Strathmore
UNIVERSITY

STRATHMORE UNIVERSITY BUSINESS SCHOOL

BACHELOR OF COMMERCE

END OF SEMESTER EXAMINATION

BFS 3103: ESSENTIALS OF BUSINESS DATA ANALYTICS

DATE: 5th August,2022 Time: 2 Hours

Instructions

1. This examination consists of **FIVE** questions.
2. Answer **Question ONE (COMPULSORY)** and any other **TWO** questions.
3. Read through the entire exam before you begin and decide how to budget your time most effectively.
4. **DON'T FORGET TO SHOW ALL YOUR WORKINGS.**

Question one [30 Marks]

a) Distinguish between business data analytics & business analysis **[2]**

b) Briefly discuss five types of applications of Business data analytics **[5]**

c) Describes the phenomenon of big data through the **four Vs** **[4]**

d) Calculate the probability that at least 9 out of a group of 10 people who have been infected by a corona virus will survive, if the survival probability for the virus is 70%.

(Hint: Use table in Appendix 1) **[3]**

e) Emmanuel sells new cars for Baraka Motors ltd. He usually sells the large number of cars on Saturday. He has established the following probability distribution for the number of cars he expects to sell on a particular Saturday:

No. of cars sold, (X)	Probability, p(X)
0	**0.1**
1	**0.2**
2	**0.3**
3	**0.3**
4	**0.1**

Required:

i. What Type of distribution is this? [1]

ii. On a typical Saturday, how many cars should John expect to sell? [2]

iii. What is the variance and standard deviation of the distribution? [3]

[Total: 6]

f) A recent study by the Nairobi Metropolitan Service (NMS) showed that the mean fare charged for service from town to Eastlands is KSH. 70 and the standard deviation is KSH. 30. We select a sample of 50 fares.

i. If we select a random sample of 50 fares, what is the standard error of the mean? **[1]**

ii. What is the expected shape of the distribution of the sample mean? **[1]**

iii. What is the likelihood that the sample mean is between KSH. 75 and KSH. 80? **[3]**

[Total: 5]

g) A market research study has collected data on monthly salaries (y) and the grade point averages for students (x) who obtained a diploma's degree in information technology. The estimated regression equation is

$$\hat{y} = 1790.5 + 581.1x, \quad R\ squared\ =\ 0.863\ ,$$

(i) Interpret the value of R squared. **[1]**

(ii) Compute correlation coefficient (R) and interprete **[2]**

(iii) Estimate the monthly salary for a student whose grade point average was 3.2.

[2]

[Total 5]

[Total: 30 marks]

Question two [20 marks]

a) A survey was conducted to determine the number of children raised by a Kenyan parent in the year 2019. From 400 parents interviewed, only 320 were able to complete the survey and the data was summarized using a pivot table as shown in the Table 4 below.

***Table*: Crosstabulation**

	Number of children				
	None	**One**	**Two**	**At least three**	**Total**
Divorced	24	32	41	23	120
Married	40	37	88	35	200
Total	64	69	129	58	320

A person is selected at random.

D denotes the event 'the parent is divorced'.

R denotes the event 'no children leave with a parent'.

S denotes the event 'one child with a parent'.

T denotes the event 'two children live a parent'.

D' denotes the event 'not D'.

Find:

i. $P(D)$ **[1]**

ii. $P(D \cap R)$ **[1]**

iii. $P(D \cup T)$ **[2]**

iv. $P(D|R)$ **[2]**

v. $P(R|D')$ **[2]**

(a) Name two of the events $D, R, S \; and \; T$ that are mutually exclusive. Justify your answer **[2]**

(b) Determine whether the events $D \; and \; R$ are independent. Justify your answer **[2]**

[Total 12]

b) A statistical experiment was conducted to determine effectiveness of a certain drug.

