編號： 219 國立成功大學108學年度碩士班招生考試試題

系　　所：工業設計學系

考試科目：統計方法　　考試日期：0224，節次：3

※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Calculate the value of the following questions: (15分，每題3分)
   (a) Find the area under the standard normal curve to the left of z = 1.12
   (b) Find the area under the standard normal curve over the interval z = -0.25 to z = 1.88
   (c) Find the critical t value for one-tailed test with df.= 8 at the 0.05 level of significance
   (d) Find the critical t value for non-directional test with df.= 20 at the 0.01 level of significance
   (e) Calculate the value of the z test for x = 142; σ=35; n = 49; μ_{hyp} = 150

2. During their first swim through a water maze, 12 laboratory rats made the following number of errors (blind alleyway entrance): 5, 12, 5, 3, 24, 7, 5, 12, 5, 6, 8, 12 (15分)
   (a) Find the mode, median, mean, and standard deviation for these data. (8%)
   (b) Without constructing a frequency distribution or graph, would you characterize the shape of this distribution as balanced, positively skewed, or negatively skewed? Why? (7%)

3. A new wearable device is designed and its weight with a mean of 525 grams and a standard deviation of 30 grams, which follows a normal distribution. A random sample of 49 wearable devices has a mean weight of 532 grams. Please use the customary procedure to test the null hypothesis at the 0.05 level of significance. (15分)

4. A company wants to know how many days, in average, a salesman sales a new product with the AR design. He randomly picked the sales records of 64 products from the corporate computer center. He found the product deals were averagely made in 18 days. What is the 95% Confidence Interval (C.I.) averaged days for the product being successfully sold? (Assuming the standard deviation of the population mean is 2 days) (15分)

5. Each of the following pairs represents the number of licensed drivers (X) and the number of cars (Y) for five houses in my neighborhood: (20分)
   (a) Construct a scatterplot to verify a lack of pronounced curvilinearity. (5%)
   (b) Determine the least squares regression equation for these data. (10%) (Remember, you have to calculate *r*, *SSy*, and *SSx*)
   (c) Predict the number of cars for a new family with four drivers. (5%)

DRIVERS (*X*)	CARS (*Y*)
5	4
5	3
2	2
3	2
1	1

6. An investigator tests a claim that vitamin C reduces the frequency of common colds. To eliminate the variability due to different family environments, pairs of children from the same family are randomly assigned to either a treatment group that receives vitamin C or a control group that receives fake vitamin C. Each child has a score that reflects the total number of days ill because of colds during the school year. The scores are obtained for ten pairs of children. Please use t to test the null hypothesis at the 0.05 level of significance. (20 分，每題 4 分)

	DAYS ILL DUE TO COLDS	
PAIR NUMBER	VITAMIN C (X_1)	FAKE VITAMIN C (X_2)
1	3	2
2	3	5
3	0	2
4	8	8
5	3	2
6	4	7
7	5	9
8	0	3
9	2	6
10	3	0

Please use the following step-by-step procedure of the hypothesis test: (a) Research Problem; (b) Statistical Hypotheses; (c) Decision Rule; (d) Calculations; (e) Decision and Interpretation.

Table A[a]

