Department of Marketing

OTTO VON GUERICKE UNIVERSITÄT MAGDEBURG

WW FACULTY OF ECONOMICS AND MANAGEMENT

Examination:	20566 Marketing Methods and Analysis
Examiner:	Prof. Dr. Marko Sarstedt

Last Name	
First Name	
Matriculation Number	
Faculty	

This is an open-book exam, i.e., you are allowed to use everything (dictionaries, lecture scripts, books...) in paper form and a non-programmable pocket calculator without communication functions.

This exam has 21 pages and yields 100 points.

The pages must not be torn apart!

The duration of the exam is one hour (60 min.).

The exam has 3 tasks. Each must be answered.

Answers can be given in German or English.

Please round to 2 decimals-unless indicated otherwise.

Do not just write the result in the computational tasks. Show how you got to your result. You can use the front and back pages of the exam for your answers. Loose pages are prohibited!

Please make sure in your own interest that your approach to solving the tasks is comprehensible to others.

Task 1 (35 points)

In the utility industry, customer churn is comparatively low in Germany. You, however, are assistant to the CEO in a company where – at least in the eyes of your boss – too many customers have cancelled their energy supply contract. You hypothesized that this is due to the bad marketing in the region "North", while the region "South" (where one of your buddies is in charge of customer care) would not suffer from a customer churn problem.
The CEO has received the following table which contrasts the number of customers that churned and did not churn in the regions "North" and "South" (in 1000). It shows that 1.6% of customers in the region "North" have cancelled the contract within the last 12 months while approximately 1.3% is the corresponding value for region "South".

Region / Churned?	North	South
Yes	200	130
No	12000	10000

a) The CEO says that, in his eyes, there is no difference in churn between North and South. But you would like to demonstrate that your hypothesis is correct. What kind of statistical test would you suggest for the data given? Please formulate the corresponding hypotheses (i.e., null hypothesis and alternative hypothesis)!
(5 points)

b) Please perform the test for α = 1% and α = 5%. See the Appendix for statistical tables. According to the results: Who is right – you or the CEO? Please be as precise as possible in your interpretation. (25 points)

c) If you wanted to statistically show that customer churn and region are not independent, how would you select alpha (α = 1%, α = 5%, or α = 10%)? Please justify your opinion! (5 points)

Task 2 (15 points)