i. Describe what is meant by a **Bernoulli Trial.** **[2]**

ii. State the conditions necessary for a **Bernoulli Process.** **[3]**

iii. From previous history, the drug was known to be **80% successful** in treating a certain disease. If **6** people suffering from the disease are to be given the drug what is the probability that at least **3** of them will be cured**?**

(Hint: Use table in Appendix 1)

[3]

[Total 8]

[Total: 20 marks]

Question three [20 marks]

(a) Because of relatively high interest rates, most consumers attempt to pay off their credit card bills promptly. However, this is not always possible. An analysis of the amount of interest paid monthly by a bank's Visa cardholders reveals that the amount is normally distributed with a mean of $27 and a standard deviation of $7.

i. What percentage of the bank's Visa cardholders pay more than $30 in interest**?**

[3]

ii. What percentage of the bank's Visa cardholders pay less than $15 in interest**?**

[3]

iii. Calculate the probability that out of every three randomly selected consumers from among the bank's Visa cardholders, two will pay between $15 and $30 in interest**.**

[3]

[Total 9]

(b) The growing use of bicycles to commute to work has caused Nairobi metropolitan services (NMS) to create exclusive bicycle lanes. These lanes are usually created by disallowing parking on streets that formerly allowed curb-side parking. Shop-owners on such streets complain that the removal of parking will cause their businesses to suffer. To examine this problem NMS decided to launch an experiment on one busy street that had parking lanes. The parking lanes were removed, and a bicycle lane was created. NMS asked three businesses (a drycleaner, a PIZZA INN outlet, and a Money Transfer outlet) in one area to record daily sales for two complete weeks (Sunday to Saturday) prior to the change and two complete weeks after the change, the assumption being that the removal of parking bays would result in fewer sales. The summaries from the data were extracted using excel as shown in the **Appendix 3**:

i. State the null hypothesis for the PIZZA INN Outlet. Write the null hypothesis in words AND statistical notation. **[2]**

ii. State the alternative hypothesis for the PIZZA INN Outlet. Write the alternative hypothesis in words AND statistical notation. **[2]**

iii. Use the information from the EXCEL output to decide whether you should reject the null hypothesis for each of the three shops. Show all workings. **[6]**

iv. What would you conclude from this study in relation to the original concern of the shop owners? **[2]**

[Total 11]

` **[Total: 20 marks]**

Question four [20 marks]

(a) Calculate a 95% confidence interval for the average height of 10-year-old children, assuming that heights have a $N(\mu, \sigma^2)$ distribution (where μ and σ are unknown), based on a random sample of 5 children whose heights are: 124cm, 122cm, 130cm, 125cm and 132cm.

[7]

(b) A retailer believes that its new advertising strategy will increase sales. Previously, the mean spending in 15 categories of consumer items in both the 18–34 and 35+ age groups was $70.00.

i. Formulate a hypothesis test to determine if the mean spending in these categories has statistically increased. **[1]**

ii. After the new advertising campaign was launched, a marketing study found that the mean spending for 300 respondents in the 18–34 age group was $75.86, with a standard deviation of $50.90. Is there sufficient evidence to conclude that the advertising strategy significantly increased sales in this age group? **[6]**

iii. For 700 respondents in the 35 + age group, the mean and standard deviation were $68.53 and $45.29, respectively. Is there sufficient evidence to conclude that the advertising strategy significantly increased sales in this age group? **[6]**

[Total: 13]

[Total: 20 marks]

Question five [20 Marks]

(a) Suppose a simple regression model is given by

$$y = \beta_0 + \beta_1 x + \varepsilon$$

where β_0 and β_1 are parameters of the model. Explain assumptions about the error term ε of regression model. **[5]**

