outdoor Use. This component encompasses the outdoor rugged used of certain outdoor vehicles; this component includes outdoorsy, ruggedness, and versatility.

Question 2.

A correspondence analysis of newspaper readership is performed based on occupation of readers. The data are from the 1999 Eurobarometer Survey. The newspapers are further categorized based on their political orientation as described in the question as follow:

Newpsaper Name	Categorization in analysis
Daily Mirror	Left 1
Sun	Left 2
Daily / Sunday Mail	Right 1
Daily / Sunday Express	Right 2
Times / Sunday Times	Middle
Daily / Sunday Telegraph	Right 3
Guardian	Left 3

The count of readership is first weighted in SPSS. The descriptions of the readership is

shown below.

Correspondence Table

		NEWS											
OCCU	Left 1	Left 2	Right 1	Right 2	Middle	Right 3	Left 3	Other	None	Active Margin			
Self-employed	8	16	12	6	6	4	7	2	6	67			
Manager	9	14	19	8	17	10	18	12	9	116			
White collar	20	20	20	9	7	10	6	12	8	112			
Manual	90	103	34	28	10	4	7	30	28	334			
House keep	51	64	19	9	9	4	6	24	29	215			
Unemployed	22	30	6	1	2	3	5	12	11	92			
Retired	60	50	52	31	8	19	7	48	31	306			
Student	15	17	10	5	10	3	7	11	6	84			
Active Margin	275	314	172	97	69	57	63	151	128	1326			

Summary

					Proportion	of Inertia	Confidence Si	ingular Value
						1	Standard	Correlation
Dimension	Singular Value	Inertia	Chi Square	Sig.	Accounted for	Cumulative	Deviation	2
1	.314	.099			.641	.641	.029	.119
2	.189	.036			.233	.874	.027	
3	.104	.011			.070	.944		
4	.070	.005			.032	.976		
5	.048	.002			.015	.991		
6	.035	.001			.008	.999		
7	.012	.000			.001	1.000		
Total		.154	204.230	.000(a)	1.000	1.000		

a 56 degrees of freedom

Overview Row Points(a)

		Score in Din	nension		Contribution						
					Of Point to Inertia of Dimension		Of Dimens	ion to Inertia o	f Point		
OCCU	Mass	1	2	Inertia	1	2	1	2	Total		
Self-employed	.051	.640	339	.011	.066	.031	.575	.097	.672		
Manager	.087	1.359	387	.053	.514	.069	.949	.046	.996		
White collar	.084	.410	.356	.008	.045	.056	.544	.247	.791		
Manual	.252	508	145	.025	.207	.028	.802	.039	.841		
House keep	.162	412	300	.014	.088	.077	.622	.199	.821		
Unemployed	.069	403	459	.011	.036	.077	.334	.261	.595		
Retired	.231	.031	.707	.022	.001	.609	.003	.972	.975		
Student	.063	.468	399	.009	.044	.053	.506	.221	.727		
Active Total	1.000			.154	1.000	1.000					

a Symmetrical normalization

Overview Column Points(a)

		Score in Dir	iension				Contribution			
					Of Point to Dime	o Inertia of ension	Of Dimension to Inertia of Point			
NEWS	Mass	1	2	Inertia	1	2	1	2	Total	
Left 1	.207	476	021	.015	.150	.000	.957	.001	.958	
Left 2	.237	444	387	.022	.148	.188	.663	.305	.968	
Right 1	.130	.379	.463	.012	.059	.147	.484	.436	.920	
Right 2	.073	.111	.587	.009	.003	.133	.031	.520	.551	
Middle	.052	1.160	728	.029	.223	.146	.761	.181	.941	
Right 3	.043	.969	.687	.018	.128	.107	.688	.208	.896	
Left 3	.048	1.356	851	.035	.278	.182	.793	.188	.981	
Other	.114	017	.400	.009	.000	.096	.001	.401	.402	
None	.097	186	039	.005	.011	.001	.226	.006	.232	
Active Total	1.000			.154	1.000	1.000				

a Symmetrical normalization

The output of the correspondence analysis is shown below.



Based on the result of the correspondence analysis, the occupation and the readership can be described as forming three approximate clusters:

- (1) Manuel-type labor / unemployed read left-of-centre type newspapers like the Daily Mirror or the Sun or they do not read any newspaper. As can be seen in the cluster on the left, manual workers and house keepers and the unemployed respondents likely to read Daily Mirror or the Sun. Many also responded that they do not read any of the newspapers listed in the survey.
- (2) White collar / retired read right-of-centre or other newspapers. As can be seen in the cluster on the top center, white collar workers and retirees most likely to read rightof-centre newspapers like the Daily. They are also likely to read the "other" types of newspapers as described in the survey.
- (3) Self-employed / student most likely to read either the left-of-centre newspapers or the Times or the Guardian. Since the self-employed and the student lies between the left-of-centre newspaper and the Times, they are most likely to read these types of newspapers.
- (4) Managers likely to read the Times, the Guardian or the right-of-centre newspaper.

Question 4.

Perceived academic performance and perceived attractiveness of 207 boys are studied and structural equation modeling is used to determine relationship within this construct. The relationships of the variables are shown in Figure 1 below.

The regression weights from SPSS are shown below. Based on the SEM model, the relationship between height - perceived attractiveness and perceived attractive – perceived academic performance might not be significant. The height - perceived attractiveness relationship has p-value of 0.066 and perceived attractive – perceived academic performance has p-value of 0.603. They are shown in italics below.

The model is estimated to be:

academic = 0.022 GPA + .0017 attractiveness

attractivenss = 0.018 height – 0.004 weight + 0.099 rating + 1.274 academic

For perceived academic performance, since attractiveness is not significant, it can be explained solely by level of GPA – which is more or less an expected result.

For perceived attractiveness, rating d attractiveness by others, perceived academic performance, are positively related to attractiveness. Weight is negatively related to attractiveness as thinner people are perceived to be more attractiveness. Although not significant statistically, taller people are perceived to be more attractive.

Regression Weights

			Estimate	S.E.	C.R.	Р
ACADEMIC	<	GPA	0.022	0.002	9.197	0.000
ATTRACT	<	HEIGHT	0.018	0.010	1.838	0.066
ATTRACT	<	WEIGHT	-0.004	0.001	-2.491	0.013
ATTRACT	<	RATING	0.099	0.030	3.261	0.001
ATTRACT	<	ACADEMIC	1.274	0.286	4.461	0.000
ACADEMIC	<	ATTRACT	0.017	0.032	0.520	0.603

Based on this model, 30.5% of perceived attractiveness is explained by height, weight, rating, and perceived academic performance; while 36.8% of perceived academic performance is explained by the variables of GPA and perceived attractiveness.

Squared Multiple Correlations

	Estimate
ATTRACT	0.305
ACADEMIC	0.368

The Fit Measures of the SEM is attached at the end. But an overall evaluation of how well the model provides an acceptable fit to the data can be determined by the following measures.

- (a) Chi-square of 1.139, which is not significant.
- (b) GFI of 0.998 indicating good fit as it is greater than 0.9.
- (c) Adjusted GFI of 0.987 indicating good fit as it is greater than 0.8.
- (d) RMR of 0.05 indicating good fit as it is lower than 0.10.
- (e) RMSEA of 0.079 at the upper bound indicating good fit as it is lower than 0.10.
- (f) CFI index of 1.0 indicating good fit as it is greater than 0.9.

Figure 2 below provides the unstandardized correlation coefficient and Figure 3 below provides the standardized correlation coefficient output based on the SPSS SEM.

Figure 1.



Figure 2.



Figure 3.