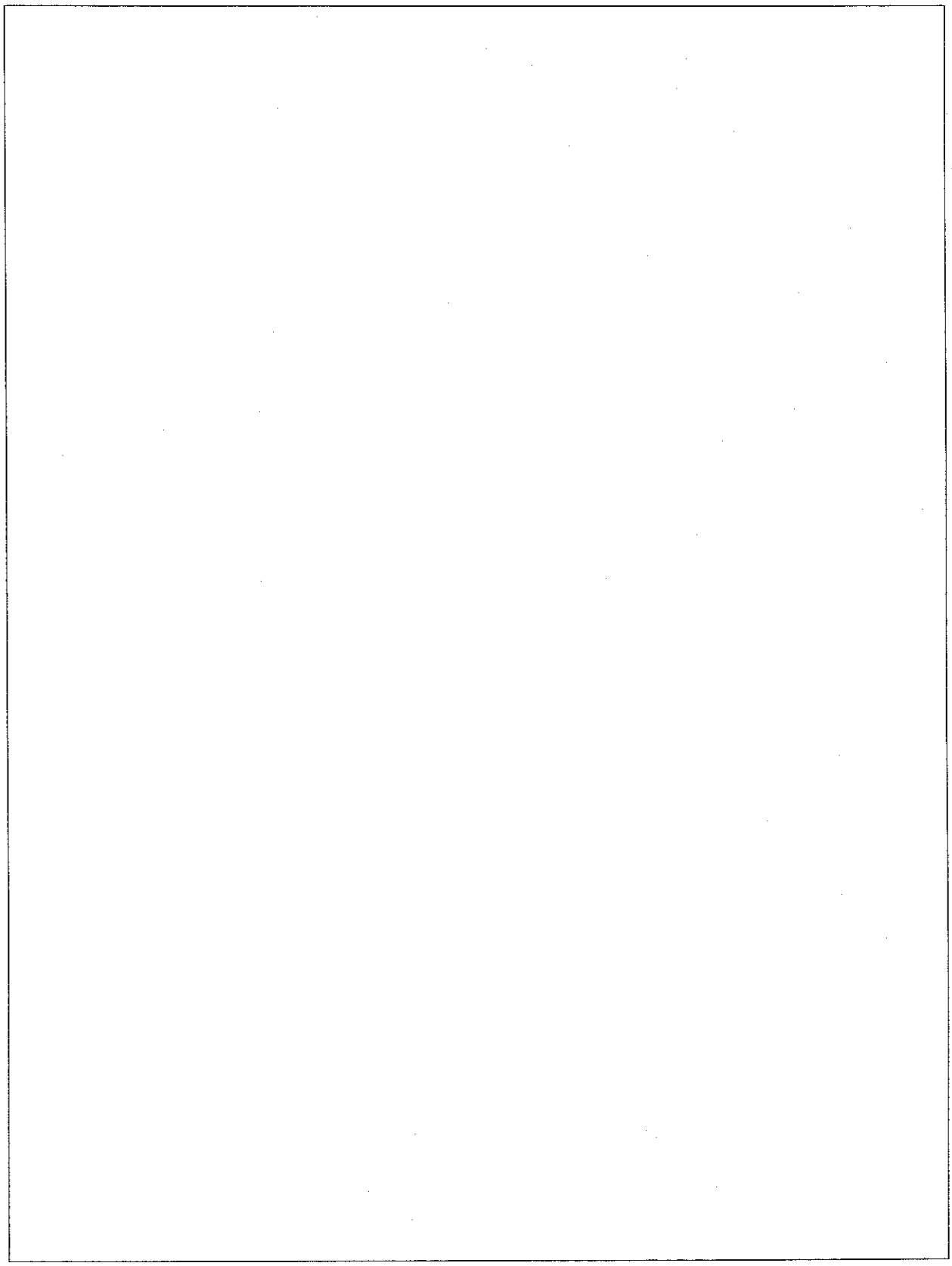
ODI Company is an international car manufacturer with its headquarters in Stottgert, Germany.

To assess the success of their newest car, the O8, ODI's management decides to intensively use the car clinic as a market research tool. They used an old factory building to set up a combination of the new ODI O8 and several of its closest competitor cars, providing the invited test persons enough space and a broad selection of tools to inspect and test the cars extensively and in every manner they wished to do so. In addition, participants were granted whatever information about the new O8 that they asked for. Afterwards, they were handed out a questionnaire that was supposed to cope with all aspects of the car testing that respondents just had undergone.

According to your opinion, does the questionnaire (shown below and on the next page) cover all important aspects in order to measure customer satisfaction with the new car? Please comment critically on the questionnaire set-up by looking at the concrete questions as well as scales being used. Name at least **five** aspects that need to be reconsidered.

Customer satisfaction		
	I am... completely unsatisfied – completely satisfied	Do not know
1 In general, are you as a car driver satisfied with the new ODI O8?	1 – 2 – 3 – 4 – 5 – 6 -7	○
2 How satisfied are you with the engine performance?	1 – 2 – 3 – 4 – 5 – 6 -7	○
3 Are you satisfied with the speed of the new car?	1 – 2 – 3 – 4 – 5 – 6 -7	○
4 Tests have shown that the motor power of ODI cars is of high importance to its customers. How satisfied are you with the power of the new ODI O8?	1 – 2 – 3 – 4 – 5 – 6 -7	○
5 The ODI Company is very proud of its high achievements in design. How satisfied are you with the design of the new ODI O8?	1 – 2 – 3 – 4 – 5 – 6 -7	○
6 Judging by the look of the new ODI car, do you like it? How satisfied are you with the look of the new O8?	1 – 2 – 3 – 4 – 5 – 6 -7	○

