CONFIDENTIAL

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023

COURSE NAME	:	EDUCATIONAL DATA REASONING
COURSE CODE	:	BBD 30402
PROGRAMME CODE	:	BBA/BBB/BBC/BBD/BBE/BBF/BBG
EXAMINATION DATE	:	JULY/AUGUST 2023
DURATION	:	2 HOURS
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS 2. THIS FINAL EXAMINATION IS CONDUCTED VIA **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 **ELEVEN (11)** PAGES

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Q1 Dr Suhaizal conducted research to test the hypothesis that eating fish makes one smarter. In an experiment, a random sample of 12 people took fish oil supplement for one year. Then their IQ were tested. The results shown as Table Q1:

Table Q1

116	111	101	120	99	94	106	115	107	101	110	92

(a) What is the suitable method for analyzing the data? Give two reasons.

(6 Marks)

(b) State the null and alternative hypotheses for this research.

(4 Marks)

(c) At $\alpha = 0.05$, Compute the results using p-value, to test the hypotheses, then summarize your finding.

(15 Marks)

Q2 At the end of a management training course, a thinking test is given to all the trainees. The test assess the relationship between the number of correct answers and the time taken to complete the test. The following nonparametric data were obtained from 12 random sample.

Table Q2

Trainee	A	B	C	D	E	F	G	H	I	J	K	L
Number correct	4	6	7	9	10	11	13	14	16	17	18	20
Time taken	112	140	115	130	125	128	135	137	142	150	145	148

(a) Suggest null and alternative hypotheses for this research.

(4 Marks)

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

(12Marks)

(c) At the 1% level of significance, find whether there is any association between the time taken to complete the test and the number of correct answers. Make a conclusion.

(9 Marks)

Q3 (a) A student from Seri Indah Vocational college claimed that he can increase his scores in the major field areas of the entry examination by at least 50 points if he is provided with sample problems in advance. To test this claim, 20 college are divided in two groups. One group with sample problem given one week prior to the examination, and another group without. Data is shown in Table Q3(a).

Table Q3(a)

Pair	1	2	3	4	5	6	7	8	9	10
With sample problems	531	621	663	579	451	660	591	719	543	575
Without sample problems	509	540	688	502	424	683	568	748	530	524

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

(4 Marks)

(ii) At the level of significance of 0.05 test the null hypothesis that sample problems increase the scores by 50 points.

(11 Marks)

(b) A researcher conducted research to find out the gender differences in terms of motivation among secondary school students after pandemic. Two schools were selected, SMK Tun Ismail and SMK Sri Gading. All the gathered data were analyzed by statistician using $\alpha = 0.05$.

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

(4 Marks)

(i) State the appropriate statistical tests to test the hypotheses in Q2(a)(i). Give two (2) reasons.

(6 Marks))

Q4 (a) A TVET researcher took random samples of 14 professors and 11 physicians and tested them for job-related stress. Data in Table Q4(a) shows the stress levels for professors and physicians on a scale of 1 to 20, where 1 is the lowest level of stress and 20 is the highest. Assume that the data is normally distributed.

Table Q4(a)

Professors	5	9	4	12	6	15	2	8	10	4	6	11	8	3
Physicians	10	18	12	5	13	18	14	9	6	16	11			

(i) State the null and alternative hypotheses according to the given information.

(4 Marks)

(ii) Using the data in Table Q4(a), at the 5% significance level, can you conclude that the job-related stress level for professors is lower than that of physicians?

(8 Marks)

(b) Theory predicts that the types of mice should be obtained in the ratios 9 : 3 : 3 : 1. using a 5% critical value. Table Q4(b) records the observed frequencies in its first row and the frequencies expected. Test the compatibility of the data with theory, under the null hypothesis.

Table Q4(b)

Type mice	Black mice: Pink eyes	Black mice: Brown eyes	White mice: Pink eyes	White mice: Brown eyes
Observed	120	48	36	13
Expected	122	41	41	14

(13 Marks)

-END OF QUESTION-

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

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

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

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

$$r = \frac{\sum XY - N\bar{X}\bar{Y}}{\sqrt{(\sum X^2 - N\bar{X}^2)(\sum Y^2 - N\bar{Y}^2)}}$$

$$T = r_p \sqrt{\frac{n-2}{1-{r_p}^2}}$$

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

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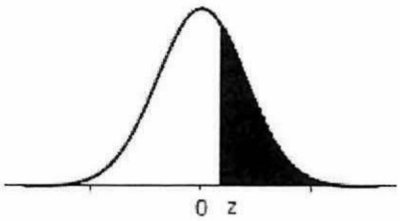
Probabilities Associated with Values as Extreme as Observed Value of Z in the Normal Curve of distribution



Read values of Z to one decimal place down the left hand column, *Column z*. Read across Row z for values to two decimal

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

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 $\rho = 2 \times (0.0239) = 0.0478$

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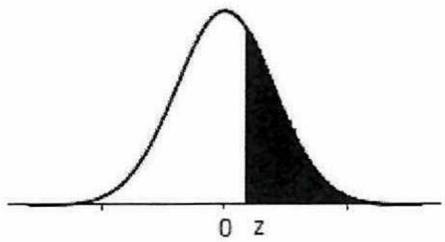
Probabilities Associated with Values as Extreme as Observed Value of z in the Normal Curve of Distribution (continued)



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									

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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

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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

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	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

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

Equal sample sizes

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

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

L = larger sample size

ns = smaller 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		

Source: Table 5.3, of Neave, H. R., Statistics Tables. London: George Allen & Unwin, 1978, p. 53, with the kind permission of the author and publisher