※注意：第一大題單選題請於試卷上「選擇題作答區」內依序作答。

一、單選題(共 25 題，每題 3 分)：請按照題號順序作答。

1. Which of the following statements is true?
   A. Individual observations within each class may be found in a frequency distribution.
   B. A frequency distribution is a listing of the individual observations arranged in ascending or descending order.
   C. A bimodal histogram is one with two or more peaks equal in height.
   D. The sum of cumulative frequencies in a distribution always equals 1.
   E. None of above

2. Which of the following statements is not true regarding graphical deception?
   A. Perceptive is often distorted if percentage changes, rather than only absolute changes, are reported.
   B. Illusions can be created with bar charts by stretching or shrinking the vertical or horizontal axis.
   C. The first thing to watch for is a graph without a scale on one axis.
   D. Some distortions should be watched for particularly in pictograms, which replace the bars with pictures of objects (such as bags of money, people, or animals) to enhance the visual appeal.
   E. None of above

3. Suppose you make a 2 – year investment of \$2,500 and it grows by 100% to \$5,000 during the first year. During the second year, however, the investment suffers a 50% loss from \$5,000 back to \$2,500. What are the arithmetic mean and the geometric mean?
   A. 50% and 25%   B. 25% and 25%   C. 0% and 50%
   D. 25% and 50%   E. None of above

4. The following data represent the weights in pounds of a sample of 25 workers: 164, 148, 137, 157, 173, 156, 177, 172, 169, 165, 145, 168, 163, 162, 174, 152, 156, 168, 154, 151, 174, 146, 134, 140, and 171. Determine the location and value of the 60th percentile of the weights.
   A. In the range [140, 150)   B. In the range [150, 160)   C. In the range [160, 170)
   D. In the range [170, 180)   E. None of above

5. Which of the following is **not** a characteristic of a binomial experiment?
   A. There is a sequence of identical trials.
   B. Each trial results in two or more outcomes.
   C. The trials are independent of each other.
   D. Probability of success p is the same from one trial to another.
   E. None of above

6. The Central Limit Theorem states that
   A. for a large n, the population is approximately normal.
   B. for any population, the sampling distribution of the sample mean is approximately normal, regardless of the shape of the population.
   C. for a large n, the sampling distribution of the sample mean is approximately normal, regardless of the shape of the population.
   D. for any sample size, the sampling distribution of the sample mean is approximately normal.
   E. None of above

7. Which of the following statements is **correct**?
   A. The larger the confidence level used in constructing a confidence interval estimate of the population mean, the narrower the confidence interval.
   B. The width of the confidence interval estimate of the population mean μ is a function of only two quantities: the population standard deviation σ and the sample size n.
   C. In order to construct a confidence interval estimate of the population mean, the value of the population mean is needed.
   D. In determining the sample size n needed to estimate the population mean, n decreases as the population standard deviation σ decreases.

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E. None of above

8. Suppose we want to test $H_o : \mu = 30$ vs. $H_1 : \mu < 30$ while the population standard deviation σ is unknown. Which of the following possible sample results based on a sample of size 36 gives the strongest evidence to reject H_o in favor of H_1 at the 5% significance level?

A. $\bar{x} = 28$ and $s = 6$　　　　B. $\bar{x} = 32$ and $s = 2$
C. $\bar{x} = 26$ and $s = 9$　　　　D. $\bar{x} = 27$ and $s = 4$
E. None of the above

9. Domino's Pizza in Big Rapids, Michigan, advertises that they deliver your pizza within 15 minutes of placing an order or it is free. A sample of 25 customers is selected at random. The average delivery time in the sample was 13 minutes with a sample standard deviation of 4 minutes. Test to determine if we can infer at the 5% significance level that the population mean is less than 15 minutes.
A. Do not reject the null hypothesis. There is significant evidence to infer at the 5% significance level that the population mean is less than 15 minutes.
B. Reject the null hypothesis. There is significant evidence to infer at the 5% significance level that the population mean is less than 15 minutes.
C. Do not reject the null hypothesis. There is not enough evidence to infer at the 5% significance level that the population mean is less than 15 minutes.
D. Reject the null hypothesis. There is not enough evidence to infer at the 5% significance level that the population mean is less than 15 minutes.
E. None of above

10. Ten functionally illiterate adults were given an experimental one-week crash course in reading. Each of the ten adults was given a reading test prior to the course and another test after the course. The results are shown below. Is there enough evidence to infer at the 5% significance level that the reading scores have improved?