7	Are you satisfied with our wide range of possible colours for the car?	1 – 2 – 3 – 4 – 5 – 6 -7	❍
8	How satisfied are you with the configuration of the ODI O8?	1 – 2 – 3 – 4 – 5 – 6 -7	❍
9	Did you know that you can choose out of 5 different setups for the side mirrors? Are you satisfied with the amount of order options you have with the new O8?	1 – 2 – 3 – 4 – 5 – 6 -7	❍
10	Imagine you were in the situation to buy a new car and you went to your favourite dealer in order to take a look at the new cars from ODI. How satisfied would the interior equipment of the new O8 make you when buying the car?	1 – 2 – 3 – 4 – 5 – 6 -7	❍
11	Are you satisfied with the Bong&Olafsson media system in the new ODI car?	1 – 2 – 3 – 4 – 5 – 6 -7	❍
12	Volume tests have shown that most car drivers are very satisfied with the sound operation. How satisfied are you with the volume control of the new O8?	1 – 2 – 3 – 4 – 5 – 6 -7	❍
13	The new ODI O8 has a specially designed remote-control for the media system which displays 48 Swarovski crystals. Are you satisfied with the ease of operation of the ms in the new O8?	1 – 2 – 3 – 4 – 5 – 6 -7	❍
14	Are you going to buy a new car any time soon?	Yes ❍ No ❍	
15	Do you think our product prices are …	Too low ❍ Appropriate ❍ Too high ❍	
	Demographical Questions (Please indicate):		
16	Gender	Male ❍ Female ❍	
17	Age	18-25 years ❍ 20-35 years ❍ 30-45 years ❍ 45 years and older ❍	



Task 3 (50 points)

You are the research consultant at a marketing research firm. Your client, an automobile company, wants to understand better how the customers perceive their newest car. You have collected data from 3000 respondents (sample size N = 3000) who evaluated your client's car on several balanced 7-point Likert scales. To analyze the data you decided to run a factor analysis. The analysis yielded the following results.
Unfortunately, your intern has messed up the SPSS output so that some values have been erased- indicated by question marks ("?").

Descriptive Statistics

	Mean	Std. Deviation	Analysis N
Price	5,62	1,430	3000
Resale value	6,09	1,389	3000
Fuel consumption	5,29	1,456	3000
Attractivity	4,41	1,834	3000
Comfort	4,31	1,989	3000
Youthfulness	5,14	1,545	3000

Correlation Matrix

		Price	Resale value	Fuel consumption	Attractivity	Comfort	Youthfulness
Correlation	Price	1,000	,642	,661	,344	,340	,486
	Resale value	,642	1,000	,546	,227	,220	,419
	Fuel consumption	,661	,546	1,000	,403	,394	,560
	Attractivity	,344	,227	,403	1,000	,594	,570
	Comfort	,340	,220	,394	,594	1,000	,469
	Youthfulness	,486	,419	,560	,570	,469	1,000
Sig. (1-tailed)	Price		,000	,000	,000	,000	,000
	Resale value	,000		,000	,000	,000	,000
	Fuel consumption	,000	,000		,000	,000	,000
	Attractivity	,000	,000	,000		,000	,000
	Comfort	,000	,000	,000	,000		,000
	Youthfulness	,000	,000	,000	,000	,000	

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0,810
Bartlett's Test of Sphericity	Approx. Chi-Square	7460,019
	df	15
	Sig.	,000

Anti-image Matrices

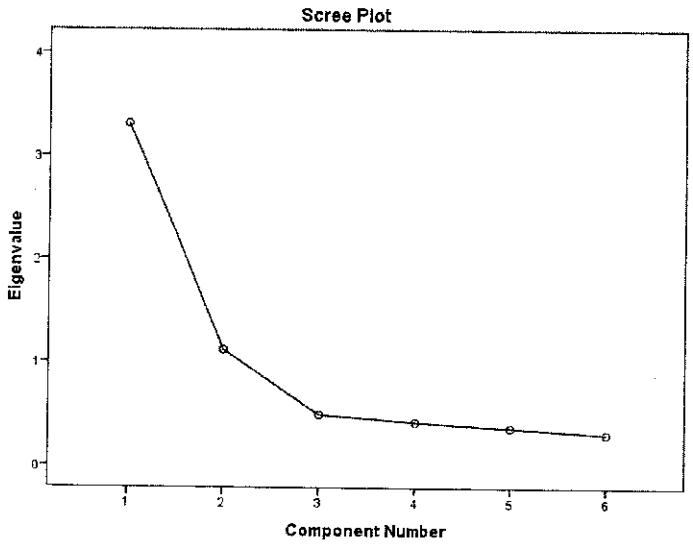
		Price	Resale value	Fuel consumption	Attractivity	Comfort	Youthfulness
Anti-image Covariance	Price	,439	-,214	-,175	-,017	-,034	-,035
	Resale value	-,214	,550	-,090	,037	,027	-,069
	Fuel consumption	-,175	-,090	,465	-,025	-,052	-,119
	Attractivity	-,017	,037	-,025	,535	-,246	-,186
	Comfort	-,034	,027	-,052	-,246	,607	-,065
	Youthfulness	-,035	-,069	-,119	-,186	-,065	,517
Anti-image Correlation	Price	,790[a]	-,436	-,387	-,035	-,066	-,074
	Resale value	-,436	,801[a]	-,178	,068	,046	-,129
	Fuel consumption	-,387	-,178	,844[a]	-,050	-,098	-,243
	Attractivity	-,035	,068	-,050	,759[a]	-,432	-,353
	Comfort	-,066	,046	-,098	-,432	,805[a]	-,116
	Youthfulness	-,074	-,129	-,243	-,353	-,116	,853[a]

