MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS
2023/2024 ACADEMIC YEAR
THIRD YEAR FIRST SEMESTER

SCHOOL OF NATURAL RESOURCES, ENVIRONMENTAL STUDIES AND AGRICULTURE

BACHELOR OF ARTS IN GEOGRAPHY AND GEOSPATIAL TECHNIQUES

COURSE CODE: GEO 3125-1
COURSE TITLE: QUANTITATIVE METHODS IN GEOGRAPHY

DATE: 4TH NOVEMBER, 2023 **TIME: 0830-1030 HRS**

INSTRUCTIONS TO CANDIDATES

Answer **ALL** questions in Section A and any other **TWO QUESTIONS** in Section B**.** You have been provided with **three graph papers**. You are allowed to use a simple scientific calculator. Sharing of any materials with other candidates is not allowed.

This paper consists of 11 printed pages. Please turn over

SECTION A (20 Marks)

Q1

a) Give two examples of what can be classified as 'quantitative social data' (2 marks)

b) Describe a practical situation that demonstrates the use of the following descriptive measures in geography.

i) Arithmetic Mean (2 marks)

ii) Range (2 marks)

c) Describe two benefits of using Nearest Neighbour Analysis in geography (2 marks)

d) A teacher marked a geography test and later found that the scores conformed to a normal distribution. The mean of the scores was 46 and the standard deviation was 13. Obtain the percentage of scores that fell between 40 and 55. (2 marks)

e) Table1 below shows a contingency table that describe a sample of Form two students at St. Joseph High School in Kenya. They were asked to name their favourite TV stations. Using this information answer the questions below.

Table 1

TV Stations	Form 2 East	Form 2 West	Form 3 South	Form 3 North
KBC	19	22	17	23
NTV	6	2	12	7
Citizen	13	16	9	9

i) What was the size of the sample? (2 marks)

ii) If one student is selected at random what is the probability that the student likes watching programmes in KBC? (2 marks)

iii) What is the probability of selecting a student at random who is in Form 2 West and does not like KBC? (2 marks)

f) A teacher taught students of geography using three different methods. He suspected that one method was better than the others. He chose at random students who liked mathematics and at the same level in his secondary school. The students were divided into three groups and subjected to three different teaching methods; Method 1, Method 2 and Method 3. Later after a one hour quiz their scores were as indicated in table 2 below.

Table 2

	Client	Client	Client	Client	Client	Client	Totals
Group1	10	8	9	7	5	3	42
Group2	6	5	4	2	1	o	18
Group3	11	12	10	10	9	8	60

After the experiment the researcher constructed the ANOVA summary Table3 show below. Answer the questions that follow.

Table 3

Source	SS	df	MS	F
Between groups	148	K -1= 2	148/2 = 74	F= 74/4.8
Within groups	72	N -K= 15	72/15 = 4.8	= 15.42
Total	220	N -1= 17		

i)What is the corresponding F critical value at 5% level in the F-distribution tables? (2 marks)

ii)What is the conclusion of this experiment? (2 marks)

SECTION B (30 MARKS)

Q2) Table1.1 below shows total number of accidents reported to the police for the period 1980- 2000. Study the table and answer the questions below.

a) Plot a time series for the period, 1980- 2000, of the number of accidents, number of injured persons and the number of those killed (5 marks)

b) Plot a 3-year running mean (on a chart) for the annual number of road accidents (2 marks)

c) Is there any trend or patterns in these variables? Explain (2 marks)

d) Compute the Pearson's product moment correlation coefficient between number of road accidents and number of injured persons (2 marks)

e) There is missing data on the number of fatal accidents for the years 1980- 1989 and 1999. What could be the reason for this? (2 marks)

f) Propose one practical strategy that could be employed to reduce the number of road accidents reported to the police in this area (2 marks)

Q3) Table 2.1 below has an extract for the period 1991- 1997 of 17 types of penal code cases from the Statistical Abstract (2000) of the Kenya National Bureau of Statistics. Study the table and answer the questions that below;

a) Plot a suitable bar graph to display the cases of Manslaughter, Rape, Assault and Offence against person (5 marks)

b) Describe the variations of these incidents in Kenya (2 marks)

c) Using the graph above, do you notice any relationship between cases of Rape and cases manslaughter? (2 marks)

d) Compute the two regression coefficients of a linear regression model for any two of the other variables you have plotted in (a) above (4 Marks)

e) State the regression model (2 marks)