Adult	1	2	3	4	5	6	7	8	9	10
Score after course	48	42	43	34	50	30	43	38	41	38
Score before course	31	34	18	30	44	28	34	33	27	32

A. Reject the null hypothesis. There is significant evidence to infer at the 5% significance level that the reading scores have improved.
B. Do not reject the null hypothesis. There is significant evidence to infer at the 5% significance level that the reading scores have improved.
C. Reject the null hypothesis. There is not enough evidence to infer at the 5% significance level that the reading scores have improved.
D. Do not reject the null hypothesis. There is not enough evidence to infer at the 5% significance level that the reading scores have improved.
E. None of above

11. Three tennis players, a beginner, an intermediate, and advanced, have been randomly selected from the membership of a racquet facility club in a large city. Using the same tennis ball, each player hits ten serves, one with each of three racquet models, with the three racquet models selected randomly. The speed of each serve is measured with a machine and the result recorded. Among the models listed below, the most likely model to fit this situation is the:
A. One-way ANOVA　　　　B. Two-way ANOVA
C. Randomized block design　　D. Matched-pairs model
E. None of the above

12. A survey will be conducted to compare the grade point averages of high school students from four different school districts. Students are to be randomly selected from each of the four districts and their grade point averages recorded. The ANOVA model most likely to fit this situation is:
A. One-way ANOVA　　　　B. Two-way ANOVA
C. Randomized block design　　D. Complete 4x4 factorial design
E. None of the above

13. Which one of the following statements is true?
A. The equation: SS(Total) = SS(A)+ SS(B) + SS(AB) + SSE, applies to one-way ANOVA model.

B. The sum of squares for error is also known as the between-treatments variation.

C. In employing the randomized block design, the primary interest lies in reducing sum of squares for blocks (SSB).

D. In a two-way ANOVA, there are 4 levels for factor A, and 2 levels for factor B, and 3 observations within each cell. The number of treatments in this experiment will be 24.

E. None of above

14. In order to examine the differences in ages of teachers among five school districts, an educational statistician took random samples of six teachers' ages in each district. Test at the 5% significance level to determine if differences in teachers' ages exist among the five districts.

Source of Variation	SS	df	MS	F	P-value	F critical
Treatments	1822.133	4	455.533	11.112	0.0256	2.759
Error	1024.833	25	40.993			
Total	2846.967	29				

With the above result, which one of the following statements is true?

A. Do not reject the null hypothesis. The ages of teachers are the same.

B. Reject the null hypothesis. The ages of teachers are the same.

C. Do not reject the null hypothesis. The ages of teachers are significantly different.

D. Reject the null hypothesis. The ages of teachers are significantly different.

E. None of above

15. In testing whether the means of two normal populations are equal, summary statistics computed for two independent samples are as follows: { $n_1 = 25$, $\bar{x}_1 = 7.30$, $s_1 = 1.05$ } and { $n_2 = 25$, $\bar{x}_2 = 6.80$, $s_2 = 1.20$ }. Assume that the population variances are equal. Then, the standard error of the sampling distribution of the sample mean difference $\bar{x}_1 - \bar{x}_2$ equals to:

A. 0.1017   B. 0.3189   C. 1.1275   D. 1.2713   E. None of the above

16. The nonparametric counterpart of the parametric t-test of μ_D for matched pairs is the:

A. Friedman test   B. Kruskal-Wallis test

C. Wilcoxon sign rank test   D. Wilcoxon rank sum test   E. Run test

17. In a Wilcoxon signed rank sum test for matched pairs with $n = 32$, the rank sums of the positive and negative differences are 367.5 and 160.5, respectively. The value of the standardized test statistic z is:

A. 3.764   B. 1.882   C. 1.391   D. 1.935   E. None of the above

18. The regression line $\hat{y} = 3 + 2x$ has been fitted to the data points (4,8), (2,5), and (1,2). The sum of the squared residuals will be:

A. 7   B. 22   C. 8   D. 15   E. None of the above

19. The following sum of squares are produced: $\sum(y_i - \bar{y})^2 = 200$, $\sum(y_i - \hat{y}_i)^2 = 50$, and $\sum(\hat{y}_i - \bar{y})^2 = 150$. The percentage of the variation in y that is explained by the variation in x is:

A. 25%   B. 80%   C. 33%   D. 50%   E. None of the above

20. For a set of 20 data points, Excel has found the estimated multiple regression equation to be $\hat{y} = -8.61 + 22x_1 + 7x_2 + 28x$, and has listed the t statistic for testing the significance of each regression coefficient. Using the 5% significance level for testing whether $b_2 = 7$ differs significantly from zero, the critical region will be that the absolute value of t is greater than or equal to:

A. 2.120   B. 1.746   C. 1.337   D. 1.333   E. None of the above

21. For which of the following values of the smoothing constant w will the smoothed series catch up most quickly whenever the original time series changes direction?

