國立成功大學

110學年度碩士班招生考試試題

編　號：249

系　所：企業管理學系

科　目：統計學

日　期：0203

節　次：第 3 節

備　註：不可使用計算機

※ 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 (80 marks) Each question is worth 4 marks.

Circle the best answer out of five for each question.

Refer to the following for questions 1 and 2.

The following frequency distribution displays the speeds (in km/hr) for a random sample of vehicles passing by a speed camera on Highway #1 at one spot.

speed	[40, 50)	[50, 60)	[60, 70)	[70, 80)	[80, 90)	[90, 100)	[100, 110)	[110, 120)
freq.	2	5	11	16	21	22	12	2

1. Which interval contains the median of the speeds data?

(A) It is impossible to determine with the given information.

(B) [60, 70)

(C) [70, 80)

(D) [80, 90)

(E) [90, 100)

2. The distribution of the speeds data is

(A) skewed to the right and so the median is likely greater than the mean.

(B) skewed to the left and so the median is likely greater than the mean.

(C) skewed to the right and so the median is likely less than the mean.

(D) skewed to the left and so the median is likely less than the mean.

(E) impossible to be determined with the given information.

Refer to the following for questions 3 to 5.

Let X_i, $i = 1, 2, \ldots, n$, be the number of points scored by the Tainan Unilions for each of their n home games in the 2020 Taiwan Major League baseball regular season, and suppose the points are ordered and shown as follows:

$$
\begin{array}{ccccccccccc}
0 & 1 & 1 & 2 & 2 & 2 & 2 & 2 & 2 & 2 & 2 \\
3 & 3 & 3 & 3 & 3 & 3 & 3 & 3 & 4 & 4 & 4 \\
4 & 5 & 6 & 6 & 6 & 6 & 6 & 7 & 7 & 7 & 7 \\
7 & 7 & 8 & 8 & 8 & 8 & 8 & 8 & 9 & 9 & 10 \\
10 & 10 & 10 & 10 & 11 & 12 & 12 & 14 & 15 & 15 & 15 \\
\end{array}
$$

For the number of points scored by the Unilions in the season:

3. The median and the mode, respectively, are

(A) 2 and 7　　(B) 7 and 8　　(C) 6 and 3　　(D) 3 and 6　　(E) 6 and 8

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4. The range and the interquartile range, respectively, are

   (A) 15 and 9　　(B) 15 and 7.5　　(C) 14 and 8　　(D) 15 and 6　　(E) 14 and 6.5

5. Given that $\sum X_i^2 = 2995$, what are the mean and the standard deviation, respectively?

   (A) 69/11 and $(\frac{2995-345/55}{54})^{1/2}$

   (B) 345 and $(\frac{2995-(345)^2/54}{55})^{1/2}$

   (C) 69/11 and $(\frac{2995-(345)^2/55}{54})$

   (D) 69/11 and $(\frac{2995-(345)^2/55}{54})^{1/2}$

   (E) 345 and $(\frac{2995-(345)^2/54}{55})$

6. Five students were asked to write an exam and the amount of time it took them to finish the exam were

Student	1	2	3	4	5
Time (min.)	128	125	?	160	172

   with a mean time to finish being 153 minutes. It happened that the time spent by the third student to finish the exam was not recorded.

   What would be the standard deviation if time to finish the exam was measured in hours?

   (A) It is impossible to determine with the information given.

   (B) 0.42

   (C) 0.18

   (D) 10.6

   (E) 0.58

Refer to the following for questions 7 and 8.

   Percentage grades of students who are to take the exam in a large statistics class follow a normal distribution with mean 77.5 and standard deviation 10.5.

7. What proportion of students in the class receive percentage grades between 65 and 75?

   (A) 0.265　　(B) 0.272　　(C) 0.288　　(D) 0.294　　(E) 0.305

8. The instructor of that class decides to assign a grade of $A+$ to the students with the top 9% of the grades, and a grade of A to the next best 13%. The minimum percentage grade required in order for a student to earn a grade of A is

   (A) 69.3　　(B) 78.3　　(C) 79.7　　(D) 85.7　　(E) 81.7

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9. Consider the following percentage annual return for some mutual fund,

End of Year	Rate of Return (%)
1	-2
2	-2
3	1
4	1
5	2

What is the geometric mean annual rate of return over these five years?

