

系所組別： 工業設計學系乙組

考試科目： 統計概論與方法

考試日期：0225，節次：3

1. (a) What is probability sampling? (5pts)
(b) Does probability sampling always yield a representative sample? Explain your answer. (5pts)
(c) Identify the advantages of probability sampling. (5pts)
2. How should a protected hypothesis test be modified if you're particularly concerned about:
(a) Type I error (5pts)
(b) Type II error (5pts)
3. Construct a stem and leaf display for the following temperatures ($^{\circ}$ F) shown by an interactive thermometer. (5pts)

90	53	79	84	72
72	87	85	68	65
83	94	70	89	
4. During their first manipulation of an Augmented Reality interface, 12 children made the following errors:

1	3	4	7	0	2
3	7	11	5	8	0

Find the following values for the data:
 - (1) Mean (3pts)
 - (2) Median (3pts)
 - (3) Mode (3pts)
 - (4) Interquartile Range (3pts)
 - (5) Range (3pts)
5. NCKU wants to build a lounge bar next to *Research Center for Humanities, Arts, and Social Sciences* for Faculty and students to relax themselves after work/class. The president decides to recruit male undergraduate students to work part time from school. If you get the assignment for designing an adjustable bar counter to accommodate 90% male students, what would the range of height adjustment need to be? Use the male students' elbow height (Mean=107 cm, Standard deviation=4 cm) for the calculation. (10pts)

(背面仍有題目,請繼續作答)

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6. The following table shows the number of card sent in relation to the number of card received by individuals.

Name	# of card sent	# of card received
Peter	5	4
John	5	3
Jean	2	2
Sean	2	2
Ron	3	2
Mary	1	1
Marcus	2	2

- (1) Construct a scatter plot for # of card sent and # of card received (3 pts). Does the scatterplot describe a pronounced curvilinear trend? (2 pts)
- (2) Calculate the correlation coefficient for the 2 variables (5pts).
- (3) Determine the least squares regression equation for these data (5pts).
- (4) Determine the average amount of predictive error, $S_{y|x}$ (5pts).
- (5) Predict the number of cards will be receive if Sam wants to send 7 cards. (5pts)

7. The times required by three workers to perform an assembly-line task were recorded on five randomly selected occasions. The manager wants to know who can best complete their tasks within the shortest time. The following are the times, to the nearest minute.

1. Jean	2. Sam	3. Marcus
8	8	10
10	9	9
9	9	10
11	8	11
10	10	9

(Note: $\bar{x}_1 = 9.6$ $\bar{x}_2 = 8.8$ $\bar{x}_3 = 9.8$ $s_1^2 = 1.3$ $s_2^2 = 0.7$ $s_3^2 = 0.7$)

- (1) State the statistical hypotheses (5pts)
- (2) Summarize the data with an ANOVA table. (10pts)
- (3) At the 0.05 level of significance, does there appear to be a difference in the mean performance time among the three workers? (5pts)

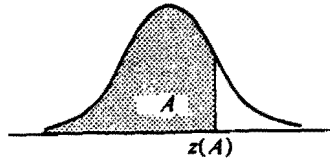
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TABLE B.1 Cumulative Probabilities of the Standard Normal Distribution.

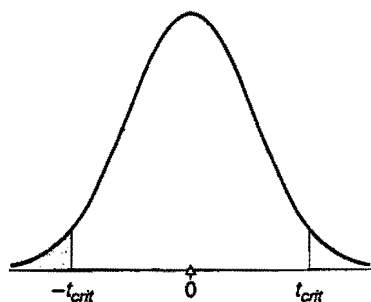
Entry is area A under the standard normal curve from $-\infty$ to $z(A)$



z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998

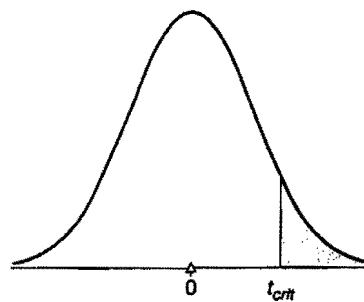
(背面仍有題目,請繼續作答)