A. 0.9   B. 0.8   C. 0.5   D. 0.4   E. 0.1

22. Which one of the following statements is true?

A. In trend analysis, the independent variable is time only if the equation is linear.

B. The number of time periods in centered moving average is always even.

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C. If the seasonal index for December sales is 120, this means that December sales tend to be 120% as high as the "average" month.

D. The cyclical component of a time series refers to repeating patterns that have a period of a year or less.

E. None of the above.

23. After estimating a trend model for annual time-series data, you obtain the following residual plot against time. The problem with your model is that:
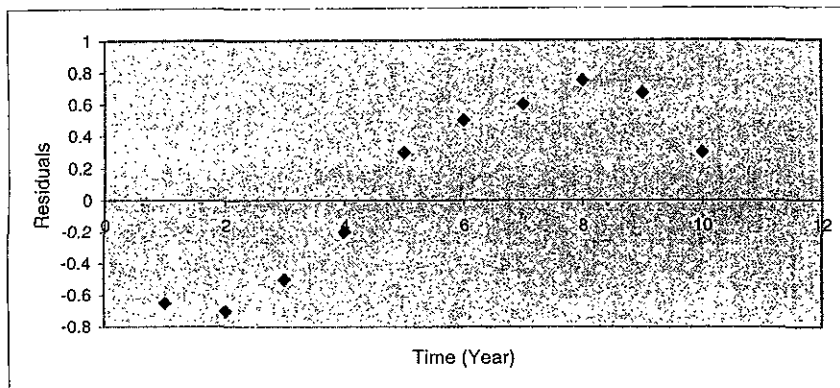
A. the seasonal component has not been accounted for

B. the cyclical component has not been accounted for

C. the trend component has not been accounted for

D. the irregular component has not been accounted for

E. None of the above.

24. The quarterly earnings of a large microcomputer company have been recorded for the years 2001-2004. These data (in millions of dollars) are shown in the accompanying table. Use an appropriate moving average to measure the quarterly variation by computing the seasonal (quarterly) indexes.

Quarter	2001	2002	2003	2004
1	60	65	68	74
2	75	83	85	90
3	93	98	102	106
4	62	69	71	75

A. The Seasonal Indexes for the four quarters are (0.873, 1.050, 1.240, 0.849)

B. The Seasonal Indexes for the four quarters are (0.851, 1.066, 1.239, 0.865)

C. The Seasonal Indexes for the four quarters are (0.845, 1.046, 1.240, 0.849)

D. The Seasonal Indexes for the four quarters are (0.856, 1.054, 1.250, 0.848)

E. None of the above.

25. The Pyramids of Giza is one of the most visited monuments in Egypt. The number of visitors per quarter has been recorded (in thousands) from 2000 to 2003. The Seasonal Indexes for the four quarters computed from the number of visitors recorded from 2000 to 2003 are (0.693, 0.892, 1.590, 0.825) and the trend line developed using the deseasonalized time series is $\hat{y} = 277.825 + 4.153t$. Use the seasonal indexes and the linear trend calculated previously to forecast the number of visitors in the next four quarters in 2004.

A. The forecast for 2004 is (303.030, 291.480, 301.887, 302.663)

B. The forecast for 2004 is (348.426, 352.579, 356.732, 360.885)

C. The forecast for 2004 is (260.32, 322.571, 498.632, 265.21)

D. The forecast for 2004 is (241.459, 314.5, 567.204, 298.091)

E. None of the above.

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二、簡答題(共 25 分)：請按照題號順序作答

1. A large carpet store wishes to determine if the brand of carpet purchased is related to the purchaser's family income. As a sampling frame, they mailed a survey to people who have a store credit card. Five hundred customers returned the survey and the results follow:

Family Income	Brand of Carpets		
	Brand A	Brand B	Brand C
High Income	65	32	32
Middle Income	80	68	104
Low Income	25	35	59

At the 5% level of significance, can you conclude that the brand of carpet purchased is related to the purchaser's family income?

