國立成功大學

113學年度碩士班招生考試試題

編　號：235

系　所：企業管理學系

科　目：統計學

日　期：0202

節　次：第 3 節

備　註：不可使用計算機

編號： 235

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※ 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。

Part A　Please choose the best answer for each question and show the answers in order.
Totally 80 points / 5 points for each question

1. 11 samples are randomly selected from the production line and their weights(g) were measured. The values are 20, 20, 21, 22, 22, 23, 24, 24, 25, 25, and 26, respectively. Which of the following options has the smallest sum?

   (A) $\sum_{i=1}^{11}|X_i-20|$　(B) $\sum_{i=1}^{11}|X_i-26|$　(C) $\sum_{i=1}^{11}|X_i-22.91|$　(D) $\sum_{i=1}^{11}|X_i-23|$

2. Descriptive statistics can be generally separated into two categories, which are location measurements and variation measurements. How many of the following common descriptive statistics are belong to variation measurements? Average, Standard deviation, Median, Range, IQR, Maximum value, Minimum value, Mode

   (A) 1　(B) 2　(C) 3　(D) 4

3. A teacher wants to know the approval rating of 70 students in the class for a certain candidate. In addition to anonymous, the survey will be conducted by using two-questionnaires, Q1 and Q2. A student will only receive either Questionnaire_Q1 or Questionnaire_Q2. The contents of the questionnaires are as follows respectively:

   Questionnaire_Q1— I support this candidate.

   If the student who received this questionnaire and support this candidate, he or she will put a "V" as an answer; if he or she does not support this candidate, he or she put a "X".

   Questionnaire_Q2— I don't support this candidate.

   If the student who received this questionnaire and "does not" support this candidate, he or she will put a "V" as an answer; if he or she supports this candidate, he or she put a "X".

   The teacher distributes 42 serves of Questionnaire_Q1 and 28 serves of Questionnaire_Q2. Among the returning answers, there are 34 "V" and 36 "X". What is the approximate rate of this candidate in this class?

   (A) 13%　(B) 23%　(C) 33%　(D) 43%

4. The probability distribution of the discrete random variable x is $p(x)=kr^x$; $0 < r < 1$. Find the appropriate value for k if x = 0, 1, ...

   (A) k=1-r　(B) k= r-1　(C) $k=\frac{1}{1-r}$　(D) $k=\frac{1}{r-1}$

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5. An insurance broker is trying to sell long-term care insurance and disability insurance to his health insurance clients. From past selling experience, he has determined the following joint probability distribution for the number of long-term insurance, X, purchased by a customer buying the health insurance, and the number of disability insurance, Y, purchased by a customer buying the health insurance.

Joint Probability Distribution		X (long-term insurance)	
		0 (not to buy)	1 (to buy)
Y (disability insurance)	0 (not to buy)	0.36	0.24
	1 (to buy)	0.24	0.16

Based on the distribution, which of the following statements is true?

(A) X and Y are positively correlated.

(B) X and Y are independent.

(C) Covariance(X, Y) < 0.

(D) X and Y are not independent identically distributed random variables.

6. On average, a certain intersection occurs four traffic accidents per hour with Poisson distribution. Which of the following statements is true?

(A) The probability that there will be no traffic accidents for an hour is $4e^{-4}$.

(B) The probability that a traffic accident occurring within half hour is $0.5\ e^{-4}$.

(C) The probability that two traffic accidents occurring in 15 minutes is $0.5e^{-1}$.

(D) It has been an hour without a traffic accident. The probability that there will be no traffic accident in the next 15 minutes is $2e^{-1}$.

7. Assume the random variable X follows normal distribution. If we know that $\Pr(X \geq 28)$ is roughly equal to 0.023 and $\Pr(x \leq 16)$ is roughly equal to 0.16, the mean (μ) and standard deviation (σ) of X should be (please refer to Appendix I)

(A) μ = 20 , σ= 4　　(B) μ = 20 , σ= 2　　(C) μ = 12 , σ= 4　　(D) μ = 12 , σ= 2

8. A store of air conditioners offers a two-year warranty. If the air conditioner fails for any reason during this period, it is replaced. The time to failure of the air conditioner can be modeled by the following probability distribution:

$$f(x) = 0.075e^{-0.075x}, x > 0$$

What the percentage of the air conditioners will fail within the warranty period?

(A) $1 - e^{-0.075}$　　(B) $1 - e^{-0.150}$　　(C) $e^{-0.075}$　　(D) $e^{-0.150}$

9. The following numbers are the weights(g) of five candies, 8, 8, 10, 12,and 12, respectively. If two candies are randomly selected without replacement, the expected value and variation of the average weights ($\bar{x}$) of the two candies are

(A) $E(\bar{x})=10$; $Var(\bar{x})=4.0$;　(B) $E(\bar{x})=10$; $Var(\bar{x})=3.2$;

(C) $E(\bar{x})=10$; $Var(\bar{x})=1.2$;　(D) $E(\bar{x})=10$; $Var(\bar{x})=1.0$;

10. Consider the following statement made by a technician: "If the production process is such that the population proportion of defective cables being produced reamins constant, then the proportion of defective cables in the samples of 100 that are selected each day will also be constant." Do you agree with this statements?

