Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2023/2024

COURSE NAME	:	EDUCATIONAL DATA REASONING
COURSE CODE	:	BBD 30402
PROGRAMME CODE	:	BBA/ BBB/ BBC/ BBD/ BBE/ BBF
EXAMINATION DATE	:	JULY 2024
DURATION	:	2 HOURS
INSTRUCTIONS	:	1. ANSWER ALL QUESTIONS 2. THIS FINAL EXAMINATION IS CONDUCTED VIA ☐ Open book ☒ Closed book 3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **SIXTEEN (16)** PAGES

Q1 (a) A researcher conducted research to find out a difference between a gender of UTHM students on self-efficacy in writing course after using AI in the UTHM. Two faculties were selected, students from FPTV as experimental group and students from FKAAB as control group. All the gathered data were analyzed by statistician using $\alpha = 0.05$

(i) State the null and alternative hypothesis for this research?

(4 marks)

(ii) State the appropriate statistical analysis to test the hypotheses in Q1(a)(i)? Give your reasons.

(4 marks)

(b) A researcher wants to study whether there is a relationship between low-income students and high-income students with choice of transportation (Car, Motorcycle, Bus) among UTHM students. The data is shown in **Table Q1(b).**

Table Q1(b)

	Car	Motorcycle	Bus	Total
Low	5	15	20	40
High	15	7	2	24
Total	20	22	22	64

(i) State the null and alternative hypotheses for this study.

(4 marks)

(ii) What are appropriate statistical tests for hypothesis in Q1(b)(i)? Give your reasons.

(2 Marks)

(iii) Conduct a statistical test to determine if there is a significant association between gender and choice of major. Show all steps and calculations.

(7 marks)

(iv) What conclusions can you draw about the relationship between gender and choice of major.

(4 marks)

Q2 (a) A researcher interested to investigate whether there is any significant difference in academic achievement between male students and female students in the class. Students were asked to fill out a questionnaire using 1-10 rating data which is one (1) representing low academic achievement while 10 represents high academic achievement. Data is shown in **Table Q2(a).**

Table Q2(a)

Male		**Female**	
Student	**Scale**	**Student**	**Scale**
1	3	1	9
2	4	2	7
3	2	3	5
4	6	4	10
5	2	5	6
6	5	6	8

(i) State the relevant hypothesis null and alternative.

(4 Marks)

(ii) What are appropriate statistical tests for hypothesis in Q2(a)(i)? Give your reasons.

(4 Marks)

(iii) Compute the statistical tests you proposed in Q2(a)(ii) to test the hypotheses stated in (i) above using $\alpha = 0.05$. You are to decide whether to reject or not to reject the null hypotheses. Explain your conclusions based on the obtained results.

(7 Marks)

(b) A random sample of 356 students were selected to determine the relationship between student's instructional preference whether online classes or face to face by gender. Data shows that 33 males and 68 females were preferring online classes; and the others 134 males and 121 females are more preferring to face to face classes.

(i) State the relevant hypothesis null and alternative.

(4 Marks)

(ii) Are gender and instructional preference dependent at 5% level of significance? Make a conclusion.

(6 Marks)

Q3 (a) A short survey was carried out at UTHM, with the participants being shown adverts for two rival brands of smart phone, which they then rated on the overall likelihood of them buying the product. The scale used 1out of 10, with 10 being "definitely going to buy the product". Half of the participants gave ratings for one of the products, the other half gave ratings for the other product.

Table Q3(a)

Brand X		Brand Y	
Participant	Rating	Participant	Rating
1	3	1	9
2	4	2	7
3	2	3	5
4	6	4	10
5	2	5	6
6	5	6	8

(i) What are the statistical test to use?

(2 marks)

(ii) What are appropriate statistical tests for hypothesis in Q3(a)(i)? Give your reasons

(4 marks)

(iii) Calculate which brand are preferred by the participants?

(4 marks)

(b) A clinical trial is conducted to assess the effectiveness of a new vaccine for flu. Patients are randomized to receive a standard X vaccines or Y vaccines and are monitored for 3 months. The primary outcome is viral load which represents the number of viral copies per millilitre of blood. A total of 30 participants are randomly selected and the data are shown as **Table Q3(b).** Assume that the data are not randomly distributed and alpha level 0.05.