(1) (2 分)Please write down the testing hypotheses.

(2) (4 分)Please choose the testing method, compute the test statistics, and make conclusion.

2. The following data were generated from a 2x2 factorial experiment with 3 replicates, where factor A levels represent two different injection procedures of an anesthetic to the occipital nerve (located in the back of the neck), and factor B levels represent two different drugs, which physicians recommend to increase the effectiveness of the injections. Three headache patients were randomly selected for each combination of injection and drug.

Source of Variation	SS	df	MS	F	P-value	F critical
Factor A	5.333	1	5.333	1.231	0.2995	5.318
Factor B	56.333	1	56.333	13.00	0.0069	5.318
Interaction	1.333	1	1.333	0.308	0.5943	5.318
Error	34.667	8	4.333			
Total	97.667	11				

(1) (4 分) Is there sufficient evidence at the 5% significance level to infer that different injection procedures results in different reaction to the three headache patients?

(2) (4 分) Is there sufficient evidence at the 5% significance level to infer that different drugs causes different reaction to the three headache patients?

(3) (4 分) Is there sufficient evidence at the 5% significance level to infer that two different drugs cause different effectiveness of the different injections?

3. The number of cases of wine sold by a winery in an 8-year period follows.

Year	1996	1997	1998	1999	2000	2001	2002	2003
# of Cases	270	356	398	456	358	500	410	376

(1) (2 分) Please compute the three year moving average sales.

(2) (2 分) Please compute the exponentially smoothed sales with $\alpha = 0.9$.

(3) (3 分) Use MAPE to compare the results of (1) and (2).

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For your references:

Table 4
Critical Values of t

Df	0.100	0.050	0.025	0.010	0.005
1	3.078	6.314	12.706	31.821	63.657
2	1.886	2.920	4.303	6.965	9.925
3	1.638	2.353	3.182	4.541	5.841
4	1.533	2.132	2.776	3.747	4.604
5	1.476	2.015	2.571	3.365	4.032
6	1.440	1.943	2.447	3.143	3.707
7	1.415	1.895	2.365	2.998	3.499
8	1.397	1.860	2.306	2.896	3.355
9	1.383	1.833	2.262	2.821	3.250
10	1.372	1.812	2.228	2.764	3.169
11	1.363	1.796	2.201	2.718	3.106
12	1.356	1.782	2.179	2.681	3.055
13	1.350	1.771	2.160	2.650	3.012
14	1.345	1.761	2.145	2.624	2.977
15	1.341	1.753	2.131	2.602	2.947
16	1.337	1.746	2.120	2.583	2.921
17	1.333	1.740	2.110	2.567	2.898
18	1.330	1.734	2.101	2.552	2.878
19	1.328	1.729	2.093	2.539	2.861
20	1.325	1.725	2.086	2.528	2.845
21	1.323	1.721	2.080	2.518	2.831
22	1.321	1.717	2.074	2.508	2.819
23	1.319	1.714	2.069	2.500	2.807
24	1.318	1.711	2.064	2.492	2.797
25	1.316	1.708	2.060	2.485	2.787
26	1.315	1.706	2.056	2.479	2.779
27	1.314	1.703	2.052	2.473	2.771
28	1.313	1.701	2.048	2.467	2.763
29	1.311	1.699	2.045	2.462	2.756
30	1.310	1.697	2.042	2.457	2.750
35	1.306	1.690	2.030	2.438	2.724
40	1.303	1.684	2.021	2.423	2.704
45	1.301	1.679	2.014	2.412	2.690
50	1.299	1.676	2.009	2.403	2.678
60	1.296	1.671	2.000	2.390	2.660
70	1.294	1.667	1.994	2.381	2.648
80	1.292	1.664	1.990	2.374	2.639
90	1.291	1.662	1.987	2.368	2.632
100	1.290	1.660	1.984	2.364	2.626
120	1.289	1.658	1.980	2.358	2.617
140	1.288	1.656	1.977	2.353	2.611
150	1.287	1.654	1.975	2.350	2.607
180	1.286	1.653	1.973	2.347	2.603
200	1.286	1.653	1.972	2.345	2.601
Infinity	1.282	1.645	1.960	2.326	2.576