SBS student decides to predict the selling price for apartments in an upmarket suburb of Nairobi. The student randomly collected data for 17 apartments sold in the last 6 months. The variables included the age of the apartment in years (Age), square footage and the number of bedrooms in the apartment (bedrooms).). Using the summary of the data in **Appendix 2**:

i. Comment briefly on the correlation matrix. Specifically in relation to the relationship between the dependent variable and each independent variable (i.e. strength and direction). **[3]**

ii. Based on the results above, is the regression model appropriate predictor of Selling Price and why (refer to output)? **[2]**

iii. **Perform hypothesis testing for the** least squares estimates coefficients in the regression model. **[5]**

iv. State the regression equation that should be used to predict Selling Price (using your selected model) **[2]**

v. Using the equation in question 5 estimate the selling price that an apartment owner can expect given that they have an apartment which is 16 years old, has 2 bedrooms and 1500 square foot. Show all workings. **[3]**

[Total: 15]

[Total: 20 marks]

Appendix 1

Binomial distribution table						
n	**10**			**n**	**6**	
p	**0.7**			**n**	**0.8**	
X	**P(X=x)**	**F(X)**		**X**	**P(X=x)**	**F(X)**
0	0.0000	0.0000		0	0.0001	0.0001
1	0.0001	0.0001		1	0.0015	0.0016
2	0.0014	0.0016		2	0.0154	0.0170
3	0.0090	0.0106		3	0.0819	0.0989
4	0.0368	0.0473		4	0.2458	0.3446
5	0.1029	0.1503		5	0.3932	0.7379
6	0.2001	0.3504		6	0.2621	1.0000
7	0.2668	0.6172				
8	0.2335	0.8507				
9	0.1211	0.9718				
10	0.0282	1.0000				

Appendix 2

Correlation matrix

	Selling Price	*Square Footage*	*Bedrooms*	*Age*
Selling Price	1.000			
Square Footage	0.804	1.000		
Bedrooms	0.604	0.773	1.000	
Age	(0.881)	(0.617)	(0.473)	1.000

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.941
R Square	0.886
Adjusted R Square	0.860
Standard Error	13,439.767
Observations	17

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	18,274,462,394.776	6,091,487,464.925	33.724	0.000
Residual	13	2,348,155,252.283	180,627,327.099		
Total	16	20,622,617,647.059			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	82,185.649	23,008.767	3.572	0.003	32,478.231	131,893.068
Square Footage	25.941	9.583	2.707	0.018	5.238	46.644
Bedrooms	(2,151.742)	8,826.087	(0.244)	0.811	(21,219.344)	16,915.860
Age	(1,711.537)	327.191	(5.231)	0.000	(2,418.390)	(1,004.685)

Appendix 3

T-Test: Paired Two Sample for Means-- Drycleaners

	Sales Before	*Sales After*
Mean	168	165.5
Variance	351.3846154	321.9615385
Observations	14	14
Pearson Correlation	0.858991493	
Hypothesized Mean Difference	0	
df	13	
t Stat	0.95719923	
P(T<=t) one-tail	0.177965076	
t Critical one-tail	1.770933396	
P(T<=t) two-tail	0.355930152	
t Critical two-tail	2.160368656	

T-Test: Paired Two Sample for Means-- PIZZA INN outlet

	Sales Before	*Sales After*
Mean	308.1428571	295.2857143
Variance	809.6703297	812.0659341
Observations	14	14
Pearson Correlation	0.863977958	
Hypothesized Mean Difference	0	
df	13	
t Stat	3.239009513	
P(T<=t) one-tail	0.003231764	
t Critical one-tail	1.770933396	
P(T<=t) two-tail	0.006463529	
t Critical two-tail	2.160368656	

T-Test: Paired Two Sample for Means- Money Transfer outlet

	Sales Before	*Sales After*
Mean	374.6428571	348.1428571
Variance	2270.401099	2941.824176
Observations	14	14
Pearson Correlation	0.973108487	
Hypothesized Mean Difference	0	
df	13	
t Stat	7.341249824	
P(T<=t) one-tail	2.82735E-06	
t Critical one-tail	1.770933396	
P(T<=t) two-tail	5.65469E-06	
t Critical two-tail	2.160368656	