(A) 0%　　(B) 8%　　(C) 0.014%　　(D) 25%　　(E) 99.93%

Refer to the following for questions 10 to 11.

The electric-vehicle manufacturing company Toyota estimates that a driver who commutes 75 kilometres per day in a Model T will require a nightly charge of 1 hour and 30 minutes to recharge the vehicle's battery. Assume that the actual required time is uniformly distributed between 80 and 110 minutes to get the battery fully charged.

10. What is the probability that it will take a randomly selected vehicle less than 90 or more than 100 minutes to be fully recharged?

(A) 0.556　　(B) 0.667　　(C) 0.444　　(D) 0.333　　(E) 0.5

11. Suppose you and four other neighbours of yours each have a Model T car and all start to charge up your cars at the same time, what is the probability that exactly one of you will require between 90 and 100 minutes to fully recharge the cars?

(A) 80/81　　(B) 10/81　　(C) 10/243　　(D) 160/243　　(E) 80/243

Refer to the following for questions 12 to 14.

A receptionist of a busy law firm estimates that the number of phone calls arrive at her desk is according to a Poisson distribution at a rate of 12 calls per hour during her typical work day.

12. What is the probability of her receiving more than three calls in a 10-minute period?

(A) $1 - \sum_{i=0}^{2} \frac{2^i e^{-2}}{i!}$　　(B) $1 - \sum_{i=1}^{2} \frac{2^i e^{-2}}{i!}$　　(C) $1 - \sum_{i=0}^{2} \frac{2^i e^2}{i!}$　　(D) $\sum_{i=3}^{\infty} \frac{(12)^i e^{-12}}{i!}$　　(E) $\sum_{i=4}^{\infty} \frac{(12)^i e^{-12}}{i!}$

13. Suppose in a morning her boss asked her to keep track of each call she can complete within five minutes, she then writes down in sequence a 1 for each call completed within five minutes or a 0 otherwise. If she completed 7 calls this morning, what is the number of different ways of 0s and 1s can appear in her records for the morning?

(A) 56　　(B) 28　　(C) 128　　(D) 16　　(E) 256

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14. If each call can be completed within five minutes with probability 0.5, what is the probability that exactly 4 calls out of the 7 from Question 18 were completed within five minutes?

(A) $\dfrac{93}{128}$　　(B) $1 - \dfrac{(12)^3 e^{-12}}{3!}$　　(C) $\dfrac{2^4 e^{-2}}{4!}$　　(D) $\dfrac{(12)^4 e^{-12}}{4!}$　　(E) $\dfrac{35}{128}$

15. From each of two normally distributed populations take a random sample and measure the value of some variable for each individual in the sample. Let μ_1 be the mean of the variable of population 1 and μ_2 the mean of the variable of population 2. Some statistics concerning the samples are summarized below:

Population	sample size	sample mean	sample variance
1	10	28	36
2	15	25	25

What would be the margin of error of a 95% confidence interval for $\mu_1 - \mu_2$?

(A) $3 \pm 2.0687 \sqrt{\left(\frac{1}{10} + \frac{1}{15}\right)\frac{9\times6+14\times5}{23}}$　　　　(B) $3 \pm 2.0687 \sqrt{\left(\frac{1}{10} + \frac{1}{15}\right)\frac{9\times36+14\times25}{23}}$

(C) $-3 \pm 2.0687 \sqrt{\left(\frac{1}{10} + \frac{1}{15}\right)\frac{9\times6+14\times5}{23}}$　　　　(D) $-3 \pm 2.2622 \sqrt{\left(\frac{1}{10} + \frac{1}{15}\right)\frac{9\times36+14\times25}{23}}$

(E) $3 \pm 2.0687 \sqrt{\left(\frac{36}{10} + \frac{25}{15}\right)}$

Refer to the following for questions 16 to 17.

A hat contains 10 gold coins, 10 silver coins and 10 copper coins. We randomly select four coins from the hat, one at a time is selected without replacement. Let A be the event that the first selected coin is the only gold coin in our four selections.