Q4) With reference to Annex1 (attached), study the abstract on of a research paper on "Knowledge of First aid in Kathandu County School Students and Teachers" and answer the questions that follow.

a) What was the main objective of the investigation? (3 marks)
b) Describe one main quantitative variable that was involved in this study (2 marks)
c) With the aid of a suitable sketch show how the six schools may have been selected (2 marks)
d) Explain one could get a fair sample of teachers for such a study (2 marks)
e) Give suggestions on how to increase the representativeness of the sample of the students chosen (2 marks)
f) Describe one quantitative method that the researcher may have used to compare the First Aid knowledge of the teachers with that of the students. (4 marks)

Q5) A Geographer wishes to find out whether or not studying for 40 minutes per day for two weeks helps students score better in a test. A group of 17 students were randomly assigned to a study or no-study group. After two weeks, all of the students took the same test. Assuming that the observations are not normally distributed we wish to compare the results from the two groups. Study the observations below and Answer the questions that follow;

Study Sample	66	91	93	95	90	98	83	89	82
No-study Sample	84	89	01	71	68	76	77	67	

a) Copy the table and state the Null hypothesis (3 marks)
b) Using an assumed alpha= 0.01 significance level obtain the appropriate Test statistic. (4 marks)
d) Obtain the critical value from the statistical tables (2 mark)
e) Reject or Fail to reject the Null hypothesis. Give a suitable interpretation of your results. (6 marks)

//END //

TABLE 1.1

Year	Total Number of Accidents	Fatal Accidents	Killed Persons	Injured Persons
1980	7,865		954	6,381
1981	9,274		960	6,126
1082	7,037		843	5,897
1983	6,494		827	6,076
1984	7,082		1,021	6,670
1985	8,119		1,071	7,613
1986	7,883		1,038	7.678
1987	9,674		1,117	7,937
1988	9,538		1,256	9,283
1989	9,925		1,116	8,139
1990	10,107	883	1,059	9,910
1991	10,611	959	1,129	10,249
1992	11,865	1,185	1,367	11,406
1993	12,595	1,203	1,483	11,513
1994	13,871	1,346	1,548	12,377
1995	13,767	1,371	1,663	12,625
1996	14,050	1,440	1,809	12,515
1997	14,335	1,323	1,625	12,490
1998	12,234	1,232	1,583	11,381
1999	13,478		1,612	12,845
2000	14, 548	1,441	1,737	14,094

ANNEX-1

KNOWLEDGE OF FIRST AID IN KATHANDU COUNTY SCHOOL STUDENTS AND TEACHERS.

ABSTRACT

Background

Basic knowledge on first aid is required to every citizen. School children are best target group for giving such training. School teachers have duel responsibility on this regard. They should have adequate knowledge on first aid so that they can provide when necessary and to train students.

This study was conducted to assess the knowledge of school teachers and students and effect of first aid training.

Methods

This study was conducted in school teachers and high school students of 6 schools in Kathandu District. Two days training on first aid was given to all participants. Knowledge on first aid was assessed through self-administered 10 questionnaires before and after training. Response was recorded as 'correct' or 'incorrect' of individual question and total score obtained by individual. Responses were *compared before and after* training and between students and teachers also.

Results

A total of 152 participants were included in the study. The sample had 121 students and 31 teachers.

Average score in pretest and posttest was 5.1 ±1.56 and 8.01 ±1.49 respectively with P value 0.001. Majority were aware of meaning of first aid, time to perform CPR, and first aid knowledge on fracture and electric shock

First aid knowledge on other incidents was not satisfactory. The training improved overall knowledge of participants.

There was *no difference* of knowledge in students and teachers.

Conclusion

First aid knowledge of school teachers and students was similar and not satisfactory. Training improves knowledge significantly.