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



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

p > .05 *p* < .05 *p* < .01 *p* < .001

<i>df</i>	.05*	.01**	.001	<i>df</i>	.05	.01	.001
1	12.706	63.657	636.62	1	6.314	31.821	318.31
2	4.303	9.925	31.598	2	2.920	6.965	22.326
3	3.182	5.841	12.924	3	2.353	4.541	10.213
4	2.776	4.604	8.610	4	2.132	3.747	7.173
5	2.571	4.032	6.869	5	2.015	3.365	5.893
6	2.447	3.707	5.959	6	1.943	3.143	5.208
7	2.365	3.499	5.408	7	1.895	2.998	4.785
8	2.306	3.355	5.041	8	1.860	2.896	4.501
9	2.262	3.250	4.781	9	1.833	2.821	4.297
10	2.228	3.169	4.587	10	1.812	2.764	4.144
11	2.201	3.106	4.437	11	1.796	2.718	4.025
12	2.179	3.055	4.318	12	1.782	2.681	3.930
13	2.160	3.012	4.221	13	1.771	2.650	3.852
14	2.145	2.977	4.140	14	1.761	2.624	3.787
15	2.131	2.947	4.073	15	1.753	2.602	3.733
16	2.120	2.921	4.015	16	1.746	2.583	3.686
17	2.110	2.898	3.965	17	1.740	2.567	3.646
18	2.101	2.878	3.922	18	1.734	2.552	3.610
19	2.093	2.861	3.883	19	1.729	2.539	3.579
20	2.086	2.845	3.850	20	1.725	2.528	3.552
21	2.080	2.831	3.819	21	1.721	2.518	3.527
22	2.074	2.819	3.792	22	1.717	2.508	3.505
23	2.069	2.807	3.767	23	1.714	2.500	3.485
24	2.064	2.797	3.745	24	1.711	2.492	3.467
25	2.060	2.787	3.725	25	1.708	2.485	3.450
26	2.056	2.779	3.707	26	1.706	2.479	3.435
27	2.052	2.771	3.690	27	1.703	2.473	3.421
28	2.048	2.763	3.674	28	1.701	2.467	3.408
29	2.045	2.756	3.659	29	1.699	2.462	3.396
30	2.042	2.750	3.646	30	1.697	2.457	3.385
40	2.021	2.704	3.551	40	1.684	2.423	3.307
60	2.000	2.660	3.460	60	1.671	2.390	3.232
120	1.980	2.617	3.373	120	1.658	2.358	3.160
∞	1.960	2.576	3.291	∞	1.645	2.326	3.090

^aDiscussed in Section 13.2.

*95% level of confidence.

**99% level of confidence.

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Table C-1
CRITICAL VALUES OF F



FINDING p-VALUE
If observed F is
... smaller than light number, $p > .05$
... between light and dark numbers, $p < .05$
... larger than dark number, $p < .01$

.05 level of significance (light numbers)
.01 level of significance (dark numbers)

DEGREES OF FREEDOM IN NUMERATOR

DEGREES OF FREEDOM IN DENOMINATOR

Table with columns for Degrees of Freedom in Numerator (1-13) and Degrees of Freedom in Denominator (1-500). The table contains critical values for F-distribution at .05 and .01 levels of significance.

(背面仍有題目,請繼續作答)

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Table C1 (Continued)
CRITICAL VALUES OF F

