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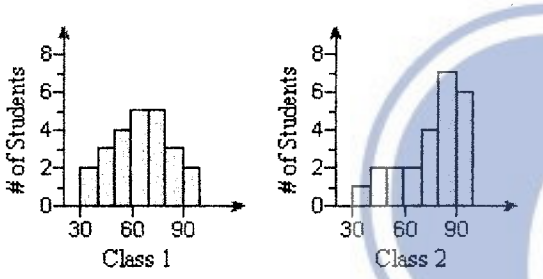
第一大題(3pt for each, please write down the item numbers and answers in order. For example: 1 (d) 2 (d) 3(d)..... 10 (d))

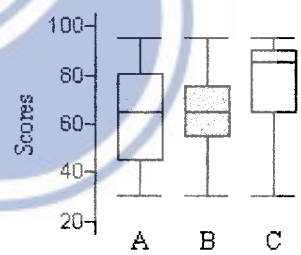
1. An assumption made about the value of a population parameter is called a
(a) sampling distribution
(b) hypothesis
(c) confidence interval
(d) significance

The next two questions will be based on the following
Three statistics classes all took the same test and the histograms of the test scores are shown to the right



2. Overall, which class has the highest mean and median? Check one that apply
(a) Class 1 (b) Class 2 (c) Class 3

3. Match each class with the corresponding boxplot
Class 1 corresponds to boxplot _____.
Class 2 corresponds to boxplot _____.
Class 3 corresponds to boxplot _____.
(a) ABC (b) ACB (c) BCA (d) BAC



4. We test the null hypothesis H_0: $\mu = 10$ and the alternative H_a: $\mu < 10$, for a normal population with $\sigma = 4$. A random sample of 16 observations is drawn from the population and we find the sample mean of these observations is 12. The p-value is closest to
(a) 0.0228
(b) 0.0456
(c) 0.1016
(d) 0.9772

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5. A certain population follows a normal distribution with mean μ and standard deviation $\sigma = 2.5$. You collect data and test the hypotheses H_0: μ = 1, H_a: μ≠ 1.
You obtain a *p*-value of 0.022. Which of the following is true?
(a) a 90% confidence interval for μ will include the value 1
(b) a 95% confidence interval for μ will include the value 1
(c) a 97% confidence interval for μ will include the value 1
(d) a 99% confidence interval for μ will include the value 1

6. The time to complete a standardized exam is approximately normal with a mean of 70 minutes and a standard deviation of 10 minutes. Using the 68-95-99.7 rule, what percent of students will complete the exam in under an hour?
(a) 68%
(b) 32%
(c) 16%
(d) 5%

7. Which of the following is true?
(a) if we draw a simple random sample of any size from any population the sampling distribution of the sample mean will be **exactly** Normal
(b) if we draw a simple random sample of any size from any population the sampling distribution of the sample mean will be **close** to Normal
(c) central limit theorem only applies when sampling from Normal populations
(d) none of the above

8. If two random samples of sizes 30 and 36 are selected independently from two populations with means 78 and 85, and standard deviations 12 and 15, respectively, then the standard error of $\bar{X}_1 - \bar{X}_2$ is equal to:
(a) 0.904
(b) 3.324
(c) 3.391
(d) 0.833

9. A student took a math test whose mean was 70 and standard deviation was 5. The total points possible was 100. Suppose that the exam is normally distributed. Stacey's results were reported to be at the 95th percentile. What was his actual exam score, rounded to the nearest whole number?
(a) 80
(b) 75
(c) 78
(d) 62

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10. Consider the following model $Y = \beta_0 + \beta_1 x + \varepsilon$, whether Y is the daily rate of return of a stock, and x is the daily rate of return of the stock market as a whole, measured by the daily rate of return of Standard & Poor's(S&P) 500 Composite Index. Using a random sample of $n = 12$ days from 1980, the least squares lines shown in the table below were obtained for four firms. The estimated standard error of $\hat{\beta}_1$ is shown to the right of each least squares prediction equation

Firm	Estimated Market Model	Estimated Standard Error of $\hat{\beta}_1$
Company A	y= 0.0010-1.40x	0.30
Company B	y= 0.0005-1.21x	0.60
Company C	y= 0.0010+1.62x	1.34
Company D	y= 0.0013+0.76x	0.15

For which of the stocks is there evidence (at $\alpha = 0.05$) of a positive linear relationship between Y and x?

(a) Company D only

(b) Company C and D only

(c) Companies A, B and D

(d) Companies B and D only

第二大題(15%)

7 pairs of twin male lambs were selected; diet plan I was given to one twin and diet plan II to the other twin in each case. The weights at eight months were as follows.