a. Measures of Sampling Adequacy(MSA)

Communalities

	Initial	Extraction
Price	1,000	?
Resale value	1,000	,766
Fuel consumption	1,000	,717
Attractivity	1,000	,783
Comfort	1,000	,724
Youthfulness	1,000	,659

Extraction Method: Principal Component Analysis.



Total Variance Explained

Com-ponent	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	?	55,169	55,169		55,169	55,169		39,001	39,001
2	?	18,626	73,795		18,626	73,795		34,794	73,795
3	,490	8,172	81,967						
4	,418	6,962	88,929						
5	,362	6,025	94,954						
6	,303	5,046	100,000						

Extraction Method: Principal Component Analysis.

Component Matrix[a]

	Component	
	1	2
Fuel consumption	,815	-,230
Youthfulness	,794	,169
Price	,792	-,392
Resale value	,693	,550
Attractivity	,687	-,541
Comfort	,660	,536

Extraction Method: Principal Component Analysis.

a. 2 components extracted.

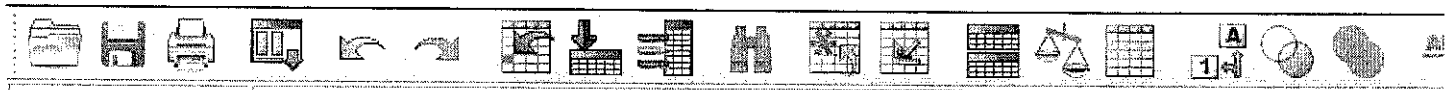
Rotated Component Matrix[a]

	Component	
	1	2
Resale value	,873	,053
Price	,852	,234
Fuel consumption	,761	,371
Attractivity	,152	,872
Comfort	,136	,840
Youthfulness	,481	,654

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.



	var_1	var_2	var_3	var_4	var_5	var_6	FAC1_1	FAC2_1
1	5	7	6	4	3	5	,43274	-,55758
2	6	6	5	6	6	5	-,28642	,81772
3	6	7	7	5	6	7	,69252	,74704

a) Shortly explain two purposes of factor analysis- why would you conduct it? (4 points)

b) Is a factor analysis applicable for the data? Please comment on the scales used, the data as well as the correlations of the variables. (13 points)

c) Compute the missing Eigenvalues for the two extracted factors. How can you determine the number of factors to extract from the data? Please describe at least two approaches. (12 points)

d) How much information do the two extracted factors capture from the initial amount of information? Do you believe that the factors capture a sufficient amount of information? (2 points)

e) Assign the variables to the factors and find labels for the factors. (12 points)

f) Compute the missing communality for the variable "Price". (2 points)

g) Interpret the result of the factor scores for respondent number 1. Differentiate shortly the terms factor scores and factor loadings. (5 points)