16. Which of the following events is mutually exclusive of event A?

(A) second coin selected is silver

(B) no copper coins are selected

(C) third selected coin is the only silver coin

(D) same number of gold and copper coins are selected

(E) same number of silver and copper coins are selected

17. Knowing that the first selected coin is the only gold coin in our four selections, what is the probability that the other three selected are silver coins?

(A) 10/30　　(B) 1/4　　(C) 1/7200　　(D) 2/19

(E) $6300/(30 \times 30 \times 29 \times 28)$

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Refer to the following for questions 18 to 20.

From past data suppose we know the following facts about customers who shop at a particular supermarket:

- ◇ 60% buy bread
- ◇ 55% buy milk
- ◇ 45% buy eggs
- ◇ 78% buy bread or eggs
- ◇ 38% buy bread and milk
- ◇ 30% buy milk and eggs
- ◇ 19% buy all three items

18. Which of the following statements is true?

(A) A customer's decisions to buy bread and to buy milk are independent.
(B) A customer's decisions to buy bread and to buy eggs are independent.
(C) A customer's decisions to buy milk and to buy eggs are independent.
(D) all of the above
(E) none of the above

19. If we randomly select a customer, what is the probability that the customer buys none of the three items?

(A) 0.12　　(B) 0.13　　(C) 0.14　　(D) 0.15　　(E) 0.16

20. What is the probability that a customer buys milk and eggs if we know she buys bread?

(A) 0.225　　(B) 0.3167　　(C) 0.4375　　(D) 0.5283　　(E) 0.6333

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Part B (20 marks)

- You must clearly give an explanation to your answer or show all of your work in order to receive full marks.

1. Bleaching chemicals are used in the pulp and paper industry to increase the brightness of the paper that is produced. Five chemical agents were studied to determine their effect on the brightness of paper produced from pulp treated with the chemical. The data are shown below:

Agent Type	A	B	C	D	E
	86	73	91	88	76
	80	81	78	83	79
	92	85	86	75	82
	87		84	80	72
			90	85	
				77	

$\bar{x}_A = 86.25$　$\bar{x}_B = 79.67$　$\bar{x}_C = 85.8$　$\bar{x}_D = 81.33$　$\bar{x}_E = 77.25$

$s_A^2 = 24.20$　$s_B^2 = 37.33$　$s_C^2 = 27.25$　$s_D^2 = 24.30$　$s_E^2 = 18.23$

where $\bar{x}_i$ is the mean, and s_i^2 is the variance, of sampled observations treated with chemical agent i, $i = A, B, \ldots, E$.

Conduct an analysis of variance at the 5% level of significance to compare the means of the five populations.

(a) What are the null and the alternative hypothesis statements?

(b) What is the test statistic to be used and its distribution?

(c) What is the critical value for the appropriate test of significance?

(d) What are the observed test statistic and the conclusion of your test?

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Appendix 1

Table of Standard Normal cumulative distribution function $\Phi(z)$

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
-3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
-3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
-3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
-3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
-3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
-2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
-2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
-2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
-2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
-2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
-2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
-2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
-2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
-2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
-2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
-1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
-1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
-1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
-1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
-1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
-1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
-1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
-1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
-1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
-1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
-0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
-0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
-0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
-0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
-0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
-0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
-0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
-0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
-0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
-0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998

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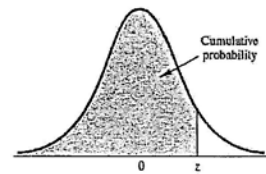
※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

Appendix 2

$t(p; df)$
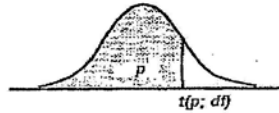
Table of $(1 - \alpha)$th quantile of Student's t-distribution