Table Q3(b)

Vaccine	
X Brand	Y Brand
7500	400
8000	250
2000	800
550	1400
1250	8000

1000	7400
2250	1020
6800	6000
3400	920
6300	1420
9100	2700
970	4200
1040	5200
670	4100
400	Undetectable

(i) State the null and alternative hypothesis for this study.

(4 marks)

(ii) What are appropriate statistical tests for hypothesis in Q3(b)(i)? Give your reasons

(4 marks)

(iii) Using the statistical tests you proposed in Q3(b)(ii), test the hypothesis stated in Q3(b)(i) above using $\alpha = 0.05$ to determine if there a significant difference in viral load in patients receiving the X Brand versus the Y Brand vaccine?

(7 marks)

Q4 **Table Q4** represents an assessments scores of 14 UTHM students on a Reading (X) test and Speaking (Y) test for MUET Test.

Table Q4

Student	Reading score (X)	Speaking score (Y)
1	97	89
2	68	57
3	85	87
4	74	76
5	92	97
6	92	79
7	100	91
8	63	50
9	85	85

10	87	84
11	81	91
12	93	91
13	77	75
14	82	77

(a) State the null and alternative hypotheses for this study.

(4 marks)

(b) Sketch the scatter plot and explain the degree or strength of relationship between two variables.

(12 marks)

(c) Using the following data Table Q4 calculate a Spearmen Correlation coefficient significant, r_s. Conclude your data.

(9 marks)

- END OF QUESTIONS -

APPENDIX A

$$r_s = 1 - \frac{6\sum d^2}{n(n^2-1)}$$

$$r_p = \frac{\sum xy - N\bar{x}\bar{y}}{\sqrt{(\sum x^2 - N\bar{x}^2)(\sum y^2 - N\bar{y}^2)}}$$

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

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

$$z = \frac{(x-\bar{x})}{(s)}$$

$$z = \frac{\bar{x}-\mu}{\frac{\sigma}{\sqrt{n}}}$$

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

$$U_2 = n_1 n_2 + \frac{n_2(n_2+1)}{2} - R_2$$

$$U_1 = n_1 n_2 + \frac{n_1(n_1+1)}{2} - R_1$$

$$t = \frac{(\sum D)/_N}{\sqrt{\frac{\sum D^2 - (\frac{(\sum D)^2}{N})}{(N-1)(N)}}}$$

$$t = r\sqrt{\frac{(n-2)}{1-r^2}}$$

$$\bar{x} = (\sum x)/n$$

$$r_p = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{[\sqrt{(N\sum X^2 - (\sum X)^2}][\sqrt{(N\sum Y^2 - (\sum Y)^2}]}}$$

$$t = r\sqrt{\frac{(n-2)}{1-r^2}}$$

$$r_s = 1 - \frac{6\sum D^2}{n^3 - n}$$

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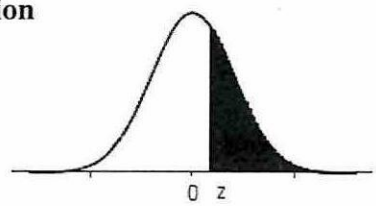
APPENDIX B

Probabilities Associated with Values as Extreme as Observed Value of Z in the Normal Curve of distribution



z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641
0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233

Read values of Z to one decimal place down the left hand column, *Column z.* Read across Row z for values to two decimal places. The probabilities contained in the table are *one-tailed.* For two-tailed tests, multiply by 2.

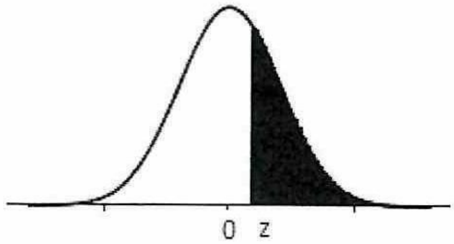
Examples

The probability of a $Z \geq 0.14$ on a one-tailed test is $\rho = 0.4443$.