	1	2	3	4	5	6	7
Diet I	111	102	90	110	108	125	99
Diet II	97	90	96	95	110	107	85

a. (7pt) Someone use the two-sample t-test to test the hypothesis that there is no difference in the diets against the alternative that diet I is preferable to diet II at $\alpha = 0.10$. Please show the test statistic and its p-value

b. (8pt) Does this testing convince you? Explain. Can you find other testing procedure which is better than the two-sample t-test? Ps., your answers should have some statistical analysis to support your arguments.

第三大題(15%)

There are 5 urns. The r-th urn contains $(r-1)$ red balls and $(5-r)$ blue balls, for $r = 1, 2, \ldots, 5$. You randomly pick one urn and chose two balls without replacement.

a. (12pt) Find the probability that the second ball is blue

b. (3pt) Find the probability that the second ball is blue, given the first one is blue

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第四大題(20%)

Suppose that two shipping companies, A and B, each decide to estimate the annual percentage of shipments on which a $100 or greater claim for loss or damage was filed by sampling their records, and they report the data shown below.

	Company A	Company B
Total shipments sampled	800	600
Number of shipments with a claim ≥ $100	200	100

The owner of Company B is hoping to use these data to show that her company is superior to Company A with regard to the percentage of claims filed. Let $\alpha = 0.05$

a. (10pt) Conduct a two-sample test procedure to analyze the data in this experiment

b. (10pt) Conduct another testing based on the Chi-square test statistic

第五大題(20%)

A random sample of 30 executives from companies with assets over $1 million was selected and asked for their annual income and level of education. The following table summarized the results

	High School or less	Undergraduate Degree	Master's Degree or More
Sample size	7	11	12
Average Salary (1,000s)	49	76.3	78.3

a. (4pt) Find H_0 and H_a

b. (6pt) Given the mean square error (MSE) was 243.7. Please construct a ANOVA table

c. (5pt) Compute the test statistic and test the hypotheses at a 5% level of significance.

d. (5pt) The difference of salaries between undergraduate and master's degree or more is of interest. Find a 95% confidence interval for the difference

表格附錄(t, z, χ^2, F table)

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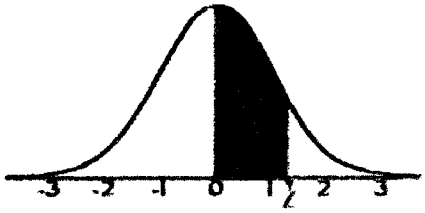

STANDARD NORMAL TABLE (Z)

Entries in the table give the area under the curve between the mean and *z* standard deviations above the mean. For example, for $z = 1.25$ the area under the curve between the mean (0) and z is 0.3944.

	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2969	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3513	0.3554	0.3577	0.3529	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4606	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916

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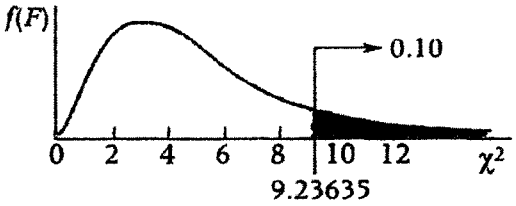

Example: df (Number of degrees of freedom) = 5, the tail above $\chi^2 = 9.23635$ represents 0.10 or 10% of the area under the curve.

Degrees of Freedom	Area in Upper Tail .995	.99	.975	.95	.9	.1	.05	.025	.01	.005
1	0.0000393	0.0001571	0.0009821	0.0039322	0.0157907	2.7055	3.8415	5.0239	6.6349	7.8794
2	0.010025	0.020100	0.050636	0.102586	0.210721	4.6052	5.9915	7.3778	9.2104	10.5965
3	0.07172	0.11483	0.21579	0.35185	0.58438	6.2514	7.8147	9.3484	11.3449	12.8381
4	0.20698	0.29711	0.48442	0.71072	1.06362	7.7794	9.4877	11.1433	13.2767	14.8602
5	0.41175	0.55430	0.83121	1.14548	1.61031	9.2363	11.0705	12.8325	15.0863	16.7496
6	0.67573	0.87208	1.23734	1.63538	2.20413	10.6446	12.5916	14.4494	16.8119	18.5475