$p = 1 - \alpha$

df	0.75	0.8	0.85	0.9	0.95	0.975	0.98	0.99	0.995	0.9975	0.999
1	1.0000	1.3764	1.9626	3.0777	6.3137	12.706	15.895	31.821	63.656	127.32	318.29
2	0.8165	1.0607	1.3862	1.8856	2.9200	4.3027	4.8487	6.9645	9.9250	14.089	22.329
3	0.7649	0.9785	1.2498	1.6377	2.3534	3.1824	3.4819	4.5407	5.8408	7.4532	10.214
4	0.7407	0.9410	1.1896	1.5332	2.1318	2.7765	2.9985	3.7469	4.6041	5.5975	7.1729
5	0.7267	0.9195	1.1558	1.4759	2.0150	2.5706	2.7565	3.3649	4.0321	4.7733	5.8935
6	0.7176	0.9057	1.1342	1.4398	1.9432	2.4469	2.6122	3.1427	3.7074	4.3168	5.2075
7	0.7111	0.8960	1.1192	1.4149	1.8946	2.3646	2.5168	2.9979	3.4995	4.0294	4.7853
8	0.7064	0.8889	1.1081	1.3968	1.8595	2.3060	2.4490	2.8965	3.3554	3.8325	4.5008
9	0.7027	0.8834	1.0997	1.3830	1.8331	2.2622	2.3984	2.8214	3.2498	3.6896	4.2969
10	0.6998	0.8791	1.0931	1.3722	1.8125	2.2281	2.3593	2.7638	3.1693	3.5814	4.1437
11	0.6974	0.8755	1.0877	1.3634	1.7959	2.2010	2.3281	2.7181	3.1058	3.4966	4.0248
12	0.6955	0.8726	1.0832	1.3562	1.7823	2.1788	2.3027	2.6810	3.0545	3.4284	3.9296
13	0.6938	0.8702	1.0795	1.3502	1.7709	2.1604	2.2816	2.6503	3.0123	3.3725	3.8520
14	0.6924	0.8681	1.0763	1.3450	1.7613	2.1448	2.2638	2.6245	2.9768	3.3257	3.7874
15	0.6912	0.8662	1.0735	1.3406	1.7531	2.1315	2.2485	2.6025	2.9467	3.2860	3.7329
16	0.6901	0.8647	1.0711	1.3368	1.7459	2.1199	2.2354	2.5835	2.9208	3.2520	3.6861
17	0.6892	0.8633	1.0690	1.3334	1.7396	2.1098	2.2238	2.5669	2.8982	3.2224	3.6458
18	0.6884	0.8620	1.0672	1.3304	1.7341	2.1009	2.2137	2.5524	2.8784	3.1966	3.6105
19	0.6876	0.8610	1.0655	1.3277	1.7291	2.0930	2.2047	2.5395	2.8609	3.1737	3.5793
20	0.6870	0.8600	1.0640	1.3253	1.7247	2.0860	2.1967	2.5280	2.8453	3.1534	3.5518
21	0.6864	0.8591	1.0627	1.3232	1.7207	2.0796	2.1894	2.5176	2.8314	3.1352	3.5271
22	0.6858	0.8583	1.0614	1.3212	1.7171	2.0739	2.1829	2.5083	2.8188	3.1188	3.5050
