國立中央大學103學年度碩士班考試入學試題卷

所別：營建管理研究所碩士班 不分組(一般生)　科目：工程經濟與統計　共 2 頁 第 1 頁

本科考試可使用計算器，廠牌、功能不拘　＊請在試卷答案卷（卡）內作答

I. Engineering Statistics (50 points)

1. The student union of ABC University plans to inquire some students their opinions about on-campus parking. The university provides a list of the 10,000 enrolled students to serve as a sampling frame. Please concisely answer the following questions. (20 points, 5 points each)
   (a) How would you choose a simple random sample of 100 students?
   (b) How would you choose a systematic sample of 100 students?
   (c) The list also shows whether students live on campus (4,000 students) or off campus (6,000 students). How would you choose a stratified random sample of 25 on-campus students and 75 off-campus students?
   (d) Compare these three sampling methods and briefly discuss the advantages and disadvantages of each method.

2. The sick-leave time of employees in a construction company in a month is normally distributed with a mean of 100 hours and standard deviation of 20 hours. Use the following standardized normal distribution function table to answer the two questions below. (10 points, 5 points each)
   (a) What is the probability that the sick-leave time for next month will be between 62 and 80 hours?
   (b) How much time should be budgeted for sick leave if the budgeted amount should be exceeded with a probability of only 10%?

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
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	0.7703	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

3. An engineer randomly samples and tests 6 CNS560 SD420 concrete reinforcing bars and obtains their tensile strength as follows: 651, 636, 655, 655, 658, and 647 N/mm^2. Please calculate the median, sample mean, sample standard deviation, range and coefficient of variation (write out the detailed calculation steps and formula used together with your answers). (10 points, 2 points each)

4. Data for 20 (x,y) pairs with hours of machine use as the x variable and millimeters deviating from the target as the y variable are shown in the following table. (10 points, 6 points for question (a) and 4 points for question (b))

Sample Number	Hours of Machine Use	Deviation Distance (mm)	Sample Number	Hours of Machine Use	Deviation Distance (mm)
1	30	1.10	11	40	1.38
2	31	1.21	12	41	1.35
3	32	1.00	13	42	1.38
4	33	1.21	14	43	1.38
5	34	1.25	15	44	1.4
6	35	1.23	16	45	1.42
7	36	1.24	17	46	1.45
8	37	1.28	18	47	1.45
9	38	1.30	19	48	1.5
10	39	1.30	20	49	1.58

   (a) Determine if there is a relationship between the two variables by drawing a scatter diagram.
   (b) Draw a line for the data using eyesight only and estimate the number of millimeters deviating from the target at 56 hours.

參考用

注意：背面有試題

II. Engineering Economy (50 points)

A college graduated freshman wants to start his career with a small business. There are 2 types of businesses that are attractive to him: Alternative A is a fried chicken vendor and Alternative B is a clothing vendor. The compounding period used for computation is on the basis of year. The cashflows in Year 0 are costs of facilities/equipment which have no salvage value in the end of their study periods. Given that his minimum attractive rate of return (MARR) is set to 10%, the estimated information for both types of business is listed as follows.

Alternative	Cashflow (0 year)	Cashflow (1st year)	Cashflow (2nd year)	Cashflow (3rd year)	Cashflow (4th year)	Cashflow (5th year)	Cashflow (6th year)	Cashflow (7th year)	Study period
A	-$800	$300	$300	$200	$200	$200	$200	$200	7 years
B	-$1000	$400	$400	$400	$400	-	-	-	4 years

Please answer the following questions:

(a) If performing a comparison for these two alternatives, which assumption should he use to compare these two alternatives (5 pt.)? Explain why (5 pt.).
(b) Calculate the Internal Rate of Return (IRR) for Alternative A and the External rate of return (ERR) for Alternative B if ε = MARR. Please round up the answers to the integral (20 pt.).
(c) Determine which alternative is better (10 pt.).
(d) With the use of 200% DB switchover to SL, please tabulate the annual depreciation amounts for the better alternative obtained from (c) (10 pt.).

** To find Present value given Future value (P/F) at the first 10 years, discount rate:

	i=2%	*i*=3%	*i*=4%	*i*=5%	*i*=6%	*i*=8%	*i*=10%	*i*=12%	*i*=15%
Year 1	.9804	.9709	.9615	.9524	.9434	.9259	.9091	.8929	.8696
Year 2	.9612	.9426	.9246	.9070	.8900	.8573	.8264	.7972	.7561
Year 3	.9423	.9151	.8890	.8638	.8396	.7938	.7513	.7118	.6575
Year 4	.9238	.8885	.8548	.8227	.7921	.7350	.6830	.6355	.5718
Year 5	.9057	.8626	.8219	.7835	.7473	.6806	.6209	.5674	.4972
Year 6	.8880	.8375	.7903	.7462	.7050	.6302	.5645	.5066	.4323
Year 7	.8706	.8131	.7599	.7107	.6651	.5835	.5132	.4523	.3759
Year 8	.8535	.7894	.7307	.6768	.6274	.5403	.4665	.4039	.3269
Year 9	.8368	.7664	.7026	.6446	.5919	.5002	.4241	.3606	.2843
Year 10	.8203	.7441	.6756	.6139	.5584	.4632	.3855	.3220	.2472

** To find Present value given Annuity (P/A) at the first 10 years discount rate:

	i=2%	*i*=3%	*i*=4%	*i*=5%	*i*=6%	*i*=8%	*i*=10%	*i*=12%	*i*=15%
Year 1	0.9804	0.9709	0.9615	0.9524	0.9434	0.9259	0.9091	0.8929	0.8696
Year 2	1.9416	1.9135	1.8861	1.8594	1.8334	1.7833	1.7355	1.6901	1.6257
Year 3	2.8839	2.8286	2.7751	2.7232	2.6730	2.5771	2.4869	2.4018	2.2832
Year 4	3.8077	3.7171	3.6299	3.5460	3.4651	3.3121	3.1699	3.0373	2.8550
Year 5	4.7135	4.5797	4.4518	4.3295	4.2124	3.9927	3.7908	3.6048	3.3522
Year 6	5.6014	5.4172	5.2421	5.0757	4.9173	4.6229	4.3553	4.1114	3.7845
Year 7	6.4720	6.2303	6.0021	5.7864	5.5824	5.2064	4.8684	4.5638	4.1604
Year 8	7.3255	7.0197	6.7327	6.4632	6.2098	5.7466	5.3349	4.9676	4.4873
Year 9	8.1622	7.7861	7.4353	7.1078	6.8017	6.2469	5.7590	5.3282	4.7716
Year 10	8.9826	8.5302	8.1109	7.7217	7.3601	6.7101	6.1446	5.6502	5.0188