(A) Agree— If the population proportion remains constant the sample proportion should also remain constant.

(B) Disagree— Each sample of size 100 will not result in a constant percentage due to sampling variation.

(C) Agree— The sample proportion will center around the population proportion.

(D) Disagree— The sample proportions taken from multiple samples of size 100 will never be equivalent.

11. & 12.

In a market survey of breakfast cereal flavors, we plan to know that proportion of customers preferred the strawberry flavor. When the level of significant is set at 0.05, and the sampling error of population proportion is controlled at 0.03, please answer question 11 and 12 as follows.

11. Usually, there are 30% of cusromers like strawberry-flafored products. In this condition, the sample size can be estimated approximately

(A) 900.　(B) 950.　(C) 1000.　(D) 1050.

12. If the survey does not consider the preference ratio of customers for strawberry-flavored products, what is the optimal number of sample size?

(A) 900　(B) 950　(C) 1000　(D) 1050

13~16

Scientists at a hospital laboratory selected 52 subjects from the local population of obese adults. They randomly assigned 31 to the A-Program diet project and 21 to the B-Program diet project. The following table shows the average weight loss and standard deviation (SD) of participants in two diet programs respectively during the project period. Do the results show that the A-Program is worth the extra effort and produces 5 more pounds of weight loss at $\alpha = 0.05$?

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	samples	average	SD
A-Prrogram	n_A =31	18	6
B-Program	n_B =21	12	4

Assume $\sigma_A = \sigma_B$, please answer the questions from 13 to 16

13. Which hypothesis form is suitable for the test according to the description?

(A) $\begin{cases}\mu_A - \mu_B \le 5 \\ \mu_A - \mu_B > 5\end{cases}$　(B) $\begin{cases}\mu_A - \mu_B \ge 5 \\ \mu_A - \mu_B < 5\end{cases}$　(C) $\begin{cases}\mu_A - \mu_B < 5 \\ \mu_A - \mu_B \ge 5\end{cases}$　(D) $\begin{cases}\mu_A - \mu_B \le 0 \\ \mu_A - \mu_B > 0\end{cases}$

14. The test statistic is roughly equal to

(A) 4.0120　(B) 3.2021　(C) 1.3251　(D) 0.6687

(If S_P = 5.2915; $\sqrt{\frac{1}{n_A}+\frac{1}{n_B}}$ = 0.2826; $t_{0.05,\,50}$ =1.676; $t_{0.025,\,50}$ = 2.009)

15. The confidence interval (CI) of $\mu_A - \mu_B$ in this test should be

(A) (3.50, 8.51)　(B) (-∞, 8.51)　(C) (3.50, ∞)　(D) (-∞, 9.00)

16. According to questions 13, 14, and 15, which of the following conclusion is the best?

(A) Since the test statistic < $t_{0.05,\,50}$, we don't have sufficient evidence to accept H_0.

(B) Since the test statistic > $t_{0.025,\,50}$, we have sufficient evidence to reject H_0.

(C) Since 0 is exclued from CI, we have sufficient evidence to reject H_0.

(D) Since 5 is included in CI, we have sufficient evidence to accept H_0.

Part B　Totally 20 Points/ 2 points for each blank

A survey company wants to know whether the brand and packaging of instant noodles will affect the sales. Therefore, the company conducts research on the hourly sales volume of three brands (B1, B2, B3) and four packages (P1, P2, P3, P4). The table below shows the survey results:

	Brand (i)			$Y_{.j}$
Package (j)	B1	B2	B3	
P1	8	3	5	16
P2	6	2	4	12
P3	7	4	4	15
P4	9	3	5	17
$Y_{i.}$	30	12	18	$y_{..}$ = 60

$\Sigma\Sigma y_{ij}^2$=350; $\sum_{i=1}^{3} y_{i.}^2$=1368; $\sum_{j=1}^{4} y_{.j}^2$=914

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Answer the blanks from (1) to (10) in order.

(A) Please complete the following ANOVA table and show your answers in order. (3 decimals)

ANOVA Table

Source	SS	df	MS	F
Brand	(1)	(3)	(5)	37.8
Package	4.667	(4)	(6)	2.8
Error	(2)	6	(7)	
Total	50	11		

(B) If you want to conduct a hypothesis test to understand whether different packaging will affect the sales, how can you construct the null hypothesis (8) and alternative hypothesis (9)? Consider to appendix II, what is your conclusion (10)?