23	0.6853	0.8575	1.0603	1.3195	1.7139	2.0687	2.1770	2.4999	2.8073	3.1040	3.4850
24	0.6848	0.8569	1.0593	1.3178	1.7109	2.0639	2.1715	2.4922	2.7970	3.0905	3.4668
25	0.6844	0.8562	1.0584	1.3163	1.7081	2.0595	2.1666	2.4851	2.7874	3.0782	3.4502
26	0.6840	0.8557	1.0575	1.3150	1.7056	2.0555	2.1620	2.4786	2.7787	3.0669	3.4350
27	0.6837	0.8551	1.0567	1.3137	1.7033	2.0518	2.1578	2.4727	2.7707	3.0565	3.4210
28	0.6834	0.8546	1.0560	1.3125	1.7011	2.0484	2.1539	2.4671	2.7633	3.0470	3.4082
29	0.6830	0.8542	1.0553	1.3114	1.6991	2.0452	2.1503	2.4620	2.7564	3.0380	3.3963
30	0.6828	0.8538	1.0547	1.3104	1.6973	2.0423	2.1470	2.4573	2.7500	3.0298	3.3852
31	0.6825	0.8534	1.0541	1.3095	1.6955	2.0395	2.1438	2.4528	2.7440	3.0221	3.3749
32	0.6822	0.8530	1.0535	1.3086	1.6939	2.0369	2.1409	2.4487	2.7385	3.0149	3.3653
33	0.6820	0.8526	1.0530	1.3077	1.6924	2.0345	2.1382	2.4448	2.7333	3.0082	3.3563
34	0.6818	0.8523	1.0525	1.3070	1.6909	2.0322	2.1356	2.4411	2.7284	3.0020	3.3480
35	0.6816	0.8520	1.0520	1.3062	1.6896	2.0301	2.1332	2.4377	2.7238	2.9961	3.3400
36	0.6814	0.8517	1.0516	1.3055	1.6883	2.0281	2.1309	2.4345	2.7195	2.9905	3.3326
37	0.6812	0.8514	1.0512	1.3049	1.6871	2.0262	2.1287	2.4314	2.7154	2.9853	3.3256
38	0.6810	0.8512	1.0508	1.3042	1.6860	2.0244	2.1267	2.4286	2.7116	2.9803	3.3190
39	0.6808	0.8509	1.0504	1.3036	1.6849	2.0227	2.1247	2.4258	2.7079	2.9756	3.3127
40	0.6807	0.8507	1.0500	1.3031	1.6839	2.0211	2.1229	2.4233	2.7045	2.9712	3.3069
50	0.6794	0.8489	1.0473	1.2987	1.6759	2.0086	2.1087	2.4033	2.6778	2.9370	3.2614
60	0.6786	0.8477	1.0455	1.2958	1.6706	2.0003	2.0994	2.3901	2.6603	2.9146	3.2317
75	0.6778	0.8464	1.0436	1.2929	1.6654	1.9921	2.0901	2.3771	2.6430	2.8924	3.2024
100	0.6770	0.8452	1.0418	1.2901	1.6602	1.9840	2.0809	2.3642	2.6259	2.8707	3.1738
∞	0.6745	0.8416	1.0364	1.2816	1.6449	1.9600	2.0537	2.3263	2.5758	2.8070	3.0

