

國立中央大學101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. 工程統計 (共五十分)

1. Short answer questions: (5 pts each, totally 20 pts)

- a. What is the meaning of R^2 in regression analysis?
- b. Explain the relationship between 'Central Limit Theory' and PERT.
- c. What is the statistical theory behind the 'Control Chart' method of quality control?
- d. What is the 'Statistical hypothesis testing'? Please write three possible applications in engineering management?

2. A highway tunnel is under construction using the D&B method. The total length of the tunnel is 240m. The progressing cycle is set to be 1 m. So far, 20 progressing cycles have been completed. Their respective cycle times are listed in the table below.

Unit: hour

10.8	10.2	9.8	11.4
10.6	8.6	10.6	9.2
11.8	11.4	45.5	10.2
34.0	11.6	10.2	12.8
10.2	12.0	10.4	11.2

- a. Calculate the Mean, Mode, Median and Standard deviation of the cycle time. (8 pts)
- b. With 95% confidence interval, how much more time is needed to complete the work? (7 pts)

3. 某工程混凝土抗壓強度如下表，繪製直方圖及累積次數分配圖。混凝土抗壓強度小於 210kgf/cm^2 之機率？介於 $210\text{--}280\text{kgf/cm}^2$ 之機率？(15分)

No.	取樣日期	樣品代號	試體 1	試體 2
1	85.7.1	P5-1	246	260
2	85.7.1	P5-2	260	249
3	85.7.1	P7-1	255	272
4	85.7.1	P7-2	294	275
5	85.7.1	P3-1	305	290
6	85.7.2	P3-2	266	278
7	85.7.2	P4-1	224	242
8	85.7.2	P4-2	225	204
9	85.7.3	P6-1	177	169
10	85.7.3	P6-2	198	210
11	85.7.3	P1-1	209	231
12	85.7.3	P1-2	236	214
13	85.7.4	C1-1	257	243
14	85.7.4	C1-2	260	280
15	85.7.4	C1-3	226	252
16	85.7.5	P8-1	286	271
17	85.7.5	P8-2	313	310
18	85.7.5	S3-1	274	273
19	85.7.6	S3-2	243	248
20	85.7.6	S3-3	184	201

注意：背面有試題

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II. Engineering Economy (50 points)

Given that the Ironman construction company has conducted construction business for 4 decades, it is one of top five companies in the Southeastern Asia region. Here comes related financial information for the company: (1) the average interest rate of short-term loan is at 4%; (2) the costs for corporate bond is estimated at 8%; (3) the common stock price in the end of 2011 is at \$70 NT dollars per share with \$7 dividend per share every year and is expected to have a growth rate at 5%; (4) cost of retained earnings is exactly the same as that of common stock. The corporate capital structure in the end of 2011 can be broken down into: \$25 billion NT dollars of short-term loan, \$25 billion NT dollars of corporate bond, \$30 billion NT dollars of common stock, and \$10 billion NT dollars of retained earnings. A corporate senior analyst is trying to evaluate a mega project. Here comes the detailed information for the project: the initial capital investment in constructing necessary facilities is \$100 billion NT dollars annually for the first 3 years (Year 0 – Year 2), no salvage value is considered, the study period is set to 10 years, and the net cashflows for the rest years (Year 3 – Year 10) are \$50, \$60, \$70, \$80, \$100, \$100, \$100, \$100, respectively. All cashflows occur in the end of their corresponding years.

Please answer the following questions:

- (a) Based on the concept of weighted average cost of capital, find the before-tax cost of capital for this company (10 pts).
- (b) Since the project requires extra funds, the company has to raise funds of \$180 billion NT dollars. According to the results from (a), which source of financing would result in the lowest cost (5 pts)? If extra \$180 billion NT dollars are raised in the beginning of 2012 using the cheapest financing source, what is the new cost of capital (10 pts)?
- (c) Assume that the new cost of capital obtained in (b) is equal to the project's minimum attractive rate of return (MARR). However, the analyst has found that the local economic situation has an extra price escalation at 9%, which means risks to the project. Thus, the MARR must be adjusted to fit the reality. What is the adjusted MARR due to the price escalation (5 pts)?
- (d) Using the adjusted MARR obtained in (c) and the present worth (PW) method, conduct the sensitivity analysis of the project by $\pm 10\%$ of initial investment, net cashflows and adjusted MARR and rank the sensitivity of these 3 factors (15 pts). Is this project doable (5 pts)?

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

	$i=4\%$	$i=5\%$	$i=6\%$	$i=8\%$	$i=10\%$	$i=12\%$	$i=14\%$	$i=15\%$	$i=20\%$
Year 1	.9615	.9524	.9434	.9259	.9091	.8929	.8772	.8696	.8333
Year 2	.9426	.9070	.8900	.8573	.8264	.7972	.7695	.7561	.6944
Year 3	.8890	.8638	.8396	.7938	.7513	.7118	.6750	.6575	.5787
Year 4	.8548	.8227	.7921	.7350	.6830	.6355	.5921	.5718	.4823
Year 5	.8219	.7835	.7473	.6806	.6209	.5674	.5194	.4972	.4019
Year 6	.7903	.7462	.7050	.6302	.5645	.5066	.4556	.4323	.3349
Year 7	.7599	.7107	.6651	.5835	.5132	.4523	.3996	.3759	.2791
Year 8	.7307	.6768	.6274	.5403	.4665	.4039	.3506	.3269	.2326
Year 9	.7026	.6446	.5919	.5002	.4241	.3606	.3075	.2843	.1938
Year 10	.6756	.6139	.5584	.4632	.3855	.3220	.2697	.2472	.1615

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

	$i=4\%$	$i=5\%$	$i=6\%$	$i=8\%$	$i=10\%$	$i=12\%$	$i=14\%$	$i=15\%$	$i=20\%$
Year 1	0.9615	0.9524	0.9434	0.9259	0.9091	0.8929	0.8929	0.8696	0.8333
Year 2	1.8861	1.8594	1.8334	1.7833	1.7355	1.6901	1.6467	1.6257	1.5278
Year 3	2.7751	2.7232	2.6730	2.5771	2.4869	2.4018	2.3216	2.2832	2.1065
Year 4	3.6299	3.5460	3.4651	3.3121	3.1699	3.0373	2.9137	2.8550	2.5887
Year 5	4.4518	4.3295	4.2124	3.9927	3.7908	3.6048	3.4331	3.3522	2.9906
Year 6	5.2421	5.0757	4.9173	4.6229	4.3553	4.1114	3.8887	3.7845	3.3255
Year 7	6.0021	5.7864	5.5824	5.2064	4.8684	4.5638	4.2883	4.1604	3.6046
Year 8	6.7327	6.4632	6.2098	5.7466	5.3349	4.9676	4.6389	4.4873	3.8372
Year 9	7.4353	7.1078	6.8017	6.2469	5.7590	5.3282	4.9464	4.7716	4.0310
Year 10	8.1109	7.7217	7.3601	6.7101	6.1446	5.6502	5.2161	5.0188	4.1925

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