PROPORTIONS (OF AREA) UNDER THE STANDARD NORMAL CURVE FOR VALUES OF *z*

z	A	B	C
0.00	.0000	.5000
0.01	.0040	.4960
0.02	.0080	.4920
0.03	.0120	.4880
0.04	.0160	.4840
0.05	.0199	.4801
0.06	.0239	.4761
0.07	.0279	.4721
0.08	.0319	.4681
0.09	.0359	.4641
0.10	.0398	.4602
0.11	.0438	.4562
0.12	.0478	.4522
0.13	.0517	.4483
0.14	.0557	.4443
0.15	.0596	.4404
0.16	.0636	.4364
0.17	.0675	.4325
0.18	.0714	.4286
0.19	.0753	.4247
0.20	.0793	.4207
0.21	.0832	.4168
0.22	.0871	.4129
0.23	.0910	.4090
0.24	.0948	.4052
0.25	.0987	.4013
0.26	.1026	.3974
0.27	.1064	.3936
0.28	.1103	.3897
0.29	.1141	.3859
0.30	.1179	.3821
0.31	.1217	.3783
0.32	.1255	.3745
0.33	.1293	.3707
0.34	.1331	.3669
0.35	.1368	.3632
0.36	.1406	.3594
0.37	.1443	.3557
0.38	.1480	.3520
0.39	.1517	.3483
0.40	.1554	.3446
0.41	.1591	.3409
0.42	.1628	.3372
0.43	.1664	.3336
0.44	.1700	.3300
0.45	.1736	.3264
0.46	.1772	.3228
0.47	.1808	.3192
0.48	.1844	.3156
0.49	.1879	.3121
0.50	.1915	.3085
0.51	.1950	.3050
0.52	.1985	.3015
0.53	.2019	.2981
0.54	.2054	.2946
0.55	.2088	.2912
0.56	.2123	.2877
0.57	.2157	.2843
0.58	.2190	.2810
0.59	.2224	.2776
0.60	.2257	.2743
0.61	.2291	.2709
0.62	.2324	.2676
0.63	.2357	.2643
0.64	.2389	.2611
0.65	.2422	.2578
0.66	.2454	.2546
0.67	.2486	.2514
0.68	.2517	.2483
0.69	.2549	.2451
0.70	.2580	.2420
0.71	.2611	.2389
0.72	.2642	.2358
0.73	.2673	.2327
0.74	.2704	.2296
0.75	.2734	.2266
0.76	.2764	.2236
0.77	.2794	.2206
0.78	.2823	.2177
0.79	.2852	.2148
0.80	.2881	.2119
0.81	.2910	.2090
0.82	.2939	.2061
0.83	.2967	.2033
0.84	.2995	.2005
0.85	.3023	.1977
0.86	.3051	.1949
0.87	.3078	.1922
0.88	.3106	.1894
0.89	.3133	.1867
0.90	.3159	.1841
0.91	.3186	.1814
0.92	.3212	.1788
0.93	.3238	.1762
0.94	.3264	.1736
0.95	.3289	.1711
0.96	.3315	.1685
0.97	.3340	.1660
0.98	.3365	.1635
0.99	.3389	.1611
1.00	.3413	.1587
1.01	.3438	.1562
1.02	.3461	.1539
1.03	.3485	.1515
1.04	.3508	.1492
1.05	.3531	.1469
1.06	.3554	.1446
1.07	.3577	.1423
1.08	.3599	.1401
1.09	.3621	.1379
1.10	.3643	.1357
1.11	.3665	.1335
1.12	.3686	.1314
1.13	.3708	.1292
1.14	.3729	.1271
1.15	.3749	.1251
1.16	.3770	.1230
1.17	.3790	.1210
1.18	.3810	.1190
1.19	.3830	.1170
1.20	.3849	.1151
1.21	.3869	.1131
1.22	.3888	.1112
1.23	.3907	.1093
1.24	.3925	.1075
1.25	.3944	.1056
1.26	.3962	.1038
1.27	.3980	.1020
1.28	.3997	.1003
1.29	.4015	.0985
1.30	.4032	.0968
1.31	.4049	.0951
1.32	.4066	.0934
1.33	.4082	.0918
1.34	.4099	.0901
1.35	.4115	.0885
1.36	.4131	.0869
1.37	.4147	.0853
1.38	.4162	.0838
1.39	.4177	.0823
1.40	.4192	.0808
1.41	.4207	.0793
1.42	.4222	.0778
1.43	.4236	.0764
1.44	.4251	.0749
1.45	.4265	.0735
1.46	.4279	.0721
1.47	.4292	.0708
1.48	.4306	.0694
1.49	.4319	.0681
1.50	.4332	.0668
1.51	.4345	.0655
1.52	.4357	.0643
1.53	.4370	.0630
1.54	.4382	.0618
1.55	.4394	.0606
1.56	.4406	.0594
1.57	.4418	.0582
1.58	.4429	.0571
1.59	.4441	.0559
1.60	.4452	.0548
1.61	.4463	.0537
1.62	.4474	.0526
1.63	.4484	.0516
1.64	.4495	.0505
1.65	.4505	.0495
1.66	.4515	.0485
1.67	.4525	.0475