TABLED

T distribution critical values

	Upper-tail probability *p*											
df	.25	.20	.15	.10	.05	.025	.02	.01	.005	.0025	.001	.0005
1	1.000	1.376	1.963	3.078	6.314	12.71	15.89	31.82	63.66	127.3	318.3	636.6
2	0.816	1.061	1.386	1.886	2.920	4.303	4.849	6.965	9.925	14.09	22.33	31.60
3	0.765	0.978	1.250	1.638	2.353	3.182	3.482	4.541	5.841	7.453	10.21	12.92
4	0.741	0.941	1.190	1.533	2.132	2.776	2.999	3.747	4.604	5.598	7.173	8.610
5	0.727	0.920	1.156	1.476	2.015	2.571	2.757	3.365	4.032	4.773	5.893	6.869
6	0.718	0.906	1.134	1.440	1.943	2.447	2.612	3.143	3.707	4.317	5.208	5.959
7	0.711	0.896	1.119	1.415	1.895	2.365	2.517	2.998	3.499	4.029	4.785	5.408
8	0.706	0.889	1.108	1.397	1.860	2.306	2.449	2.896	3.355	3.833	4.501	5.041
9	0.703	0.883	1.100	1.383	1.833	2.262	2.398	2.821	3.250	3.690	4.297	4.781
10	0.700	0.879	1.093	1.372	1.812	2.228	2.359	2.764	3.169	3.581	4.144	4.587
11	0.697	0.876	1.088	1.363	1.796	2.201	2.328	2.718	3.106	3.497	4.025	4.437
12	0.695	0.873	1.083	1.356	1.782	2.179	2.303	2.681	3.055	3.428	3.930	4.318
13	0.694	0.870	1.079	1.350	1.771	2.160	2.282	2.650	3.012	3.372	3.852	4.221
14	0.692	0.868	1.076	1.345	1.761	2.145	2.264	2.624	2.977	3.326	3.787	4.140
15	0.691	0.866	1.074	1.341	1.753	2.131	2.249	2.602	2.947	3.286	3.733	4.073
16	0.690	0.865	1.071	1.337	1.746	2.120	2.235	2.583	2.921	3.252	3.686	4.015
17	0.689	0.863	1.069	1.333	1.740	2.110	2.224	2.567	2.898	3.222	3.646	3.965
18	0.688	0.862	1.067	1.330	1.734	2.101	2.214	2.552	2.878	3.197	3.611	3.922
19	0.688	0.861	1.066	1.328	1.729	2.093	2.205	2.539	2.861	3.174	3.579	3.883
20	0.687	0.860	1.064	1.325	1.725	2.086	2.197	2.528	2.845	3.153	3.552	3.850
21	0.686	0.859	1.063	1.323	1.721	2.080	2.189	2.518	2.831	3.135	3.527	3.819
22	0.686	0.858	1.061	1.321	1.717	2.074	2.183	2.508	2.819	3.119	3.505	3.792
23	0.685	0.858	1.060	1.319	1.714	2.069	2.177	2.500	2.807	3.104	3.485	3.768
24	0.685	0.857	1.059	1.318	1.711	2.064	2.172	2.492	2.797	3.091	3.467	3.745
25	0.684	0.856	1.058	1.316	1.708	2.060	2.167	2.485	2.787	3.078	3.450	3.725
26	0.684	0.856	1.058	1.315	1.706	2.056	2.162	2.479	2.779	3.067	3.435	3.707
27	0.684	0.855	1.057	1.314	1.703	2.052	2.158	2.473	2.771	3.057	3.421	3.690
28	0.683	0.855	1.056	1.313	1.701	2.048	2.154	2.467	2.763	3.047	3.408	3.674
29	0.683	0.854	1.055	1.311	1.699	2.045	2.150	2.462	2.756	3.038	3.396	3.659
30	0.683	0.854	1.055	1.310	1.697	2.042	2.147	2.457	2.750	3.030	3.385	3.646
40	0.681	0.851	1.050	1.303	1.684	2.021	2.123	2.423	2.704	2.971	3.307	3.551
50	0.679	0.849	1.047	1.299	1.676	2.009	2.109	2.403	2.678	2.937	3.261	3.496
60	0.679	0.848	1.045	1.296	1.671	2.000	2.099	2.390	2.660	2.915	3.232	3.460
80	0.678	0.846	1.043	1.292	1.664	1.990	2.088	2.374	2.639	2.887	3.195	3.416
100	0.677	0.845	1.042	1.290	1.660	1.984	2.081	2.364	2.626	2.871	3.174	3.390
1000	0.675	0.842	1.037	1.282	1.646	1.962	2.056	2.330	2.581	2.813	3.098	3.300
*z**	0.674	0.841	1.036	1.282	1.645	1.960	2.054	2.326	2.576	2.807	3.091	3.291
	50%	60%	70%	80%	90%	95%	96%	98%	99%	99.5%	99.8%	99.9%
	Confidence level *C*											