TABLE 2.1: PENAL CODE CASES IN KENYA

Offence	1991	1992	1993	1994	1995	1996	1997
1. Murder	2071	1536	1517	1603	1720	1837	1954
Probability	0.02	0.015	0.008	0.017	0.02	0.016	.017
2. Manslaughter	497	498	434	389	416	443	470
Probability	0.004	0.005	0.005	0.004	0.012	0.004	0.004
3.Rape, including attempt	774	590	589	650	681	712	743
Probability	0.01	0.006	0.007	0.01	0.017	0.008	0.01
4. Assault	13464	12994	12324	11796	12213	12630	13047
Probability	0.11	0.13	0.14	0.125	0.13	0.118	0.113
5. Offences against person	1138	274	308	326	529	732	935
Probability	0.01	0.003	0.004	0.003	0.0131	0.008	0.01
6. Robberies	11804	10197	9242	804	9554	10304	11054
Probability	0.091	0.10	0.105	0.093	0.003		
7. Breakings	18419	18445	16867	16067	16655	17243	17831
Probability	0.15	0.171	0.192	0.17	0.175	0.156	0.151
8. Cattle Theft	4234	2844	3139	2946	3268	3590	3972
Probability	0.033	0.03	0.036	0.031	0.032	0.03	0.034
9. Theft of other livestock	832	537	600	636	685	734	783
Probability	0.01	0.01	0.007	0.007	0.13	0.008	0.010
10. Theft of over Kshs. 400	13206	9908	11323	11194	11697	12200	12703
Probability	0.11	0.10	0.13	0.116	0.124	0.11	0.11
11. Other thefts	10804	6473	5257	6072	7255	8438	9621
Probability	0.084	0.061	0.06	0.064	0.08	0.076	0.08
12. Theft from vehicles	2102	2115	2142	1758	1844	1930	2016
Probability	0.01	0.021	0.025	0.02	0.02	0.016	0.02
13. Theft of bicycles	789	787	796	661	693	725	757
Probability	0.023	0.006	0.01	0.007	0.01	0.008	0.01
14. Theft of produce	2942	1897	2495	1914	2171	2428	2685
Probability	0.023	0.02	0.03	0.02	0.026	0.02	
15. Theft by servants	6403	5515	5697	5543	5758	5973	6188
Probability	0.051	0.05	0.065	0.056	0.06	0.057	
16. Receiving stolen property	1182	977	1094	1050	1083	1116	1149
Probability	0.01	0.01	0.012	0.011	0.015	0.01	0.01
17. Offences against property	6169	5979	5626	5753	5857	5961	6065
Probability	0.05	0.06	0.07	0.061	0.06	0.055	0.05
18. All other penal offences	25832	20400	8417	17540	19613	21686	23759
Probability	0.201	0.2	0.096	0.185	0.193	0.20	0.205

Source: Statistical Abstract 2000, Central Bureau of Statistics and author's calculation

FIG1: GEOGRAPHY SHEET

$$\bar{x} = \frac{\sum x}{n}$$

$$\bar{\mathbf{x}} = \frac{\sum \mathbf{f_i x_i}}{\sum \mathbf{f_i}}$$

$$\gamma = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k + \varepsilon$$

$${}_nC_r = \frac{n!}{(n-r)!r!} \qquad {}_nP_r = \frac{n!}{(n-r)!}$$

$$\bar{\mathbf{X}} = \mathbf{A} + \frac{\sum dx}{\mathbf{N}}$$

$$M_m = l + \left(\frac{\frac{n}{2} - cf}{f}\right) h$$

$$\mathrm{MD} \equiv \frac{1}{N} \sum_{i=1}^{N} |x_i - \bar{x}|$$

$$\bar{X}_{12} = \frac{N_1 \bar{X}_1 + N_2 \bar{X}_2}{N_1 + N_2}$$

$$G = \sqrt[n]{\prod_{i=1}^{n} x_i} = \sqrt[n]{x_1 \cdot x_2 \cdot x_3 \cdots x_n}$$

$$Z = \frac{(X - \mu)}{\sigma}$$

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$$

$$\sigma = \sqrt{\frac{\Sigma (x - u)^2}{N}}$$

$$\sigma = \sqrt{\frac{\sum fX^2}{N} - \left(\frac{\sum fX}{N}\right)^2}$$

$$\widehat{\text{skew}} = \frac{n^{-1} \sum_{i=1}^{n} (X_i - \overline{X})^3}{\{n^{-1} \sum_{i=1}^{n} (X_i - \overline{X})^2\}^{3/2}}$$

$$H = \frac{n}{\frac{1}{x_1} + \frac{1}{x_2} + \frac{1}{x_3} + \ldots + \frac{1}{x_n}}$$

$$K = \frac{\frac{1}{n} \sum_{i=1}^{N} (x_i - \bar{x})^4}{\left(\frac{1}{n} \sum_{i=1}^{N} (x_i - \bar{x})^2\right)^2}$$