Table 5
Critical Values of Chi-square

Df	0.995	0.990	0.975	0.900	0.100	0.050	0.025	0.010	0.005
1	0.0000393	0.0001571	0.0009821	0.0157908	2.70554	3.84146	5.02389	6.63490	7.87944
2	0.0100251	0.0201007	0.0506356	0.2107210	4.60517	5.99146	7.37776	9.21034	10.59663
3	0.071722	0.114832	0.215795	0.5843744	6.25139	7.81473	9.34840	11.34487	12.83816
4	0.206989	0.297109	0.484419	1.06362	7.77944	9.48773	11.14329	13.27670	14.86026
5	0.411742	0.554298	0.831212	1.61031	9.23636	11.07050	12.83250	15.08627	16.74960
6	0.675727	0.872090	1.23734	2.20413	10.6446	12.5916	14.4494	16.8119	18.5476
7	0.989256	1.23904	1.68987	2.83311	12.0170	14.0671	16.0128	18.4753	20.2777
8	1.34441	1.64650	2.17973	3.48954	13.3616	15.5073	17.5345	20.0902	21.9550
9	1.73493	2.08790	2.70039	4.16816	14.6837	16.9190	19.0228	21.6660	23.5894
10	2.15586	2.55821	3.24697	4.86518	15.9872	18.3070	20.4832	23.2093	25.1882
11	2.60322	3.05348	3.81575	5.57778	17.2750	19.6751	21.9200	24.7250	26.7568
12	3.07382	3.57057	4.40379	6.30380	18.5493	21.0261	23.3367	26.2170	28.2995
13	3.56503	4.10692	5.00875	7.04150	19.8119	22.3620	24.7356	27.6882	29.8195
14	4.07467	4.66043	5.62873	7.78953	21.0641	23.6848	26.1189	29.1412	31.3193
15	4.60092	5.22935	6.26214	8.54676	22.3071	24.9958	27.4884	30.5779	32.8013
16	5.14221	5.81221	6.90766	9.31224	23.5418	26.2962	28.8454	31.9999	34.2672
17	5.69722	6.40776	7.56419	10.08519	24.7690	27.5871	30.1910	33.4087	35.7185
18	6.26480	7.01491	8.23075	10.86494	25.9894	28.8693	31.5264	34.8053	37.1565
19	6.84397	7.63273	8.90652	11.65091	27.2036	30.1435	32.8523	36.1909	38.5823
20	7.43384	8.26040	9.59078	12.44261	28.4120	31.4104	34.1696	37.5662	39.9968
21	8.03365	8.89720	10.28290	13.23960	29.6151	32.6706	35.4789	38.9322	41.4011
22	8.64272	9.54249	10.98232	14.04149	30.8133	33.9244	36.7807	40.2894	42.7957
23	9.26042	10.1957	11.68855	14.84796	32.0069	35.1725	38.0756	41.6384	44.1813
24	9.88623	10.8564	12.40115	15.65868	33.1962	36.4150	39.3641	42.9798	45.5585
25	10.5197	11.5240	13.11972	16.47341	34.3816	37.6525	40.6465	44.3141	46.9279
26	11.1602	12.1981	13.84391	17.29189	35.5632	38.8851	41.9232	45.6417	48.2899
27	11.8076	12.8785	14.57338	18.11390	36.7412	40.1133	43.1945	46.9629	49.6449
28	12.4613	13.5647	15.30786	18.93924	37.9159	41.3371	44.4608	48.2782	50.9934
29	13.1211	14.2565	16.04707	19.76774	39.0875	42.5570	45.7223	49.5879	52.3356
30	13.7867	14.9535	16.79077	20.59923	40.2560	43.7730	46.9792	50.8922	53.6720
40	20.7065	22.1643	24.43304	29.05052	51.8051	55.7585	59.3417	63.6907	66.7660
50	27.9907	29.7067	32.35736	37.68865	63.1671	67.5048	71.4202	76.1539	79.4900
60	35.5345	37.4849	40.48175	46.45889	74.3970	79.0819	83.2977	88.3794	91.9517
70	43.2752	45.4417	48.75757	55.32894	85.5270	90.5312	95.0232	100.4252	104.2149
80	51.1719	53.5401	57.15317	64.27785	96.5782	101.8795	106.6286	112.3288	116.3211
90	59.1963	61.7541	65.64662	73.29109	107.565	113.145	118.136	124.116	128.299
100	67.3276	70.0649	74.22193	82.35814	118.498	124.342	129.561	135.807	140.169

Table 3
Normal Probability

Z	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	0.2967	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	0.3531	0.3554	0.3577	0.3599	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	0.4608	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
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990

試題隨卷繳回