STANDARD NORMAL DISTRIBUTION: Table Values Represent AREA to the LEFT of the Z score.

Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.9	.00005	.00005	.00004	.00004	.00004	.00004	.00004	.00004	.00003	.00003
-3.8	.00007	.00007	.00007	.00006	.00006	.00006	.00006	.00005	.00005	.00005
-3.7	.00011	.00010	.00010	.00010	.00009	.00009	.00008	.00008	.00008	.00008
-3.6	.00016	.00015	.00015	.00014	.00014	.00013	.00013	.00012	.00012	.00011
-3.5	.00023	.00022	.00022	.00021	.00020	.00019	.00019	.00018	.00017	.00017
-3.4	.00034	.00032	.00031	.00030	.00029	.00028	.00027	.00026	.00025	.00024
-3.3	.00048	.00047	.00045	.00043	.00042	.00040	.00039	.00038	.00036	.00035
-3.2	.00069	.00066	.00064	.00062	.00060	.00058	.00056	.00054	.00052	.00050
-3.1	.00097	.00094	.00090	.00087	.00084	.00082	.00079	.00076	.00074	.00071
-3.0	.00135	.00131	.00126	.00122	.00118	.00114	.00111	.00107	.00104	.00100
-2.9	.00187	.00181	.00175	.00169	.00164	.00159	.00154	.00149	.00144	.00139
-2.8	.00256	.00248	.00240	.00233	.00226	.00219	.00212	.00205	.00199	.00193
-2.7	.00347	.00336	.00326	.00317	.00307	.00298	.00289	.00280	.00272	.00264
-2.6	.00466	.00453	.00440	.00427	.00415	.00402	.00391	.00379	.00368	.00357
-2.5	.00621	.00604	.00587	.00570	.00554	.00539	.00523	.00508	.00494	.00480
-2.4	.00820	.00798	.00776	.00755	.00734	.00714	.00695	.00676	.00657	.00639
-2.3	.01072	.01044	.01017	.00990	.00964	.00939	.00914	.00889	.00866	.00842
-2.2	.01390	.01355	.01321	.01287	.01255	.01222	.01191	.01160	.01130	.01101
-2.1	.01786	.01743	.01700	.01659	.01618	.01578	.01539	.01500	.01463	.01426
-2.0	.02275	.02222	.02169	.02118	.02068	.02018	.01970	.01923	.01876	.01831
-1.9	.02872	.02807	.02743	.02680	.02619	.02559	.02500	.02442	.02385	.02330
-1.8	.03593	.03515	.03438	.03362	.03288	.03216	.03144	.03074	.03005	.02938
-1.7	.04457	.04363	.04272	.04182	.04093	.04006	.03920	.03836	.03754	.03673
-1.6	.05480	.05370	.05262	.05155	.05050	.04947	.04846	.04746	.04648	.04551
-1.5	.06681	.06552	.06426	.06301	.06178	.06057	.05938	.05821	.05705	.05592
-1.4	.08076	.07927	.07780	.07636	.07493	.07353	.07215	.07078	.06944	.06811
-1.3	.09680	.09510	.09342	.09176	.09012	.08851	.08691	.08534	.08379	.08226
-1.2	.11507	.11314	.11123	.10935	.10749	.10565	.10383	.10204	.10027	.09853
-1.1	.13567	.13350	.13136	.12924	.12714	.12507	.12302	.12100	.11900	.11702
-1.0	.15866	.15625	.15386	.15151	.14917	.14686	.14457	.14231	.14007	.13786
-0.9	.18406	.18141	.17879	.17619	.17361	.17106	.16853	.16602	.16354	.16109
-0.8	.21186	.20897	.20611	.20327	.20045	.19766	.19489	.19215	.18943	.18673
-0.7	.24196	.23885	.23576	.23270	.22965	.22663	.22363	.22065	.21770	.21476
-0.6	.27425	.27093	.26763	.26435	.26109	.25785	.25463	.25143	.24825	.24510
-0.5	.30854	.30503	.30153	.29806	.29460	.29116	.28774	.28434	.28096	.27760
-0.4	.34458	.34090	.33724	.33360	.32997	.32636	.32276	.31918	.31561	.31207
-0.3	.38209	.37828	.37448	.37070	.36693	.36317	.35942	.35569	.35197	.34827
-0.2	.42074	.41683	.41294	.40905	.40517	.40129	.39743	.39358	.38974	.38591
-0.1	.46017	.45620	.45224	.44828	.44433	.44038	.43644	.43251	.42858	.42465
-0.0	.50000	.49601	.49202	.48803	.48405	.48006	.47608	.47210	.46812	.46414