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{\frac{-(x-\mu)^2}{2\sigma^2}}$$

$$\sigma = \sqrt{\frac{\sum f(X - \bar{X})^2}{N}}$$

$$Q_1 = L + \frac{h}{f}\left(\frac{N}{4} - CF\right)$$

$$Q_2 = L + \frac{h}{f}\left(\frac{2N}{4} - CF\right)$$

$$CV = \frac{\sigma}{\mu} * 100$$

$$Q_d = \frac{Q_3 - Q_1}{2}$$

$$Q_3 = L + \frac{h}{f}\left(\frac{3N}{4} - CF\right)$$

$$Y = a + bX + \epsilon$$

$$(Q1) = (N+1) \times \frac{1}{4}$$

$$(Q2) = (N+1) \times \frac{2}{4}$$

$$(Q3) = (N+1) \times \frac{3}{4}$$

$$\rho = 1 - \frac{6\Sigma d_i^2}{n(n^2 - 1)}$$

$$SK = \frac{\text{Mean} - \text{Mode}}{\text{S.D.}}$$

$$a = \bar{Y} - b\bar{X}$$

$$\text{Q.D.} = \frac{Q_3 - Q_1}{Q_3 + Q_1}$$

$$R_n = 2\bar{d}\sqrt{\frac{n}{a}}$$

$$b = \frac{n\sum xy - (\sum x)(\sum y)}{n(\sum x^2) - (\sum x)^2}$$

$$r = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{\sqrt{[n\Sigma x^2 - (\Sigma x)^2][n\Sigma y^2 - (\Sigma y)^2]}}$$

$$\bar{x} = \frac{w_1 x_1 + w_2 x_2 + \ldots + w_n x_n}{w_1 + w_2 + \ldots + w_n}$$

SV	SS	df	MS	F
Between groups Treatments	SST $= \Sigma n_j (\bar{X}_j - \bar{\bar{X}})^2$	$df_1 = k-1$	MST= SST/ (k-1)	F= MST/ MSE

Within groups Error (Residual)	$\mathbf{SSE} = \Sigma\Sigma\left(X - \bar{X}_j\right)^2$	df_2 = n -k	MSE= SSE/ (n -k)	
Total	SS(total)= SST + SSE	n -1		

TABLE 3.1 : CRITICAL VALUES F-DISTRIBUTION

Use of this table. Table gives critical values of F at the α = 0.05 level of significance.
1. Obtain your F-ratio. This has (x, y) degrees of freedom. Here x= columns and y-= rows
2. Go along x columns, and down y rows. Point of intersection is your critical F-ratio.
3. If calculated value of F is equal to or larger than this critical F-value, then your result is significant at that level of probability.

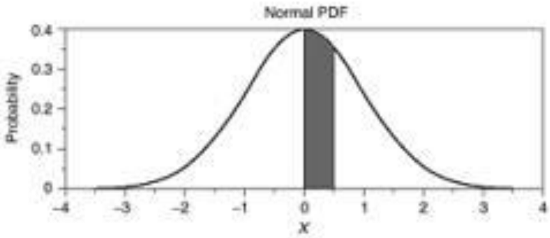
Example: You get a calculated F ratio =5.96 with (2, 24) degrees of freedom. When you go along 2 columns and down 24 rows the critical value of F = 3.40. When calculated F-ratio 5.96 is *larger than* this critical value 3.40 you may reject null hypothesis at α=05.

Critical values of F at 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

Table 4.1 :

