

所別：營建管理研究所碩士班 一般生 科目：工程經濟與統計

I. Engineering Economy (50 points)

According to the regulations, the expected amount of project loading capacity of SonicBoom Construction Company specializing in infrastructure projects is \$2 billion dollars per year based on its safety-financing capability to raise funds in the open markets. The concept of Blue Sea Strategy has deeply influenced operating management of the company. Therefore, prior to the consideration of budgeting allocation for future projects, here comes information for the internal and financial feasibility study: Assume that (i) the tax rate is 25%; (ii) the interest rate of short-term loan is at 5%; (iii) the investors require 10% per year return after tax and believe in a growth rate of 5%; (iv) the guaranteed annual dividend is \$1 per share after tax as the end of 2005 and the preferred stock price is \$10 per share; (v) the after-tax cost of retained earnings is the same as for common stock; and (vi) the company's capital structure in the end of 2005 is listed as follows: Short-term debt for \$200 million dollars, common stock for \$500 million dollars, preferred stock for \$75 million dollars, and retained earnings for \$100 million dollars.

- (a) Find the after-tax cost of each element listed in the capital structure (10 pts). Find the Weighted Average Cost of Capital (WACC) for SonicBoom Co (5 pts).
- (b) According to the Blue Sea Strategy, if raising funds of \$280 million dollars in the open markets is required, which source of financing is best regarding to the consideration of risk or cost of capital (5 pts)? What is the WACC after raising funds of \$280 million dollars by using the best source of financing (10 pts)?
- (c) Based on the Blue Sea Strategy, a replacement feasibility study for equipment needs to carry out prior to budgeting: The current equipment has annual operating and maintenance expenses of \$20 million dollars per year and it can be kept for 5 more years, at which time it will have \$0 market value. It is believed that \$25 million dollars could be obtained for the old one if it were sold in 2005. New equipment can be purchased for \$50 million dollars, will have a market value of \$25 million dollars in 5 years, and will have an annual operating and maintenance expenses of \$5 million dollars per year. By considering the WACC obtained from (b) that is the minimum value to determine acceptance or rejection of the analysis, conduct the replacement analysis using minimum Equivalent Uniform Annual Cost (EUAC) method (10 pts). Explain whether or not the old equipment should be replaced (5 pts). If the equipment is required to be replaced, when is the best time (5 pts)?

注意：背面有試題

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II. 工程統計 (共五十分)

1. Short answer questions: (5 pts each, totally 15 pts)
 - a. What is the meaning of 「sampling error」?
 - b. Explain the relationship between the 「Central Limit Theory」 and PERT.
 - c. What is the statistical theory behind the 'Control Chart' method of quality control?
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 1.5 m. So far, 12 progressing cycles have been completed. Their respective cycle times are listed in the table below.

Unit: hour

10.8	9.8	9.2
10.6	10.6	12.8
11.8	45.5	
11.4	10.2	
10.2	11.2	

- a. Calculate the Mean, Mode, Median and Standard deviation of the cycle time. (10 pts)
 - b. With 90% ($Z_{0.95}=1.645$, $Z_{0.90}=1.282$) confidence interval, how much more time is needed to complete the work? (5 pts)
3. 某建築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。以統計方法計算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？ (20 分)

No.	取樣日期	樣品代號	平均抗壓強度 (kgf/cm^2)
1	85.7.1	P5-1	260
2	85.7.1	P5-2	249
3	85.7.1	P3-1	290
4	85.7.2	P3-2	278
5	85.7.2	P4-1	242
6	85.7.2	P4-2	204
7	85.7.3	P6-1	169
8	85.7.3	P6-2	210
9	85.7.3	P1-1	231