Appendix

Standard Normal Distribution $\Phi(u)$

$\mu = 0$
$\sigma = 1$

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.5000	.5040	.5080	.5120	.5160	.5190	.5239	.5279	.5319	.5359
.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	6879
.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7157	.7549
.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
.8	.7881	.7910	.7939	.7969	.7995	.8023	.8051	.8078	.8106	.8133
.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8513	.8554	.8577	.8529	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9215	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9492	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990

$$\Phi(-u) = 1 - \Phi(u)$$

F-Distribution for (1-α)=0,99

df2 \ df1	1	2	3	4	5
1	4052,18	4999,34	5403,53	5624,26	5763,96
2	98,50	99,00	99,16	99,25	99,30
3	34,12	30,82	29,46	28,71	28,24
4	21,20	18,00	16,69	15,98	15,52
5	16,26	13,27	12,06	11,39	10,97
6	13,75	10,92	9,78	9,15	8,75
7	12,25	9,55	8,45	7,85	7,46
8	11,26	8,65	7,59	7,01	6,63
9	10,56	8,02	6,99	6,42	6,06
10	10,04	7,56	6,55	5,99	5,64
11	9,65	7,21	6,22	5,67	5,32
12	9,33	6,93	5,95	5,41	5,06
13	9,07	6,70	5,74	5,21	4,86
14	8,86	6,51	5,56	5,04	4,69
15	8,68	6,36	5,42	4,89	4,56
16	8,53	6,23	5,29	4,77	4,44
17	8,40	6,11	5,19	4,67	4,34
18	8,29	6,01	5,09	4,58	4,25
19	8,18	5,93	5,01	4,50	4,17
20	8,10	5,85	4,94	4,43	4,10
21	8,02	5,78	4,87	4,37	4,04
22	7,95	5,72	4,82	4,31	3,99
23	7,88	5,66	4,76	4,26	3,94
24	7,82	5,61	4,72	4,22	3,90
25	7,77	5,57	4,68	4,18	3,85
26	7,72	5,53	4,64	4,14	3,82
27	7,68	5,49	4,60	4,11	3,78
28	7,64	5,45	4,57	4,07	3,75
29	7,60	5,42	4,54	4,04	3,73
30	7,56	5,39	4,51	4,02	3,70
31	7,53	5,36	4,48	3,99	3,67
32	7,50	5,34	4,46	3,97	3,65
33	7,47	5,31	4,44	3,95	3,63
34	7,44	5,29	4,42	3,93	3,61
35	7,42	5,27	4,40	3,91	3,59
36	7,40	5,25	4,38	3,89	3,57
37	7,37	5,23	4,36	3,87	3,56
38	7,35	5,21	4,34	3,86	3,54
39	7,33	5,19	4,33	3,84	3,53
40	7,31	5,18	4,31	3,83	3,51
50	7,17	5,06	4,20	3,72	3,41

F-Distribution for (1-α)=0,95

df2 \ df1	1	2	3	4	5
1	161,45	199,50	215,71	224,58	230,16
2	18,51	19,00	19,16	19,25	19,30
3	10,13	9,55	9,28	9,12	9,01
4	7,71	6,94	6,59	6,39	6,26
5	6,61	5,79	5,41	5,19	5,05
6	5,99	5,14	4,76	4,53	4,39
7	5,59	4,74	4,35	4,12	3,97
8	5,32	4,46	4,07	3,84	3,69
9	5,12	4,26	3,86	3,63	3,48
10	4,96	4,10	3,71	3,48	3,33
11	4,84	3,98	3,59	3,36	3,20
12	4,75	3,89	3,49	3,26	3,11
13	4,67	3,81	3,41	3,18	3,03
14	4,60	3,74	3,34	3,11	2,96
15	4,54	3,68	3,29	3,06	2,90
16	4,49	3,63	3,24	3,01	2,85
17	4,45	3,59	3,20	2,96	2,81
18	4,41	3,55	3,16	2,93	2,77
19	4,38	3,52	3,13	2,90	2,74
20	4,35	3,49	3,10	2,87	2,71
21	4,32	3,47	3,07	2,84	2,68
22	4,30	3,44	3,05	2,82	2,66
23	4,28	3,42	3,03	2,80	2,64
24	4,26	3,40	3,01	2,78	2,62
25	4,24	3,39	2,99	2,76	2,60
26	4,23	3,37	2,98	2,74	2,59
27	4,21	3,35	2,96	2,73	2,57
28	4,20	3,34	2,95	2,71	2,56
29	4,18	3,33	2,93	2,70	2,55
30	4,17	3,32	2,92	2,69	2,53
31	4,16	3,30	2,91	2,68	2,52
32	4,15	3,29	2,90	2,67	2,51
33	4,14	3,28	2,89	2,66	2,50
34	4,13	3,28	2,88	2,65	2,49
35	4,12	3,27	2,87	2,64	2,49
36	4,11	3,26	2,87	2,63	2,48
37	4,11	3,25	2,86	2,63	2,47
38	4,10	3,24	2,85	2,62	2,46
39	4,09	3,24	2,85	2,61	2,46
40	4,08	3,23	2,84	2,61	2,45
50	4,03	3,18	2,79	2,56	2,40