Standard Normal Distribution Table



Area under the Normal Curve from 0 to X

X	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.00000	0.00399	0.00798	0.01197	0.01595	0.01994	0.02392	0.02790	0.03188	0.03586
0.1	0.03983	0.04380	0.04776	0.05172	0.05567	0.05962	0.06356	0.06749	0.07142	0.07535
0.2	0.07926	0.08317	0.08706	0.09095	0.09483	0.09871	0.10257	0.10642	0.11026	0.11409
0.3	0.11791	0.12172	0.12552	0.12930	0.13307	0.13683	0.14058	0.14431	0.14803	0.15173
0.4	0.15542	0.15910	0.16276	0.16640	0.17003	0.17364	0.17724	0.18082	0.18439	0.18793
0.5	0.19146	0.19497	0.19847	0.20194	0.20540	0.20884	0.21226	0.21566	0.21904	0.22240
0.6	0.22575	0.22907	0.23237	0.23565	0.23891	0.24215	0.24537	0.24857	0.25175	0.25490
0.7	0.25804	0.26115	0.26424	0.26730	0.27035	0.27337	0.27637	0.27935	0.28230	0.28524
0.8	0.28814	0.29103	0.29389	0.29673	0.29955	0.30234	0.30511	0.30785	0.31057	0.31327
0.9	0.31594	0.31859	0.32121	0.32381	0.32639	0.32894	0.33147	0.33398	0.33646	0.33891
1.0	0.34134	0.34375	0.34614	0.34849	0.35083	0.35314	0.35543	0.35769	0.35993	0.36214
1.1	0.36433	0.36650	0.36864	0.37076	0.37286	0.37493	0.37698	0.37900	0.38100	0.38298
1.2	0.38493	0.38686	0.38877	0.39065	0.39251	0.39435	0.39617	0.39796	0.39973	0.40147
1.3	0.40320	0.40490	0.40658	0.40824	0.40988	0.41149	0.41308	0.41466	0.41621	0.41774
1.4	0.41924	0.42073	0.42220	0.42364	0.42507	0.42647	0.42785	0.42922	0.43056	0.43189
1.5	0.43319	0.43448	0.43574	0.43699	0.43822	0.43943	0.44062	0.44179	0.44295	0.44408
1.6	0.44520	0.44630	0.44738	0.44845	0.44950	0.45053	0.45154	0.45254	0.45352	0.45449
1.7	0.45543	0.45637	0.45728	0.45818	0.45907	0.45994	0.46080	0.46164	0.46246	0.46327
1.8	0.46407	0.46485	0.46562	0.46638	0.46712	0.46784	0.46856	0.46926	0.46995	0.47062
1.9	0.47128	0.47193	0.47257	0.47320	0.47381	0.47441	0.47500	0.47558	0.47615	0.47670
2.0	0.47725	0.47778	0.47831	0.47882	0.47932	0.47982	0.48030	0.48077	0.48124	0.48169
2.1	0.48214	0.48257	0.48300	0.48341	0.48382	0.48422	0.48461	0.48500	0.48537	0.48574
2.2	0.48610	0.48645	0.48679	0.48713	0.48745	0.48778	0.48809	0.48840	0.48870	0.48899
2.3	0.48928	0.48956	0.48983	0.49010	0.49036	0.49061	0.49086	0.49111	0.49134	0.49158
2.4	0.49180	0.49202	0.49224	0.49245	0.49266	0.49286	0.49305	0.49324	0.49343	0.49361
2.5	0.49379	0.49396	0.49413	0.49430	0.49446	0.49461	0.49477	0.49492	0.49506	0.49520
2.6	0.49534	0.49547	0.49560	0.49573	0.49585	0.49598	0.49609	0.49621	0.49632	0.49643
2.7	0.49653	0.49664	0.49674	0.49683	0.49693	0.49702	0.49711	0.49720	0.49728	0.49736
2.8	0.49744	0.49752	0.49760	0.49767	0.49774	0.49781	0.49788	0.49795	0.49801	0.49807
2.9	0.49813	0.49819	0.49825	0.49831	0.49836	0.49841	0.49846	0.49851	0.49856	0.49861
3.0	0.49865	0.49869	0.49874	0.49878	0.49882	0.49886	0.49889	0.49893	0.49896	0.49900
3.1	0.49903	0.49906	0.49910	0.49913	0.49916	0.49918	0.49921	0.49924	0.49926	0.49929
3.2	0.49931	0.49934	0.49936	0.49938	0.49940	0.49942	0.49944	0.49946	0.49948	0.49950
3.3	0.49952	0.49953	0.49955	0.49957	0.49958	0.49960	0.49961	0.49962	0.49964	0.49965
3.4	0.49966	0.49968	0.49969	0.49970	0.49971	0.49972	0.49973	0.49974	0.49975	0.49976
3.5	0.49977	0.49978	0.49978	0.49979	0.49980	0.49981	0.49981	0.49982	0.49983	0.49983
3.6	0.49984	0.49985	0.49985	0.49986	0.49986	0.49987	0.49987	0.49988	0.49988	0.49989
3.7	0.49989	0.49990	0.49990	0.49990	0.49991	0.49991	0.49992	0.49992	0.49992	0.49992
3.8	0.49993	0.49993	0.49993	0.49994	0.49994	0.49994	0.49994	0.49995	0.49995	0.49995
3.9	0.49995	0.49995	0.49996	0.49996	0.49996	0.49996	0.49996	0.49996	0.49997	0.49997
4.0	0.49997	0.49997	0.49997	0.49997	0.49997	0.49997	0.49998	0.49998	0.49998	0.49998

