國立中央大學105學年度碩士班考試入學試題

所別： 營建管理研究所 碩士班 不分組(一般生)　　共3頁 第1頁

科目： 工程經濟與統計

本科考試可使用計算器，廠牌、功能不拘　　＊請在答案卷(卡)內作答

I. 工程統計（50分）

一、簡答題(共10分)

1. 抽樣是取得數據資料的重要方法，請問如何降低抽樣過程產生的偏差(bias)與變異性(variability)？(4分)
2. 品質管制工作常使用到控制圖(control chart)，請問繪製控制圖需要計算什麼資訊？控制圖實務應用上的意義為何？(6分)

二、某工程師使用加速試驗測量一個電子元件的壽命，得到40筆實驗結果(如下表，單位為天)(共25分)

127	125	131	124	129	121	142	151
160	125	124	123	120	119	128	133
137	124	142	123	121	136	140	137
125	124	128	129	130	122	118	131
125	133	141	125	140	131	129	126

1. 請分別使用3個統計量說明測量結果之集中趨勢(central tendency)與離散程度(dispersion)。(12分)
2. 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5分，直方圖與累積次數分配圖各4分，共13分)

三、某大學全校共有12,000註冊的學生(包括大學部與研究所學生)，今學生會欲採用抽樣調查方式選取100位學生來瞭解學生對於校園飼養流浪狗之意見，請扼要回答下列問題。(共15分)

1. 若採用便利抽樣(convenience sampling)，抽樣工作可能會如何進行？(3分)
2. 若採用簡單隨機抽樣(simple random sampling)，抽樣工作該如何進行？(4分)
3. 若採用分層隨機抽樣(stratified random sampling)，請協助學生會設計2種不同的抽樣工作進行方式，並說明如何執行。(8分)

注意：背面有試題

II. 工程經濟 (50 分)

There is an infrastructure project in south Asia for improving local traffic condition. You are responsible for the feasibility analysis on all alternatives including an overpass and underpass. The project will be finished within a year after the feasibility study is completed. Assuming that the real risk free interest rate is at 8% in the region, and the risk premium for both building and maintenance contractors is set to 7%, the most likely cashflows for the alternatives can be estimated in the following table 1.

Table 1: Cashflows for the alternatives

($Thousand USD)	Overpass	Underpass
Capital investment	4000	1200
Annual operation & maintenance cost	50	250
Annual benefits	820	600
Market value	1500	0
Useful life (years)	15	12

Please answer the following questions:

1) What is the reasonable minimum attractive rate of return (MARR) for the feasibility study (5 pt)? Please state your reasons (5 pt).
2) What is the assumption you should make before conducting your comparison among the alternatives (5 pt)? Please state your reasons (5 pt).
3) Due to the favorites of the local government, they prefer to have the project analyzed using the conventional Benefit-Cost (B-C) ratio method. Please carry out the incremental B-C ratio procedure to determine the preference ranking for the alternatives (15 pt).
4) Due to the climate circumstances in the region, torrential rain, which always causes severe flooding, occurs frequently. You were told that flooding reduces the efficiency for drainage equipment of underpass so that the maintenance costs of underpass become 1.2 times higher. Also flooding causes the overpass superstructure rusted so that there is no salvage value for overpass. Based on the incremental B-C ratio procedure, which alternative is preferred (15 pt)?

**To find Present value given Future value (P/F) at the first 15 period discount rate:

	i=5%	i=6%	i=7%	i=8%	i=10%	i=12%	i=15%
Period 1	.9524	.9434	.9346	.9259	.9091	.8929	.8696
Period 2	.9070	.8900	.8734	.8573	.8264	.7972	.7561
Period 3	.8638	.8396	.8163	.7938	.7513	.7118	.6575
Period 4	.8227	.7921	.7629	.7350	.6830	.6355	.5718
Period 5	.7835	.7473	.7130	.6806	.6209	.5674	.4972
Period 6	.7462	.7050	.6663	.6302	.5645	.5066	.4323
Period 7	.7107	.6651	.6227	.5835	.5132	.4523	.3759
Period 8	.6768	.6274	.5820	.5403	.4665	.4039	.3269
Period 9	.6446	.5919	.5439	.5002	.4241	.3606	.2843
Period 10	.6139	.5584	.5083	.4632	.3855	.3220	.2472
Period 11	.5847	.5268	.4751	.4289	.3505	.2875	.2149
Period 12	.5568	.4970	.4440	.3971	.3186	.2567	.1869
Period 13	.5303	.4688	.4150	.3677	.2897	.2292	.1625
Period 14	.5051	.4423	.3878	.3405	.2633	.2046	.1413
Period 15	.4810	.4173	.3624	.3152	.2394	.1827	.1229

注意：背面有試題

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**To find Present value given Annuity (P/A) at the first 15 period discount rate:

	i=5%	i=6%	i=7%	i=8%	i=10%	i=12%	i=15%
Period 1	0.9524	0.9434	0.9346	0.9259	0.9091	0.8929	0.8696
Period 2	1.8594	1.8334	1.8080	1.7833	1.7355	1.6901	1.6257
Period 3	2.7232	2.6730	2.6243	2.5771	2.4869	2.4018	2.2832
Period 4	3.5460	3.4651	3.3872	3.3121	3.1699	3.0373	2.8550
Period 5	4.3295	4.2124	4.1002	3.9927	3.7908	3.6048	3.3522
Period 6	5.0757	4.9173	4.7665	4.6229	4.3553	4.1114	3.7845
Period 7	5.7864	5.5824	5.3893	5.2064	4.8684	4.5638	4.1604
Period 8	6.4632	6.2098	5.9713	5.7466	5.3349	4.9676	4.4837
Period 9	7.1078	6.8017	6.5152	6.2469	5.7590	5.3282	4.7716
Period 10	7.7217	7.3601	7.0236	6.7101	6.1446	5.6502	5.1088
Period 11	8.3064	7.8869	7.4987	7.1390	6.4951	5.9377	5.2337
Period 12	8.8633	8.3836	7.9427	7.5361	6.8137	6.1944	5.4206
Period 13	9.3936	8.8527	8.3577	7.9038	7.1034	6.4235	5.5831
Period 14	9.8986	9.2950	8.7455	8.2442	7.3667	6.6282	5.7245
Period 15	10.3797	9.7122	9.1079	8.5595	7.6061	6.8109	5.8474