Table III: F table with $\alpha = 0.05$

Denominator DF	Numerator DF 1	2	3	4	5	6	7	8	9	10
1	161.448	199.500	215.707	224.583	230.162	233.986	236.768	238.883	240.543	241.882
2	18.513	19.000	19.164	19.247	19.296	19.330	19.353	19.371	19.385	19.396
3	10.128	9.552	9.277	9.117	9.013	8.941	8.887	8.845	8.812	8.786
4	7.709	6.944	6.591	6.388	6.256	6.163	6.094	6.041	5.999	5.964
5	6.608	5.786	5.409	5.192	5.050	4.950	4.876	4.818	4.772	4.735
6	5.987	5.143	4.757	4.534	4.387	4.284	4.207	4.147	4.099	4.060
7	5.591	4.737	4.347	4.120	3.972	3.866	3.787	3.726	3.677	3.637
8	5.318	4.459	4.066	3.838	3.687	3.581	3.500	3.438	3.388	3.347
9	5.117	4.256	3.863	3.633	3.482	3.374	3.293	3.230	3.179	3.137
10	4.965	4.103	3.708	3.478	3.326	3.217	3.135	3.072	3.020	2.978
11	4.844	3.982	3.587	3.357	3.204	3.095	3.012	2.948	2.896	2.854
12	4.747	3.885	3.490	3.259	3.106	2.996	2.913	2.849	2.796	2.753
13	4.667	3.806	3.411	3.179	3.025	2.915	2.832	2.767	2.714	2.671
14	4.600	3.739	3.344	3.112	2.958	2.848	2.764	2.699	2.646	2.602
15	4.543	3.682	3.287	3.056	2.901	2.790	2.707	2.641	2.588	2.544
16	4.494	3.634	3.239	3.007	2.852	2.741	2.657	2.591	2.538	2.494
17	4.451	3.592	3.197	2.965	2.810	2.699	2.614	2.548	2.494	2.450
18	4.414	3.555	3.160	2.928	2.773	2.661	2.577	2.510	2.456	2.412
19	4.381	3.522	3.127	2.895	2.740	2.628	2.544	2.477	2.423	2.378
20	4.351	3.493	3.098	2.866	2.711	2.599	2.514	2.447	2.393	2.348
21	4.325	3.467	3.072	2.840	2.685	2.573	2.488	2.420	2.366	2.321
22	4.301	3.443	3.049	2.817	2.661	2.549	2.464	2.397	2.342	2.297
23	4.279	3.422	3.028	2.796	2.640	2.528	2.442	2.375	2.320	2.275
24	4.260	3.403	3.009	2.776	2.621	2.508	2.423	2.355	2.300	2.255
25	4.242	3.385	2.991	2.759	2.603	2.490	2.405	2.337	2.282	2.236
26	4.225	3.369	2.975	2.743	2.587	2.474	2.388	2.321	2.265	2.220
27	4.210	3.354	2.960	2.728	2.572	2.459	2.373	2.305	2.250	2.204
28	4.196	3.340	2.947	2.714	2.558	2.445	2.359	2.291	2.236	2.190
29	4.183	3.328	2.934	2.701	2.545	2.432	2.346	2.278	2.223	2.177
30	4.171	3.316	2.922	2.690	2.534	2.421	2.334	2.266	2.211	2.165

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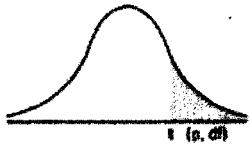
t table



df/p	0.40	0.25	0.10	0.05	0.025	0.01	0.005	0.0005
1	0.324920	1.000000	3.077684	6.313752	12.70620	31.82052	63.65674	636.6192
2	0.288675	0.816497	1.885618	2.919986	4.30265	6.96456	9.92484	31.5991
3	0.276671	0.764892	1.637744	2.353363	3.18245	4.54070	5.84091	12.9240
4	0.270722	0.740697	1.533206	2.131847	2.77645	3.74695	4.60409	8.6103
5	0.267181	0.726687	1.475884	2.015048	2.57058	3.36493	4.03214	6.8688
6	0.264835	0.717558	1.439756	1.943180	2.44691	3.14267	3.70743	5.9588
7	0.263167	0.711142	1.414924	1.894579	2.36462	2.99795	3.49948	5.4079
8	0.261921	0.706387	1.396815	1.859548	2.30600	2.89646	3.35539	5.0413
9	0.260955	0.702722	1.383029	1.833113	2.26216	2.82144	3.24984	4.7809
10	0.260185	0.699812	1.372184	1.812461	2.22814	2.76377	3.16927	4.5869
11	0.259556	0.697445	1.363430	1.795885	2.20099	2.71808	3.10581	4.4370
12	0.259033	0.695483	1.356217	1.782288	2.17881	2.68100	3.05454	43178
13	0.258591	0.693829	1.350171	1.770933	2.16037	2.65031	3.01228	4.2208
14	0.258213	0.692417	1.345030	1.761310	2.14479	2.62449	2.97684	4.1405
15	0.257885	0.691197	1.340606	1.753050	2.13145	2.60248	2.94671	4.0728

備註	一、作答於試題上者，不予計分。 二、試題請隨卷繳交。