STANDARD NORMAL DISTRIBUTION: Table Values Represent AREA to the LEFT of the Z score.

Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.50000	.50399	.50798	.51197	.51595	.51994	.52392	.52790	.53188	.53586
0.1	.53983	.54380	.54776	.55172	.55567	.55962	.56356	.56749	.57142	.57535
0.2	.57926	.58317	.58706	.59095	.59483	.59871	.60257	.60642	.61026	.61409
0.3	.61791	.62172	.62552	.62930	.63307	.63683	.64058	.64431	.64803	.65173
0.4	.65542	.65910	.66276	.66640	.67003	.67364	.67724	.68082	.68439	.68793
0.5	.69146	.69497	.69847	.70194	.70540	.70884	.71226	.71566	.71904	.72240
0.6	.72575	.72907	.73237	.73565	.73891	.74215	.74537	.74857	.75175	.75490
0.7	.75804	.76115	.76424	.76730	.77035	.77337	.77637	.77935	.78230	.78524
0.8	.78814	.79103	.79389	.79673	.79955	.80234	.80511	.80785	.81057	.81327
0.9	.81594	.81859	.82121	.82381	.82639	.82894	.83147	.83398	.83646	.83891
1.0	.84134	.84375	.84614	.84849	.85083	.85314	.85543	.85769	.85993	.86214
1.1	.86433	.86650	.86864	.87076	.87286	.87493	.87698	.87900	.88100	.88298
1.2	.88493	.88686	.88877	.89065	.89251	.89435	.89617	.89796	.89973	.90147
1.3	.90320	.90490	.90658	.90824	.90988	.91149	.91309	.91466	.91621	.91774
1.4	.91924	.92073	.92220	.92364	.92507	.92647	.92785	.92922	.93056	.93189
1.5	.93319	.93448	.93574	.93699	.93822	.93943	.94062	.94179	.94295	.94408
1.6	.94520	.94630	.94738	.94845	.94950	.95053	.95154	.95254	.95352	.95449
1.7	.95543	.95637	.95728	.95818	.95907	.95994	.96080	.96164	.96246	.96327
1.8	.96407	.96485	.96562	.96638	.96712	.96784	.96856	.96926	.96995	.97062
1.9	.97128	.97193	.97257	.97320	.97381	.97441	.97500	.97558	.97615	.97670
2.0	.97725	.97778	.97831	.97882	.97932	.97982	.98030	.98077	.98124	.98169
2.1	.98214	.98257	.98300	.98341	.98382	.98422	.98461	.98500	.98537	.98574
2.2	.98610	.98645	.98679	.98713	.98745	.98778	.98809	.98840	.98870	.98899
2.3	.98928	.98956	.98983	.99010	.99036	.99061	.99086	.99111	.99134	.99158
2.4	.99180	.99202	.99224	.99245	.99266	.99286	.99305	.99324	.99343	.99361
2.5	.99379	.99396	.99413	.99430	.99446	.99461	.99477	.99492	.99506	.99520
2.6	.99534	.99547	.99560	.99573	.99585	.99598	.99609	.99621	.99632	.99643
2.7	.99653	.99664	.99674	.99683	.99693	.99702	.99711	.99720	.99728	.99736