−z	A′	B′	C′

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Table A[a] (Continued)

PROPORTIONS (OF AREA) UNDER THE STANDARD NORMAL CURVE FOR VALUES OF *z*

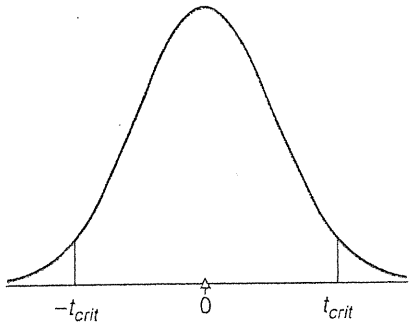
z	A	B	C
1.68	.4535	.0465
1.69	.4545	.0455
1.70	.4554	.0446
1.71	.4564	.0436
1.72	.4573	.0427
1.73	.4582	.0418
1.74	.4591	.0409
1.75	.4599	.0401
1.76	.4608	.0392
1.77	.4616	.0384
1.78	.4625	.0375
1.79	.4633	.0367
1.80	.4641	.0359
1.81	.4649	.0351
1.82	.4656	.0344
1.83	.4664	0336
1.84	.4671	.0329
1.85	.4678	.0322
1.86	.4686	.0314
1.87	.4693	.0307
1.88	.4699	.0301
1.89	.4706	.0294
1.90	.4713	.0287
1.91	.4719	.0281
1.92	.4726	.0274
1.93	.4732	.0268
1.94	.4738	.0262
1.95	.4744	.0256
1.96	.4750	.0250
1.97	.4756	.0244
1.98	.4761	.0239
1.99	.4767	.0233
2.00	.4772	.0228
2.01	.4778	.0222
2.02	.4783	.0217
2.03	.4788	.0212
2.04	.4793	.0207
2.05	.4798	.0202
2.06	.4803	.0197
2.07	.4808	.0192
2.08	.4812	.0188
2.09	.4817	.0183
2.10	.4821	.0179
2.11	.4826	.0174
2.12	.4830	.0170
2.13	.4834	.0166
2.14	.4838	.0162
2.15	.4842	.0158
2.16	.4846	.0154
2.17	.4850	.0150
2.18	.4854	.0146
2.19	.4857	.0143
2.20	.4861	.0139
2.21	.4864	.0136
2.22	.4868	.0132
2.23	.4871	.0129

z	A	B	C
2.24	.4875	.0125
2.25	.4878	.0122
2.26	.4881	.0119
2.27	.4884	.0116
2.28	.4887	.0113
2.29	.4890	.0110
2.30	.4893	.0107
2.31	.4896	.0104
2.32	.4898	.0102
2.33	.4901	.0099
2.34	.4904	.0096
2.35	.4906	.0094
2.36	.4909	.0091
2.37	.4911	.0089
2.38	.4913	.0087
2.39	.4916	.0084
2.40	.4918	.0082
2.41	.4920	.0080
2.42	.4922	.0078
2.43	.4925	.0075
2.44	.4927	.0073
2.45	.4929	.0071
2.46	.4931	.0069
2.47	.4932	.0068
2.48	.4934	.0066
2.49	.4936	.0064
2.50	.4938	.0062
2.51	.4940	.0060
2.52	.4941	.0059
2.53	.4943	.0057
2.54	.4945	.0055
2.55	.4946	.0054
2.56	.4948	.0052
2.57	.4949	.0051
2.58	.4951	.0049
2.59	.4952	.0048
2.60	.4953	.0047
2.61	.4955	.0045
2.62	.4956	.0044
2.63	.4957	.0043
2.64	.4959	.0041
2.65	.4960	.0040
2.66	.4961	.0039
2.67	.4962	.0038
2.68	.4963	.0037
2.69	.4964	.0036
2.70	.4965	.0035
2.71	.4966	.0034
2.72	.4967	.0033
2.73	.4968	.0032
2.74	.4969	.0031
2.75	.4970	.0030
2.76	.4971	0029
2.77	.4972	0028
2.78	.4973	.0027
2.79	.4974	.0026