※ 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。

Appendix 3

Table of $(1 - \alpha)$th quantile of Snedecor's F-distribution with $df1$ numerator degrees of freedom and $df2$ denominator degrees of freedom
$\alpha = 0.05$

$df2$ \\ $df1$	1	2	3	4	5	6	7	8	9	10	12	15	20	∞
1	161.4476	199.5	215.7073	224.5832	230.1619	233.986	236.7684	238.8827	240.5433	241.8817	243.906	245.9499	248.0131	254.3144
2	18.5128	19	19.1643	19.2468	19.2964	19.3295	19.3532	19.371	19.3848	19.3959	19.4125	19.4291	19.4458	19.4957
3	10.128	9.5521	9.2766	9.1172	9.0135	8.9406	8.8867	8.8452	8.8123	8.7855	8.7446	8.7029	8.6602	8.5264
4	7.7086	6.9443	6.5914	6.3882	6.2561	6.1631	6.0942	6.041	5.9988	5.9644	5.9117	5.8578	5.8025	5.6281
5	6.6079	5.7861	5.4095	5.1922	5.0503	4.9503	4.8759	4.8183	4.7725	4.7351	4.6777	4.6188	4.5581	4.365
6	5.9874	5.1433	4.7571	4.5337	4.3874	4.2839	4.2067	4.1468	4.099	4.06	3.9999	3.9381	3.8742	3.6689
7	5.5914	4.7374	4.3468	4.1203	3.9715	3.866	3.787	3.7257	3.6767	3.6365	3.5747	3.5107	3.4445	3.2298
8	5.3177	4.459	4.0662	3.8379	3.6875	3.5806	3.5005	3.4381	3.3881	3.3472	3.2839	3.2184	3.1503	2.9276
9	5.1174	4.2565	3.8626	3.6331	3.4817	3.3738	3.2927	3.2296	3.1789	3.1373	3.0729	3.0061	2.9365	2.7067
10	4.9646	4.1028	3.7083	3.478	3.3258	3.2172	3.1355	3.0717	3.0204	2.9782	2.913	2.845	2.774	2.5379
11	4.8443	3.9823	3.5874	3.3567	3.2039	3.0946	3.0123	2.948	2.8962	2.8536	2.7876	2.7186	2.6464	2.4045
12	4.7472	3.8853	3.4903	3.2592	3.1059	2.9961	2.9134	2.8486	2.7964	2.7534	2.6866	2.6169	2.5436	2.2962
13	4.6672	3.8056	3.4105	3.1791	3.0254	2.9153	2.8321	2.7669	2.7144	2.671	2.6037	2.5331	2.4589	2.2064
14	4.6001	3.7389	3.3439	3.1122	2.9582	2.8477	2.7642	2.6987	2.6458	2.6022	2.5342	2.463	2.3879	2.1307
15	4.5431	3.6823	3.2874	3.0556	2.9013	2.7905	2.7066	2.6408	2.5876	2.5437	2.4753	2.4034	2.3275	2.0658
16	4.494	3.6337	3.2389	3.0069	2.8524	2.7413	2.6572	2.5911	2.5377	2.4935	2.4247	2.3522	2.2756	2.0096
17	4.4513	3.5915	3.1968	2.9647	2.81	2.6987	2.6143	2.548	2.4943	2.4499	2.3807	2.3077	2.2304	1.9604
18	4.4139	3.5546	3.1599	2.9277	2.7729	2.6613	2.5767	2.5102	2.4563	2.4117	2.3421	2.2686	2.1906	1.9168
19	4.3807	3.5219	3.1274	2.8951	2.7401	2.6283	2.5435	2.4768	2.4227	2.3779	2.308	2.2341	2.1555	1.878
20	4.3512	3.4928	3.0984	2.8661	2.7109	2.599	2.514	2.4471	2.3928	2.3479	2.2776	2.2033	2.1242	1.8432
21	4.3248	3.4668	3.0725	2.8401	2.6848	2.5727	2.4876	2.4205	2.366	2.321	2.2504	2.1757	2.094	1.8117
22	4.3009	3.4434	3.0491	2.8167	2.6613	2.5491	2.4638	2.3965	2.3419	2.2967	2.2258	2.1508	2.0707	1.7831
23	4.2793	3.4221	3.028	2.7955	2.64	2.5277	2.4422	2.3748	2.3201	2.2747	2.2036	2.1282	2.0476	1.767
24	4.2597	3.4028	3.0088	2.7763	2.6207	2.5082	2.4226	2.3551	2.3002	2.2547	2.1834	2.1077	2.0267	1.733
25	4.2417	3.3852	2.9912	2.7587	2.603	2.4904	2.4047	2.3371	2.2821	2.2365	2.1649	2.0889	2.0075	1.711
26	4.2252	3.369	2.9752	2.7426	2.5868	2.4741	2.3883	2.3205	2.2655	2.2197	2.1479	2.0716	1.9898	1.6906
27	4.21	3.3541	2.9604	2.7278	2.5719	2.4591	2.3732	2.3053	2.2501	2.2043	2.1323	2.0558	1.9736	1.6717
28	4.196	3.3404	2.9467	2.7141	2.5581	2.4453	2.3593	2.2913	2.236	2.19	2.1179	2.0411	1.9586	1.6541
29	4.183	3.3277	2.934	2.7014	2.5454	2.4324	2.3463	2.2783	2.2229	2.1768	2.1045	2.0275	1.9446	1.6376
30	4.1709	3.3158	2.9223	2.6896	2.5336	2.4205	2.3343	2.2662	2.2107	2.1646	2.0921	2.0148	1.9317	1.6223
40	4.0847	3.2317	2.8387	2.606	2.4495	2.3359	2.249	2.1802	2.124	2.0772	2.0035	1.9245	1.8389	1.5089
60	4.0012	3.1504	2.7581	2.5252	2.3683	2.2541	2.1665	2.097	2.0401	1.9926	1.9174	1.8364	1.748	1.3893
120	3.9201	3.0718	2.6802	2.4472	2.2899	2.175	2.0868	2.0164	1.9588	1.9105	1.8337	1.7505	1.6587	1.2539
∞	3.8415	2.9957	2.6049	2.3719	2.2141	2.0986	2.0096	1.9384	1.8799	1.8307	1.7522	1.6664	1.5705	1