2.8	.99744	.99752	.99760	.99767	.99774	.99781	.99788	.99795	.99801	.99807
2.9	.99813	.99819	.99825	.99831	.99836	.99841	.99846	.99851	.99856	.99861
3.0	.99865	.99869	.99874	.99878	.99882	.99886	.99889	.99893	.99896	.99900
3.1	.99903	.99906	.99910	.99913	.99916	.99918	.99921	.99924	.99926	.99929
3.2	.99931	.99934	.99936	.99938	.99940	.99942	.99944	.99946	.99948	.99950
3.3	.99952	.99953	.99955	.99957	.99958	.99960	.99961	.99962	.99964	.99965
3.4	.99966	.99968	.99969	.99970	.99971	.99972	.99973	.99974	.99975	.99976
3.5	.99977	.99978	.99978	.99979	.99980	.99981	.99981	.99982	.99983	.99983
3.6	.99984	.99985	.99985	.99986	.99986	.99987	.99987	.99988	.99988	.99989
3.7	.99989	.99990	.99990	.99990	.99991	.99991	.99992	.99992	.99992	.99992
3.8	.99993	.99993	.99993	.99994	.99994	.99994	.99994	.99995	.99995	.99995
3.9	.99995	.99995	.99996	.99996	.99996	.99996	.99996	.99996	.99997	.99997

Critical values of F for the 0.05 significance level:

	1	2	3	4	5	6	7	8	9	10
1	161.45	199.50	215.71	224.58	230.16	233.99	236.77	238.88	240.54	241.88
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.39	19.40
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14
10	4.97	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98
11	4.84	3.98	3.59	3.36	3.20	3.10	3.01	2.95	2.90	2.85
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49
17	4.45	3.59	3.20	2.97	2.81	2.70	2.61	2.55	2.49	2.45
18	4.41	3.56	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35
21	4.33	3.47	3.07	2.84	2.69	2.57	2.49	2.42	2.37	2.32
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.38	2.32	2.28
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.26
25	4.24	3.39	2.99	2.76	2.60	2.49	2.41	2.34	2.28	2.24
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22
27	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.31	2.25	2.20
28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24	2.19
29	4.18	3.33	2.93	2.70	2.55	2.43	2.35	2.28	2.22	2.18
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.17
31	4.16	3.31	2.91	2.68	2.52	2.41	2.32	2.26	2.20	2.15
32	4.15	3.30	2.90	2.67	2.51	2.40	2.31	2.24	2.19	2.14
33	4.14	3.29	2.89	2.66	2.50	2.39	2.30	2.24	2.18	2.13
34	4.13	3.28	2.88	2.65	2.49	2.38	2.29	2.23	2.17	2.12
35	4.12	3.27	2.87	2.64	2.49	2.37	2.29	2.22	2.16	2.11