Table5.1: MANN-WHITNEY U TABLE

The following tables provide critical values for two tailed Mann-Whitney U tests for various levels of alpha.
For one-tailed tests, simply double the value of alpha and use the appropriate two-tailed table.

Alpha = .01 (two-tailed)

n1 \ n2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2																			
3								0	0	0	1	1	1	2	2	2	2	3	3
4					0	0	1	1	2	2	3	3	4	5	5	6	6	7	8
5				0	1	1	2	3	4	5	6	7	7	8	9	10	11	12	13
6			0	1	2	3	4	5	6	7	9	10	11	12	13	15	16	17	18
7			0	1	3	4	6	7	9	10	12	13	15	16	18	19	21	22	24
8			1	2	4	6	7	9	11	13	15	17	18	20	22	24	26	28	30
9		0	1	3	5	7	9	11	13	16	18	20	22	24	27	29	31	33	36
10		0	2	4	6	9	11	13	16	18	21	24	26	29	31	34	37	39	42
11		0	2	5	7	10	13	16	18	21	24	27	30	33	36	39	42	45	46
12		1	3	6	9	12	15	18	21	24	27	31	34	37	41	44	47	51	54
13		1	3	7	10	13	17	20	24	27	31	34	38	42	45	49	53	56	60
14		1	4	7	11	15	18	22	26	30	34	38	42	46	50	54	58	63	67
15		2	5	8	12	16	20	24	29	33	37	42	46	51	55	60	64	69	73
16		2	5	9	13	18	22	27	31	36	41	45	50	55	60	65	70	74	79
17		2	6	10	15	19	24	29	34	39	44	49	54	60	65	70	75	81	86
18		2	6	11	16	21	26	31	37	42	47	53	58	64	70	75	81	87	92
19	0	3	7	12	17	22	28	33	39	45	51	56	63	69	74	81	87	93	99
20	0	3	8	13	18	24	30	36	42	46	54	60	67	73	79	86	92	99	105

Alpha = .05 (two-tailed)

n1 \ n2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2							0	0	0	0	1	1	1	1	1	2	2	2	2
3				0	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8
4			0	1	2	3	4	4	5	6	7	8	9	10	11	11	12	13	14
5		0	1	2	3	5	6	7	8	9	11	12	13	14	15	17	18	19	20
6		1	2	3	5	6	7	10	11	13	14	16	17	19	21	22	24	25	27
7		1	3	5	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34
8	0	2	4	6	7	10	13	15	17	19	22	24	26	29	31	34	36	38	41
9	0	2	4	7	10	12	15	17	20	23	26	28	31	34	37	39	42	45	48
10	0	3	5	8	11	14	17	20	23	26	29	33	36	39	42	45	48	52	55
11	0	3	6	9	13	16	19	23	26	30	33	37	40	44	47	51	55	58	62
12	1	4	7	11	14	18	22	26	29	33	37	41	45	49	53	57	61	65	69
13	1	4	8	12	16	20	24	28	33	37	41	45	50	54	59	63	67	72	76
14	1	5	9	13	17	22	26	31	36	40	45	50	55	59	64	67	74	78	83
15	1	5	10	14	19	24	29	34	39	44	49	54	59	64	70	75	80	85	90
16	1	6	11	15	21	26	31	37	42	47	53	59	64	70	75	81	86	92	98
17	2	6	11	17	22	28	34	39	45	51	57	63	67	75	81	87	93	99	105
18	2	7	12	18	24	30	36	42	48	55	61	67	74	80	86	93	99	106	112
19	2	7	13	19	25	32	38	45	52	58	65	72	78	85	92	99	106	113	119
20	2	8	13	20	27	34	41	48	55	62	69	76	83	90	98	105	112	119	127