

國立中央大學102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

參考用

I. 工程統計 (共五十分)

- 一、某道路工程之邊溝共鋪設 500 塊預鑄混凝土蓋版，施工規範規定每 100 塊應抽一塊檢驗鑽心抗壓強度，請從下列之隨機亂數表第一行、第一列之 7 開始，分別以簡單隨機抽樣、分層隨機抽樣與系統抽樣決定抽樣之塊號(9 分)，並比較三種方法的優缺點(3 分)(註：蓋版由 1 起依序編號至 500)。

73676	47150	99400	01927	27754	42648	82425	36290	45467	71709	77558
00095	32863	29485	82226	90056	52711	38889	93074	60227	40011	85848
48767	52573	95592	94007	69971	91481	60779	53791	17297	59335	68417
35013	15529	72765	85089	57067	50211	47487	19223	90534	05756	28713

- 二、某工程師對 40 個養護完成之混凝土圓錐試體進行抗壓強度試驗，所得結果如下表所示(單位為 kgf/cm^2)。

- 請計算測試結果之平均值、眾數、中位數與標準差。(8 分)
- 請繪製(1)次數分配表(表中需包括組下限、組上限、組中值、次數、相對次數百分比、累積相對次數百分比)、(2)直方圖、與(3)累積次數分配圖。(次數分配表 8 分，直方圖與累積次數分配圖各 4 分)

210	181	175	188	200	186	206	202
178	182	200	192	182	175	194	196
179	204	201	178	195	190	203	179
186	209	198	208	182	187	199	193
209	181	194	188	200	186	206	202

- 三、某材料生產工廠，每天自所生產材料中抽樣量測 3 個產品的重量，連續進行了 20 天，所得數據如下表所示(單位為 kg)。(共 14 分)

- 請利用表中第 1-10 天之數據，分別計算平均值與全距的管制上限(UCL)、中心線(CL)及管制下限(LCL)(計算所需之係數請參見附表)。(6 分)
- 請將 20 天之數據，與上題計算所得之 UCL、CL 及 LCL，繪入平均值-全距管制圖內。(6 分)
- 請進行判讀且將異常部分圈出，並簡要說明應採取措施為何。(2 分)

Day	X ₁	X ₂	X ₃	Day	X ₁	X ₂	X ₃
1	33	34	37	11	36	34	34
2	32	33	32	12	35	36	33
3	34	33	32	13	31	29	28
4	31	32	31	14	33	34	33
5	34	35	32	15	35	34	32
6	32	32	35	16	31	40	34
7	34	34	32	17	31	34	35
8	31	31	34	18	40	32	32
9	30	34	31	19	34	36	34
10	32	35	34	20	34	35	32

每組樣本數 n	管制圖係數		
	A ₂	D ₃	D ₄
2	1.880	0	3.267
3	1.023	0	2.575
4	0.729	0	2.282
5	0.577	0	2.115
6	0.483	0	2.004
7	0.419	0.076	1.924
8	0.373	0.136	1.864
9	0.337	0.184	1.816
10	0.308	0.223	1.777

注意：背面有試題

參考用

II. Engineering Economy (50 points)

Before considering replacing a current facility with a new one, an analyst needs to carry out some analyses for the facility. Table 1 lists estimated information based on the base year of 2012 (= Year 0). Assuming that the before-tax minimum attractive rate of return (MARR) is at 10%, the inflation rate (f) for recent years is estimated to be 3%, and the total price escalation (e) for recent years is estimated to be 6.09%, cost of capital for market value (MV) loss in the beginning of each year is set to equal to MARR, and tax rate is 5%, please complete the following analyses:

Table 1: Information for current facility

End of year	MV, end of year k	Annual expenses
2012	60000	0
2013	35000	4000
2014	20000	5000
2015	10000	6000
2016	6000	8000
2017	3000	12000
2018	0	16000

- (1) Determine the differential price inflation (e') (5 pt).
- (2) Calculate the before-tax annual cashflows in real dollars (10 pt).
- (3) Tabulate the before-tax annual Total marginal Cost (TC) (10 pt) and Equivalent Uniform Annual Cost (EUAC) for the facility in actual dollars (20 pt).
- (4) According to the results obtained from (3), which year end is the best time to replace the facility (5 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

注意：背面有試題