FINDING p-VALUE

If observed F is

... smaller than light number, $p > .05$

... between light and dark numbers, $p < .05$

... larger than dark number, $p < .01$

DEGREES OF FREEDOM IN NUMERATOR

DEGREES OF FREEDOM IN DENOMINATOR

1	2	3	4	5	6	7	8	9	10	11	12	14	16	20	24	30	40	50	75	100	200	500	∞
4.60	3.74	3.34	3.11	2.96	2.85	2.77	2.70	2.65	2.60	2.56	2.53	2.48	2.44	2.39	2.35	2.31	2.27	2.24	2.21	2.19	2.16	2.14	2.13
8.86	6.51	5.56	5.03	4.69	4.46	4.28	4.14	4.03	3.94	3.86	3.80	3.70	3.62	3.51	3.43	3.34	3.26	3.21	3.14	3.11	3.06	3.02	3.00
4.54	3.68	3.29	3.06	2.90	2.79	2.70	2.64	2.59	2.55	2.51	2.48	2.43	2.39	2.33	2.29	2.25	2.21	2.18	2.15	2.12	2.10	2.08	2.07
8.68	6.36	5.42	4.89	4.56	4.32	4.14	4.00	3.89	3.80	3.73	3.67	3.56	3.48	3.36	3.29	3.20	3.12	3.07	3.00	2.97	2.9	2.88	2.80
8.53	6.23	5.29	4.77	4.44	4.20	4.03	3.89	3.78	3.69	3.61	3.55	3.45	3.37	3.25	3.18	3.10	3.01	2.96	2.89	2.86	2.80	2.77	2.75
4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.45	2.42	2.37	2.33	2.28	2.24	2.20	2.16	2.13	2.09	2.07	2.04	2.02	2.01
4.45	3.59	3.20	2.96	2.81	2.70	2.62	2.55	2.50	2.45	2.41	2.38	2.33	2.29	2.23	2.19	2.15	2.11	2.08	2.04	2.00	1.98	1.95	1.92
8.40	6.11	5.18	4.67	4.34	4.10	3.93	3.79	3.68	3.59	3.52	3.45	3.35	3.27	3.15	3.07	2.91	2.83	2.78	2.71	2.68	2.62	2.58	2.57
4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.37	2.34	2.29	2.25	2.19	2.15	2.11	2.07	2.04	2.00	1.96	1.94	1.91	1.88
8.28	6.01	5.09	4.58	4.25	4.01	3.85	3.71	3.60	3.51	3.44	3.37	3.27	3.19	3.07	2.92	2.84	2.76	2.70	2.63	2.60	2.54	2.51	2.49
4.38	3.52	3.13	2.90	2.74	2.63	2.55	2.48	2.43	2.38	2.34	2.31	2.26	2.21	2.15	2.11	2.07	2.02	2.00	1.96	1.94	1.91	1.88	1.88
8.18	5.93	5.01	4.50	4.17	3.94	3.77	3.63	3.52	3.43	3.36	3.28	3.19	3.12	3.00	2.92	2.84	2.76	2.69	2.63	2.56	2.53	2.47	2.44
4.35	3.49	3.10	2.87	2.71	2.60	2.52	2.45	2.40	2.35	2.31	2.28	2.23	2.18	2.12	2.08	2.04	1.99	1.96	1.93	1.89	1.87	1.85	1.84
8.10	5.85	4.94	4.43	4.10	3.87	3.71	3.56	3.45	3.37	3.30	3.23	3.13	3.05	2.94	2.86	2.77	2.69	2.63	2.56	2.51	2.47	2.42	2.42
4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37	2.32	2.28	2.25	2.20	2.15	2.09	2.05	2.00	1.96	1.93	1.89	1.87	1.84	1.82	1.81
8.02	5.78	4.87	4.37	4.04	3.81	3.65	3.51	3.40	3.31	3.24	3.17	3.07	2.99	2.88	2.80	2.72	2.63	2.58	2.51	2.47	2.42	2.38	2.36
4.30	3.44	3.05	2.82	2.66	2.55	2.47	2.40	2.35	2.30	2.26	2.23	2.18	2.13	2.07	2.03	1.98	1.93	1.91	1.87	1.84	1.81	1.78	1.78
7.94	5.72	4.82	4.31	3.99	3.76	3.59	3.45	3.35	3.26	3.18	3.12	3.02	2.94	2.83	2.75	2.67	2.58	2.53	2.46	2.42	2.37	2.33	2.31
4.28	3.42	3.03	2.80	2.64	2.53	2.45	2.38	2.32	2.28	2.24	2.20	2.14	2.10	2.04	2.00	1.96	1.91	1.88	1.84	1.82	1.79	1.77	1.76
7.88	5.68	4.76	4.26	3.94	3.71	3.54	3.41	3.30	3.21	3.14	3.07	2.97	2.89	2.78	2.70	2.62	2.53	2.48	2.41	2.37	2.32	2.28	2.26
4.26	3.40	3.01	2.78	2.62	2.51	2.43	2.36	2.30	2.26	2.22	2.18	2.13	2.09	2.02	1.98	1.94	1.89	1.86	1.82	1.80	1.76	1.74	1.73
7.82	5.61	4.72	4.22	3.90	3.67	3.50	3.36	3.25	3.17	3.09	3.03	2.93	2.85	2.74	2.66	2.58	2.49	2.44	2.36	2.33	2.27	2.23	2.21
4.24	3.38	2.99	2.76	2.60	2.49	2.41	2.34	2.28	2.24	2.20	2.16	2.11	2.06	2.00	1.96	1.92	1.87	1.84	1.80	1.77	1.74	1.71	1.71
7.77	5.57	4.68	4.18	3.86	3.63	3.46	3.32	3.21	3.13	3.05	2.99	2.89	2.81	2.70	2.62	2.54	2.45	2.40	2.32	2.29	2.23	2.19	2.17
4.22	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22	2.18	2.15	2.10	2.05	1.99	1.95	1.90	1.86	1.82	1.78	1.76	1.72	1.70	1.69
7.72	5.53	4.64	4.14	3.82	3.59	3.42	3.29	3.17	3.09	3.02	2.96	2.86	2.77	2.66	2.58	2.50	2.41	2.36	2.28	2.25	2.19	2.15	2.15