

國立成功大學

111學年度碩士班招生考試試題

編 號：101

系 所：土木工程學系

科 目：工程經濟

日 期：0219

節 次：第 2 節

備 註：可使用計算機

※ 考生請注意：本試題可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

**MARR (Minimum Attractive Rate of Return)**

- 1 A bank risk analyst assesses the risk of loaning a real estate developer for the construction cost on an apartment project. He comes up with the following statement “The loan can be recovered if the developer reduces 20% of the apartment selling price and sells 25% of the project worth”. If the bank grants 50% of the construction cost, what is the construction cost in terms of selling price? (10%)
- 2 The board of a residential community wishes to establish a fund at the end of 2022 that by the end of year 2039 will grow to an amount large enough to place new elevators for its own 3 buildings. Each building has two elevators operated. A new elevator is estimated to cost NT\$2M in 2037. In 2037, two new elevators will be installed in one of the three buildings. Another building will have new elevators in 2038 at the cost of NT\$2.1M each elevator. The last building will be re-elevated in 2039 at cost of NT\$2.2M each. The annual effective interest rate that can be earned on this fund is 3%.
  - 2.1 How much money each year should be saved starting at the end of 2023 to pay all new elevators? (10%)
  - 2.2 If the inflation rate is assumed to be 2% per year, how much money each year should be saved starting at the end of 2023 to pay all new elevators? (10%)
- 3 You bought an apartment which was on a 20 year mortgage of NT\$5,000,000 from a local bank. The bank asked you to pay back the loan by monthly payments on 3.6 % nominal interest rate. You have made payments 5 years.
  - 3.1 What is the monthly payment that you are asked to make? (5%)
  - 3.2 What is the remaining principal? (10%)
  - 3.3 A new bank offers you a deal of refinancing your car with 2.4% nominal interest rate compounding monthly for the remaining 15 years. However, depositing a NT\$200,000 in saving account with no interest in the new bank is required. Will you move your mortgage to the new bank? If you decide to move, how long; at least, should you stay with the new bank to cover the cost, if your MARR is 0.75% per month? (10%)
- 4 A contractor is considering the purchase of a set of machine tools at a cost of \$50,000. The purchase is expected to generate profits of \$19,000 (revenues less expenses) per year in each of the next 4 years. Additional profits will be taxed at a rate of 40%. The asset is depreciated by Straight-Line method with zero salvage value. The contractor's real after-tax MARR is 10%.
  - 4.1 What is the PW of this investment? Should the contractor purchase the machine tools? (10%)
  - 4.2 What is the PW of this investment if the general inflation is 3% in the 4 years period? Should the contractor purchase the machine tools? (10%)

- 5 Ten years ago, a corporation built a facility at a cost of \$400,000 in an area that has since developed into a major retail location. At the time the facility was constructed, it was estimated to have a depreciable life of 20 years with no market value and straight-line depreciation has been used. The corporation now finds it would be more convenient to be in a less congested area and can sell the old facility for \$250,000. A new facility in the desired location would cost \$500,000 and have a depreciable life of 10 years. The annual savings of \$4,000 per year is expected with the new facility. Insurance on the old facility has been \$20,000 per year while for the new facility it is estimated to be \$15,000. The study period is 10 years and the estimated market value of the new facility at the end of 10 years is \$200,000. The corporation has a 40% income tax rate and capital is worth 12% per year after taxes. Should the corporation (1) keep the old facility or (2) sell the old facility and build the new facility? (25%)

To Find:	Given:	Factor by Which to Multiply "Given"	Factor Name	Factor Functional Symbol
<i>For single cash flows:</i>				
F	P	$(1+i)^N$	Single payment compound amount	(F/P, i%, N)
P	F	$\frac{1}{(1+i)^N}$	Single payment present worth	(P/F, i%, N)
<i>For uniform series(annuities):</i>				
F	A	$\frac{(1+i)^N - 1}{i}$	Uniform series compound amount	(F/A, i%, N)
P	A	$\frac{(1+i)^N - 1}{i(1+i)^N}$	Uniform series present worth	(P/A, i%, N)
A	F	$\frac{i}{(1+i)^N - 1}$	Sinking fund	(A/F, i%, N)
A	P	$\frac{i(1+i)^N}{(1+i)^N - 1}$	Capital recovery	(A/P, i%, N)

$$F = \frac{G}{i}(F/A, i\%, N) - \frac{NG}{i}$$

$$P = \frac{A_1}{1+f}(P/A, i_{CR}\%, N)$$

$$i_{CR} = (1+i)/(1+f) - 1$$