z	A	B	C
2.80	.4974	.0026
2.81	.4975	.0025
2.82	.4976	.0024
2.83	.4977	.0023
2.84	.4977	.0023
2.85	.4978	.0022
2.86	.4979	.0021
2.87	.4979	.0021
2.88	.4980	.0020
2.89	.4981	.0019
2.90	.4981	.0019
2.91	.4982	.0018
2.92	.4982	.0018
2.93	.4983	.0017
2.94	.4984	.0016
2.95	.4984	.0016
2.96	.4985	.0015
2.97	.4985	.0015
2.98	.4986	.0014
2.99	.4986	.0014
3.00	.4987	.0013
3.01	.4987	.0013
3.02	.4987	.0013
3.03	.4988	.0012
3.04	.4988	.0012
3.05	.4989	.0011
3.06	.4989	.0011
3.07	.4989	.0011
3.08	.4990	.0010
3.09	.4990	.0010
3.10	.4990	.0010
3.11	.4991	.0009
3.12	.4991	.0009
3.13	.4991	.0009
3.14	.4992	.0008
3.15	.4992	.0008
3.16	.4992	.0008
3.17	.4992	.0008
3.18	.4993	.0007
3.19	.4993	.0007
3.20	.4993	.0007
3.21	.4993	.0007
3.22	.4994	.0006
3.23	.4994	.0006
3.24	.4994	.0006
3.25	.4994	.0006
3.30	.4995	.0005
3.35	.4996	.0004
3.40	.4997	.0003
3.45	.4997	.0003
3.50	.4998	0002
3.60	.4998	.0002
3.70	.4999	.0001
3.80	4999	.0001
3.90	.49995	.00005
4.00	.49997	00003

−z	A′	B′	C′

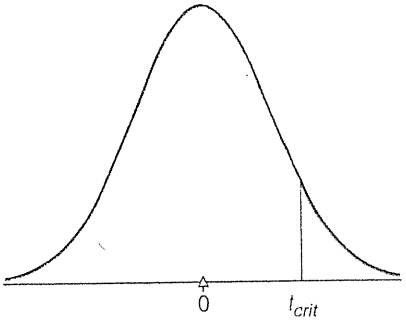
Table B[a]
CRITICAL VALUES OF *t*



Two-tailed or Nondirectional Test
LEVEL OF SIGNIFICANCE
(*p*-value in color)

$p > .05$ $p < .05$ $p < .01$ $p < .001$

df	.05*	.01**	.001
1	12.706	63.657	636.62
2	4.303	9.925	31.598
3	3.182	5.841	12.924
4	2.776	4.604	8.610
5	2.571	4.032	6.869
6	2.447	3.707	5.959
7	2.365	3.499	5.408
8	2.306	3.355	5.041
9	2.262	3.250	4.781
10	2.228	3.169	4.587
11	2.201	3.106	4.437
12	2.179	3.055	4.318
13	2.160	3.012	4.221
14	2.145	2.977	4.140
15	2.131	2.947	4.073
16	2.120	2.921	4.015
17	2.110	2.898	3.965
18	2.101	2.878	3.922
19	2.093	2.861	3.883
20	2.086	2.845	3.850
21	2.080	2.831	3.819
22	2.074	2.819	3.792
23	2.069	2.807	3.767
24	2.064	2.797	3.745
25	2.060	2.787	3.725
26	2.056	2.779	3.707
27	2.052	2.771	3.690
28	2.048	2.763	3.674
29	2.045	2.756	3.659
30	2.042	2.750	3.646
40	2.021	2.704	3.551
60	2.000	2.660	3.460
120	1.980	2.617	3.373
∞	1.960	2.576	3.291