The probability of a $Z \geq 1.98$ on a two-tailed test is $\rho = 2 \times (0.0239) = 0.0478$

Probabilities Associated with Values as Extreme as Observed Value of *z* in the Normal Curve of Distribution

(continued)



z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
3.2	0.0007									
3.3	0.0005									
3.4	0.0003									
3.5	0.00023									
3.6	0.00016									
3.7	0.00011									
3.8	0.00007									
3.9	0.00005									
4.0	0.00003									

Critical Values of *T* In the Wilcoxon Test for Two Correlated Samples

	Levels of significance			
	One-tailed test			
	0.05	0.025	0.01	0.001
	Two-tailed test			
Sample size	0.1	0.05	0.02	0.002
N = 5	*T*≤0			
6	2	0		
7	3	2	0	
8	5	3	1	
9	8	5	3	
10	10	8	S	0
11	13	10	7	1
12	17	13	9	2
13	21	17	12	4
14	25	21	15	6
15	30	25	19	8
16	35	29	23	11
17	41	34	27	14
18	47	40	32	18
19	53	46	37	21
20	60	52	43	26
21	67	58	49	30
22	75	65	55	35
23	83	73	62	40
24	91	81	69	45
25	100	89	76	51
26	110	98	84	58
27	119	107	92	64
28	130	116	101	71
30	151	137	120	86
31	163	147	130	94
32	175	159	140	103
33	187	170	151	112

Source: Adapted from Table 6.5, Ray Meddis, *Statistical Handbook for Non-Statisticians,* London: McGraw-Hi11,1975, p.113, with the kind permission of the author and publisher.

χ^2 Distribution

Level of significance

Degrees of freedom	0.05	0.01
1	3.84	6.63
2	5.99	9.21
3	7.81	11.34
4	9.49	13.28
5	11.07	15.09
6	12.59	16.81
7	14.07	18.48
8	15.51	20.09
9	16.92	21.67
10	18.31	23.21
11	19.68	24.72
12	21.03	26.22
13	22.36	27.69
14	23.68	29.14
15	25.00	30.58
16	26.30	32.00
17	27.59	33.41
18	28.87	34.81
19	30.14	36.19
20	31.41	37.57
21	32.67	38.93
22	33.92	40.29
23	35.17	41.64
24	36.42	42.98
25	37.65	44.31
26	38.89	45.64
27	40.11	46.96
28	41.34	48.28
29	42.56	49.59
30	43.77	50.89
40	55.76	63.69
50	67.50	76.15
60	79.08	88.38
70	90.53	100.43
80	101.88	112.33
90	113.15	124.12
100	124.34	135.81

t Distribution

	Level of significance for one-tailed test			
	0.05	0.025	0.01	0.005
	Level of significance for two-tailed test			
d.f.	0.10	0.05	0.02	0.01
1	6.314	12.706	31.821	63.657
2	2.920	4.303	6.965	9.925
3	2.353	3.182	4.541	5.841
4	2.132	2.776	3.747	4.604
5	2.015	2.571	3.365	4.032
6	1.943	2.447	3.143	3.707
7	1.895	2.365	2.998	3.499
8	1.860	2.306	2.896	3.355
9	1.833	2.262	2.821	3.250
10	1.812	2.228	2.764	3.169
11	1.796	2.201	2.718	3.106
12	1.782	2.179	2.681	3.055
13	1.771	2.160	2.650	3.012
14	1.761	2.145	2.624	2.977
15	1.753	2.131	2.602	2.947
16	1.746	2.120	2.583	2.921
17	1.740	2.110	2.567	2.898
18	1.734	2.101	2.552	2.878
19	1.729	2.093	2.539	2.861
20	1.725	2.086	2.528	2.845
21	1.721	2.080	2.518	2.831
22	1.717	2.074	2.508	2.819
23	1.714	2.069	2.500	2.807
24	1.711	2.064	2.492	2.797
25	1.708	2.060	2.485	2.787
26	1.706	2.056	2.479	2.779
27	1.703	2.052	2.473	2.771
28	1.701	2.048	2.467	2.763
29	1.699	2.045	2.462	2.756
30	1.697	2.042	2.457	2.750
40	1.684	2.021	2.423	2.704
60	1.671	2.000	2.390	2.660
120	1.658	1.980	2.358	2.617
∞	1.645	1.960	2.326	2.576