t-Distribution

df	α = .1	α = .05	α = .025	α = .01	α = .005
1	3.078	6.314	12.706	31.821	63.656
2	1.886	2.920	4.303	6.965	9.925
3	1.638	2.353	3.182	4.541	5.841
4	1.533	2.132	2.776	3.747	4.604
5	1.476	2.015	2.571	3.365	4.032
6	1.440	1.943	2.447	3.143	3.707
7	1.415	1.895	2.365	2.998	3.499
8	1.397	1.860	2.306	2.896	3.355
9	1.383	1.833	2.262	2.821	3.250
10	1.372	1.812	2.228	2.764	3.169
11	1.363	1.796	2.201	2.718	3.106
12	1.356	1.782	2.179	2.681	3.055
13	1.350	1.771	2.160	2.650	3.012
14	1.345	1.761	2.145	2.624	2.977
15	1.341	1.753	2.131	2.602	2.947
16	1.337	1.746	2.120	2.583	2.921
17	1.333	1.740	2.110	2.567	2.898
18	1.330	1.734	2.101	2.552	2.878
19	1.328	1.729	2.093	2.539	2.861
20	1.325	1.725	2.086	2.528	2.845
21	1.323	1.721	2.080	2.518	2.831

22	1.321	1.717	2.074	2.508	2.819
23	1.319	1.714	2.069	2.500	2.807
24	1.318	1.711	2.064	2.492	2.797
25	1.316	1.708	2.060	2.485	2.787
26	1.315	1.706	2.056	2.479	2.779
27	1.314	1.703	2.052	2.473	2.771
28	1.313	1.701	2.048	2.467	2.763
29	1.311	1.699	2.045	2.462	2.756
30	1.310	1.697	2.042	2.457	2.750
60	1.296	1.671	2.000	2.390	2.660
120	1.289	1.658	1.980	2.358	2.617
∞	1.282	1.645	1.960	2.326	2.576

Chi-Square Distribution

df	$\alpha = .10$	$\alpha = .05$	$\alpha = .025$	$\alpha = .01$
1	2.706	3.841	5.024	6.635
2	4.605	5.991	7.378	9.210
3	6.251	7.815	9.348	11.345
4	7.779	9.488	11.143	13.277
5	9.236	11.070	12.833	15.086
6	10.645	12.592	14.449	16.812
7	12.017	14.067	16.013	18.475
8	13.362	15.507	17.535	20.090
9	14.684	16.919	19.023	21.666
10	15.987	18.307	20.483	23.209
11	17.275	19.675	21.920	24.725
12	18.549	21.026	23.337	26.217
13	19.812	22.362	24.736	27.688
14	21.064	23.685	26.119	29.141
15	22.307	24.996	27.488	30.578
16	23.542	26.296	28.845	32.000
17	24.769	27.587	30.191	33.409
18	25.989	28.869	31.526	34.805
19	27.204	30.144	32.852	36.191
20	28.412	31.410	34.170	37.566
21	29.615	32.671	35.479	38.932
22	30.813	33.924	36.781	40.289
23	32.007	35.172	38.076	41.638

df	$\alpha = .10$	$\alpha = .05$	$\alpha = .025$	$\alpha = .01$
24	33.196	36.415	39.364	42.980
25	34.382	37.652	40.646	44.314
26	35.563	38.885	41.923	45.642
27	36.741	40.113	43.195	46.963
28	37.916	41.337	44.461	48.278
29	39.087	42.557	45.722	49.588
30	40.256	43.773	46.979	50.892
40	51.805	55.758	59.342	63.691
50	63.167	67.505	71.420	76.154
60	74.397	79.082	83.298	88.379
70	85.527	90.531	95.023	100.425
80	96.578	101.879	106.629	112.329
90	107.565	113.145	118.136	124.116
100	118.498	124.342	129.561	135.807