H_0: (8)

H_1: (9)

Conclusion: (10)

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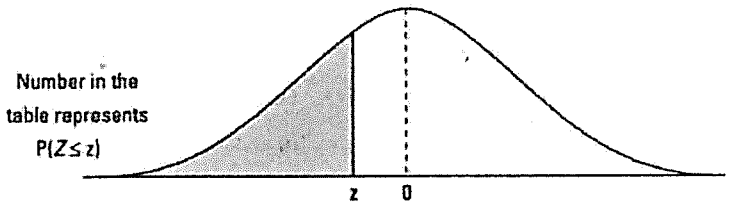
Appendix I



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-3.5	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002
-3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
-3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
-3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
-3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
-3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
-2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
-2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
-2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
-2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
-2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
-2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
-2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
-2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
-2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
-2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
-1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
-1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
-1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
-1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
-1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
-1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
-1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
-1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
-1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
-1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
-0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
-0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
-0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
-0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
-0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
-0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
-0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
-0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
-0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
-0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

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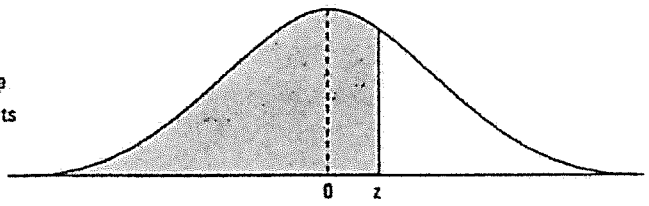
Appendix I (Continue)



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0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.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
3.5	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998
3.6	.9998	.9998	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999

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Appendix II

$F_{0.05,\,v_1,\,v_2}$

v_2 \ v_1	Degrees of freedom for the numerator (v_1)																		
Degrees of freedom for the denominator (v_2)	1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5	241.9	243.9	245.9	248.0	249.1	250.1	251.1	252.2	253.3	254.3
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38	19.40	19.41	19.43	19.45	19.45	19.46	19.47	19.48	19.49	19.50
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.74	8.70	8.66	8.64	8.62	8.59	8.57	8.55	8.53
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.91	5.86	5.80	5.77	5.75	5.72	5.69	5.66	5.63
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.68	4.62	4.56	4.53	4.50	4.46	4.43	4.40	4.36
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.00	3.94	3.87	3.84	3.81	3.77	3.74	3.70	3.67
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.57	3.51	3.44	3.41	3.38	3.34	3.30	3.27	3.23
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.28	3.22	3.15	3.12	3.08	3.04	3.01	2.97	2.93
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.07	3.01	2.94	2.90	2.86	2.83	2.79	2.75	2.71
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.91	2.85	2.77	2.74	2.70	2.66	2.62	2.58	2.54
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.79	2.72	2.65	2.61	2.57	2.53	2.49	2.45	2.40
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.69	2.62	2.54	2.51	2.47	2.43	2.38	2.34	2.30
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.60	2.53	2.46	2.42	2.38	2.34	2.30	2.25	2.21
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.53	2.46	2.39	2.35	2.31	2.27	2.22	2.18	2.13
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.48	2.40	2.33	2.29	2.25	2.20	2.16	2.11	2.07
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.42	2.35	2.28	2.24	2.19	2.15	2.11	2.06	2.01
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49	2.45	2.38	2.31	2.23	2.19	2.15	2.10	2.06	2.01	1.96
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.34	2.27	2.19	2.15	2.11	2.06	2.02	1.97	1.92
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38	2.31	2.23	2.16	2.11	2.07	2.03	1.98	1.93	1.88
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35	2.28	2.20	2.12	2.08	2.04	1.99	1.95	1.90	1.84
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37	2.32	2.25	2.18	2.10	2.05	2.01	1.96	1.92	1.87	1.81
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30	2.23	2.15	2.07	2.03	1.98	1.94	1.89	1.84	1.78
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32	2.27	2.20	2.13	2.05	2.01	1.96	1.91	1.86	1.81	1.76
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25	2.18	2.11	2.03	1.98	1.94	1.89	1.84	1.79	1.73
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28	2.24	2.16	2.09	2.01	1.96	1.92	1.87	1.82	1.77	1.71
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22	2.15	2.07	1.99	1.95	1.90	1.85	1.80	1.75	1.69
27	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.31	2.25	2.20	2.13	2.06	1.97	1.93	1.88	1.84	1.79	1.73	1.67
28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24	2.19	2.12	2.04	1.96	1.91	1.87	1.82	1.77	1.71	1.65
29	4.18	3.33	2.93	2.70	2.55	2.43	2.35	2.28	2.22	2.18	2.10	2.03	1.94	1.90	1.85	1.81	1.75	1.70	1.64
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.09	2.01	1.93	1.89	1.84	1.79	1.74	1.68	1.62
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	2.00	1.92	1.84	1.79	1.74	1.69	1.64	1.58	1.51
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1.99	1.92	1.84	1.75	1.70	1.65	1.59	1.53	1.47	1.39
120	3.92	3.07	2.68	2.45	2.29	2.17	2.09	2.02	1.96	1.91	1.83	1.75	1.66	1.61	1.55	1.55	1.43	1.35	1.25
∞	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88	1.83	1.75	1.67	1.57	1.52	1.46	1.39	1.32	1.22	1.00