***F* Distribution**

V_1= d.f. for the greater variance (Numerator)
V_2= d.f. for the lesser variance
(Denominator)
(a) 0.05 level

V_2 \ V_1	1	2	3	4	5	6	7	8	9
1	161.45	199.50	215.71	224.58	230.16	233.99	236.77.	238.88	240.54
2	18.513	19.000	19.164	19.247	19.296	19.330	19.353	19.371	19.385
3	10.128	9.5521	9.2766	91172	9.0135	8.9406	8.8867	8.8452	8.8323
4	7.7086	6.9443	6.5914	6.3882	6.2561	6.1631	6.0942	6.0410	5.9938
5	6.6079	5.7861	5.4095	5.1922	5.0503	4.9503	4.8759	4.8183	4.7725
6	5.9874	5.1433	4.7571	4.5337	4.3874	4.2839	4.2067	4.1468	4.0990
7	5.5914	4.7374	4.3468	4.1203	3.9715	3.8660	3.7870	3.7257	3.6767
8	5.3177	.4.4590	4.0662	3.8379	3.6875	3.5806	3.5005	3.4381	33881
9	5.1174	4.2565	3.8625	3.6331	3.4817	3.3738	3.2927	3.2296	3.1789
10	4.9646	4.1028	3.7083	3.4780	3.3258	3.2172	3.1355	3.0717	3.0204
11	4.8443	3.9823	3.5874	3.3567	3.2039	3.0946	3.0123	2.9480	2.8962
12	4.7472	3.8853	3.4903	3.2592	3.1059	2.9961	2.9134	2.8486	2.7964
13	4.6672	3.8056	3.4105	3.1791	3.0254	2.9153	2.8321	2.7669	2.7444
14	4.6001	3.7389	3.3439	3.1122	2.9582	2.8477	2.7642	2.6987	2.6458
1S	4.5431	3.6823	3.2874	3.0556	2.9013	2.7905	2.7066	2.6408	2.5876
16	4.4940	3.6337	3.2389	3.0069	2.8524	2.7413	2.6572	2.5911	2.5377
17	4.4513	3.5915	3.1968	2.9647	2.8100	2.6987	2.6143	2.5480	2.4443
18	4.4139	3.5546	3.1599	2.9277	2.7729	2.6613	2.5767	2.5102	2.4563
19	4.3807	3.5219	3.1274	2.8951	2.7401	2.6283	2.5435	2.4768	2.4227
20	4.3512	3.4928	3.0984	2.8661	2.7109	2.5990	2.5140	2.4471	2.3928
21	4.3248	3.4668	3.0725	2.8401	2.6848	2.5727	2.4876	2.4205	2.3660
22	4.3009	3.4434	3.0491	2.8167	2.6613	2.5491	2.4638	2.3965	2.3219
23	4.2793	3.4221	3.0280	2.7955	2.6400	2.5277	2.4422	2.3748	2.3201
24	4.2597	3.4028	3.0088	2.7763	2.6207	2.5082	2.4226	2.3551	2.3002
25	4.2417	3.3852	2.9912	2.7587	2.6030	2.4904	2.4047	2.3371	2.2821
26	4.2252	3.3690	2.9752	2.7426	2.5868	2.4741	2.3883	2.3205	2.2655
27	4.2100	3.3541	2.9604	2.7278	2.5719	2.4591	2.3732	2.3053	2.2501
28	4.1960	3.3404	2.9467	2.7141	2.5581	2.44S3	2.3593	2.2913	2.2360
29	4.1836	3.3277	2.9340	2.7014	2.5454	2.4324	2.3463	2.2783	2.2329
30	4.1709	3.3158	2.9223	2.6896	2.5336	2.4205	2.3343	2.2662	2.2507
40	4.0847	3.2317	2.8387	2.6060	2.4495	2.3359	2.2490	2.1802	2.1240
60	4.0012	3.1S04	2.7581	2.5252	2.3683	2.2541	2.1665	2.0970	2.0401
120	39201	3.0718	2.6802	2.4472	2.2899	2.1750	2.0868	2.0164	1.9688
∞	3.8415	2.9957	2.6049	2.3719	2.2141	2.0986	2.0096	19384	1.8799

F Distribution (continued)