One-tailed or Directional Test
LEVEL OF SIGNIFICANCE
(*p*-value in color)

$p > .05$ $p < .05$ $p < .01$ $p < .001$

df	.05	.01	.001
1	6.314	31.821	318.31
2	2.920	6.965	22.326
3	2.353	4.541	10.213
4	2.132	3.747	7.173
5	2.015	3.365	5.893
6	1.943	3.143	5.208
7	1.895	2.998	4.785
8	1.860	2.896	4.501
9	1.833	2.821	4.297
10	1.812	2.764	4.144
11	1.796	2.718	4.025
12	1.782	2.681	3.930
13	1.771	2.650	3.852
14	1.761	2.624	3.787
15	1.753	2.602	3.733
16	1.746	2.583	3.686
17	1.740	2.567	3.646
18	1.734	2.552	3.610
19	1.729	2.539	3.579
20	1.725	2.528	3.552
21	1.721	2.518	3.527
22	1.717	2.508	3.505
23	1.714	2.500	3.485
24	1.711	2.492	3.467
25	1.708	2.485	3.450
26	1.706	2.479	3.435
27	1.703	2.473	3.421
28	1.701	2.467	3.408
29	1.699	2.462	3.396
30	1.697	2.457	3.385
40	1.684	2.423	3.307
60	1.671	2.390	3.232
120	1.658	2.358	3.160
∞	1.645	2.326	3.090

*95% level of confidence
**99% level of confidence

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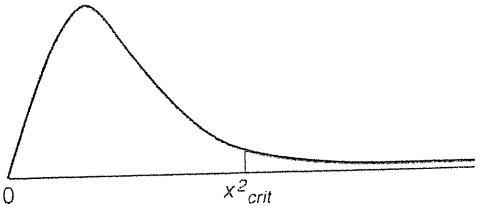
Table D[a]
CRITICAL VALUES OF χ^2



LEVEL OF SIGNIFICANCE
(*p*-value in color)

	$p > .10$	$p < .10$	$p < .05$	$p < .01$	$p < .001$
df	**.10**	**.05**	**.01**	**.001**
1	2.71	3.84	6.64	10.83
2	4.60	5.99	9.21	13.82
3	6.25	7.81	11.34	16.27
4	7.78	9.49	13.28	18.47
5	9.24	11.07	15.09	20.52
6	10.64	12.59	16.81	22.46
7	12.02	14.07	18.48	24.32
8	13.36	15.51	20.09	26.12
9	14.68	16.92	21.67	27.88
10	15.99	18.31	23.21	29.59
11	17.28	19.68	24.72	31.26
12	18.55	21.03	26.22	32.91
13	19.81	22.36	27.69	34.53
14	21.06	23.68	29.14	36.12
15	22.31	25.00	30.58	37.70
16	23.54	26.30	32.00	39.25
17	24.77	27.59	33.41	40.79
18	25.99	28.87	34.80	42.31
19	27.20	30.14	36.19	43.82
20	28.41	31.41	37.57	45.32
21	29.62	32.67	38.93	46.80
22	30.81	33.92	40.29	48.27
23	32.01	35.17	41.64	49.73
24	33.20	36.42	42.98	51.18
25	34.38	37.65	44.31	52.62
26	35.56	38.88	45.64	54.05
27	36.74	40.11	46.96	55.48
28	37.92	41.34	48.28	56.89
29	39.09	42.56	49.59	58.30
30	40.26	43.77	50.89	59.70
40	51.80	55.76	63.69	73.40
50	63.17	67.50	76.15	86.66
60	74.40	79.08	88.38	99.61
70	85.53	90.53	100.42	112.32