10	12	15	20	24	30	40	60	120	∞
241.88	243.91	245.95	248.01	249.05	250.10	251.14	252.20	253.25	254.31
19.396	19.413	19.429	19.446	19.454	19.462	19.471	19.479	19.487	19.496
8.7855	8.7446	8.7029	8.6602	8.6385	8.6166	8.5944	8.5720	8.5594	8.5264
5.9644	5.9117	5.8578	5.8025	5.7744	5.7459	5.7170	5.6877	5.6381	5.6281
4.7351	4.6777	4.6188	4.5581	4.5272	4.4957	4.4638	4.4314	4.3085	4.3650
4.0600	3.9999	3.9381	3.8742	3.8415	3.8082	3.7743	3.7398	3.7047	3.6689
3.6365	3.5747	3.5107	3.4445	3.4105	3.3758	3.3404	3.3043	3.2674	3.2298
3.3472	3.2839	3.2184	3.1503	3.1152	3.0794	3.0428	3.0053	2.9669	2.9276
3.1373	3.0729	3.0061	2.9365	2.9005	2.8637	2.8259	2.7872	2.7475	2.7067
2.9782	2.9130	2.8450	2.7740	2.7372	2.6996	2.6609	2.6211	2.5801	2.5379
2.8536	2.7876	2.7186	2.6464	2.6090	2.5705	2.5309	2.4901	2.4480	2.4045
2.7534	2.6866	2.6169	2.5436	2.5055	2.4663	2.4259	2.3842	2.3410	2.2962
2.6710	2.6037	2.5331	2.4589	2.4202	2.3803	2.3392	2.2966	2.2524	2.2064
2.6022	2.5342	2.4630	2.3879	2.3487	2.3082	2.2664	2.2229	2.1778	2.1307
2.5437	2.4753	2.4034	2.3275	2.2878	2.2468	2.2043	2.1601	2.1141	2.0658
2.4935	2.4247	2.3522	2.2756	2.2354	2.1938	2.1507	2.1058	2.0589	2.0096
2.4499	2.3807	2.3077	2.2304	2.1898	2.1477	2.1040	2.0584	2.0107	1.9604
2.4117	2.3421	2.2686	2.1906	2.1497	2.1071	2.0629	2.0166	1.9681	1.9168
2.3779	2.3080	2.2341	2.1555	2.1141	2.0712	2.0264	1.9795	1.9302	1.8780
2.3479	2.2776	2.2033	2.1242	2.0825	2.0391	1.9938	1.9464	1.8963	1.8432
2.3210	2.2504	2.1757	2.0960	2.0540	2.0102	1.9645	1.9165	1.8657	1.8117
2.2967	2.2258	2.1508	2.0707	2.0283	1.9842	1.9380	1.8894	1.8380	1.7831
2.2747	2.2036	2.1282	2.0476	2.0050	1.9605	1.9139	1.8648	1.8128	1.7570
2.2547	2.1834	2.1077	2.0267	1.983819390		1.8920	1.8424	1.7896	1.7330
2.2365	2.1649	2.0889	2.0075	1.964319192		1.8718	1.8217	1.7684	1.7110
2.2197	2.1479	2.0716	1.9898	1.9464	1.9010	1.8533	1.8027	1.7488	1.6906
2.2043	2.13232.0558		19736	1.9299	1.8842	1.8361	1.7851	1.7306	1.6717
2.1900	2.1179	2.0411	1.9586	19147	1.8687	1.8203	1.7689	1.7138	1.6541
2.1768	2.1045	2.0275	1.9446	1.9005	1.8543	1.8055	1.7537	1.6981	1.6376
2.1646	2.0921	2.0148	1.9317	1.8874	1.8409	1.7918	1.7396	1.6835	1.6223
2.0772	2.0035	1.9245	1.8389	1.7929	1.7444	1.6928	1.6373	1.5766	1.5089
1.9426	1.9174	1.8364	1.7480	1.7001	1.6491	1.5943	i.S343	1.4673	1.993
1.9105	1.8337	1.7505	1.6587	1.6084	1.5543	1.4932	1.4290	1.3519	1.2539
1.8307	1.7522	1.6664	1.57051.S173		1.4591	1.3940	1.3180	1.021•41.0000	

Spearman Rank Correlation Coefficient Values

N	Significance level (one-tailed test)	
	0.05	0.01
4	1.000	
5	0.900	1.000
6	0.829	0.943
7	0.714	0.893
8	0.643	0.833
9	0.600	0.783
10	0.564	0.746
12	0.506	0.712
14	0.456	0.645
16	0.425	0.601
18	0.399	0.564
20	0.377	0.534
22	0.359	0.508
24	0.343	0.485
26	0.329	0.465
28	0.317	0.448
30	0.306	0.432

Mann-Whitney *U* Test Values (Two-Tailed Test)

Equal sample sizes

n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
0.05	-	-	-	0	2	5	8	13	17	23	30	37	45.	55	64	75	87	99	113	127	142	158	175	192	211
0.01	-	-	-	-	0	2	4	7	11	16	21	27	34	42	51	60	70	81	93	105	118	133	148	164	180

n	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
0.05	230	250	272	294	317	341	365	391	418	445.	473	503	533	564	596	628	662	697	732	769	806	845	884	924	965
0.01	198	216	235	255	276	298	321	344	369	394	420	447	475	504	533	564	595	627	660	694	729	765	802	839	877

n_L = larger sample size

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	n_L / n_S	0.05
2		-	-	-	-	-	0	0	0	0	1	1	1	1	1	2	2	2	2	3	3	3	3	3	2	
3	-		-	0	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	3	
4	-	-		1	2	3	4	4	5	6	7	8	9	10	11	11	12	13	14	15	16	17	17	18	4	
5	-	-	-		3	5	6	7	8	9	11	12	13	14	15	17	18	19	20	22	23	24	25	27	5	
6	-	-	0	1		6	8	10	11	13	14	16	17	19	21	22	24	25	27	29	30	32	33	35	6	
7	-	-	0	1	3		10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	7	
8	-	-	1	2	4	6		15	17	19	22	24	26	29	31	34	36	38	41	43	45	48	50	53	8	
9	-	0	1	3	5	7	9		20	23	26	28	31	34	37	39	42	45	48	50	53	56	59	62	9	
10	-	0	2	4	6	9	11	13		26	29	33	36	39	42	45	48	52	55	58	61	64	67	71	10	
11	-	0	2	5	7	10	13	16	18		33	37	40	44	47	51	55	58	62	65	69	·73	76	80	11	
12	-	1	3	6	9	12	15	18	21	24		41	45	49	53	57	61	65	69	73	77	81	85	89	12	
13	-	1	3	7	10	13	17	20	24	27	31		50	54	59	63	67	72	76	80	85	89	94	98	13	
14	-	1	4	7	11	15	18	22	26	30	34	38		59	64	69	74	78	83	88	93	98	102	107	14	
15	-	2	5	8	12	16	20	24	29	33	37	42	46		70	75	80	85	90	96	101	106	111	117	15	
16	-	2	5	9	13	18	22	27	31	36	41	45	50	55		81	86	92	98	103	109	115	120	126	16	
17	-	2	6	10	15	19	24	29	34	39	44	49	54	60	65		93	99	105	111	117	123	129	135	17	
18	-	2	6	11	16	21	26	31	37	42	47	53	58	64	70	75		106	112	119	125	132	138	145	18	
19	0	3	7	12	17	22	28	33	39	45	51	57	63	69	74	81	87		119	126	133	140	147	154	19	
20	0	3	8	13	18	24	30	36	42	48	54	60	67	73	79	86	92	99		134	141	149	156	163	20	
21	0	3	8	14	19	25	32	38	44	51	58	64	71	78	84	91	98	105	112		150	157	165	173	21	
22	0	4	9	14	21	27	34	40	47	54	61	68	75	82	89	96	104	111	118	125		166	174	182	22	
23	0	4	9	15	22	29	35	43	50	57	64	72	79	87	94	102	109	117	125	132	140		183	192	23	
24	0	4	10	16	23	30	37	45	52	60	68	75	83	91	99	107	115	123	131	139	147	155		201	24	
25	0	4	10	17	24	32	39	47	55	63	71	79	87	96	104	112	121	129	138	146	155	163	172		25	
0.01 n_L / n_S	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	27	25		

n_S = smaller sample size