# IE 360 Engineering Economic Analysis

## Final Exam

Sample Test - Dr. Park

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**Name:**

**Read the following instructions carefully**

- Fill in your name on this exam sheet.
- Fill in your name, exam version number and the course number on your general purpose Scan Sheet. Use the scan sheet to answer all the questions.
- You must return both the exam sheet and the scan sheet at the end of this examination. This is the only check we have that you attended the examination.
- In recognition of the Student Honor Code, you should neither give nor receive aid on this examination.
- Note that your answers may differ slightly from the choices listed due to rounding errors. Select the closest answer from the listed choices.

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**Problem 1**

Consider the four mutually exclusive projects given below.

| Project | Investment at year 0 | IRR |
|---|---|---|
| A | $2,000 | 45% |
| B | $2,500 | 40% |
| C | $3,000 | 35% |
| D | $3,500 | 30% |

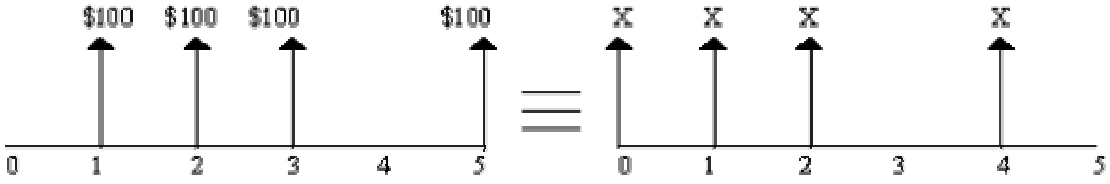
The service life for all the four projects is the same and investment is required only in year 0. Also, IRR(B-A) = 17%, IRR(A-D) = 15%, IRR(D-C) = 10%, IRR(B-C) = 20%

Which project would you prefer based on the rate of return criterion at a MARR of 13%?

A. A
B. B
C. C
D. D
E. Information insufficient to decide

**Problem 2**

The following two cash flow transactions are equivalent at an interest rate of 9%.




Find X

A. X < $90
B. $90 <= X < $94
C. $94 <= X < $98
D. $98 <= X < $102
E. None of the above

**Problem 3**

Farmer's National Bank gave you a loan of $30,000, to buy a car, at an interest rate of 12% compounded monthly. The agreement was to pay off the entire amount in 48 equal monthly installments (each payment occurs at the end of each month). After making the first 30 payments on time you missed the payments due at the end of the 31$^{st}$ and the 32$^{nd}$ months. Now at the end of the 33$^{rd}$ month you want to pay off the remaining amount of the loan in full. Assuming no penalty of charges for the missing payments, how much should you pay?

A. between $0 and $12,500
B. between $12,501 and $13,000
C. between $13,001 and $13,500
D. between $13,501 and $14,000
E. greater than $14,001

**Problem 4**

Five years ago you purchased 100 shares of Gillette stock at $30 per share. Now the current stock price is $85 per share. Assuming that the price of the stock is expected to continue an increasing trend in the future, which of the following statements is incorrect?

A. If you sell the stock right now, your annual rate of return on your Gillette investment will be less than 25%.
B. In order to realize a 25% annual rate of return, the current stock price should be about $92.
C. If you bought 200 shares 5 years ago instead of 100 shares, your rate of return would be doubled.
D. If you buy the Gillette stock at the current price of $85, and you expect the stock to appreciate at an annual rate of 12% (rate of return) in the future, it would take 6 years to double the price.

**Problem 5**

How long will it take for an investment to triple at an interest rate of 7%, compounded monthly?

A. between 0 and 10 years
B. between 10 and 12 years
C. between 12 and 14 years
D. between 15 and 16 years
E. between 17 and 50 years

**Problem 6**

Company J buys an equipment for $200,000. This equipment has a useful life of 10 years and a salvage value of $40,000. The company uses the straight line method to calculate the depreciation of the equipment. At the end of year 4, the company sells the equipment for $120,000. The tax rate is 40%

What is the net proceeds (after tax) from the sale of the equipment that the company reports?
(Note: *Assume that the half-year convention is not applied in depreciating the asset.*)

A. less than $120,000
B. between $120,001 and $122,000
C. between $122,001 and $124,000
D. between $124,001 and $126,000
E. greater than $126,001

**Problem 7**

ABC Corporation placed an asset in service 3 years ago. The company uses the *MACRS* method (7 year-life) for tax purposes and the *SOYD* method (7 year useful life) for financial reporting purposes. The cost of the asset is $100,000 and the salvage value used for depreciating purpose is $20,000. What is the difference in the current book value obtained using both the methods?

A. between $0 and $4,000
B. between $4,001 and $5,000
C. between $5,001 and $6,000
D. between $6,001 and $7,000
E. greater than $7,001

**Problem 8**

Which one of the following statements is correct?

A. Irrespective of the depreciation method adopted, total tax obligations will remain unchanged over the entire project life.
B. For a given cash flow, the present value always decreases as the interest rate increases.
C. Depreciation is a real cash expense since it represents the cost of doing business
D. When comparing mutually exclusive investments based on the rate of return principle, the incremental analysis need not be applied if all projects require the same initial investment.

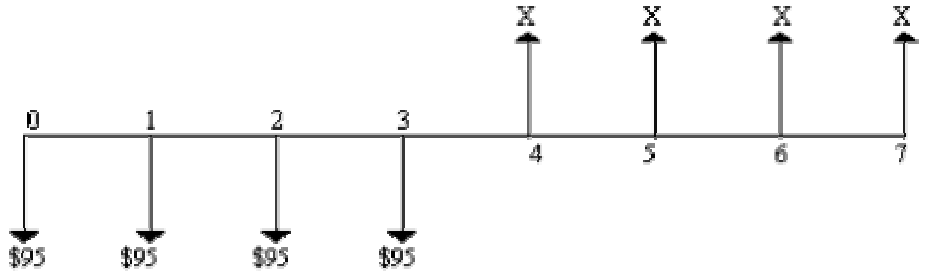
**Problem 9**

You are planning to install a new CNC that costs $150,000. This machine has an estimated service life of 10 years and a net-after tax salvage value of $15,000. Its annual after tax operating and maintenance costs (considering depreciation tax shields) is estimated to be $35,000. To get a 18% rate of return on the investment (after-tax) , what will be the required minimum annual after-tax revenues?

A. between $0 and $60,000
B. between $60,001 and $65,000
C. between $65,001 and $70,000
D. between $70,001 and $75,000
E. greater than $75,001

**Problem 10**

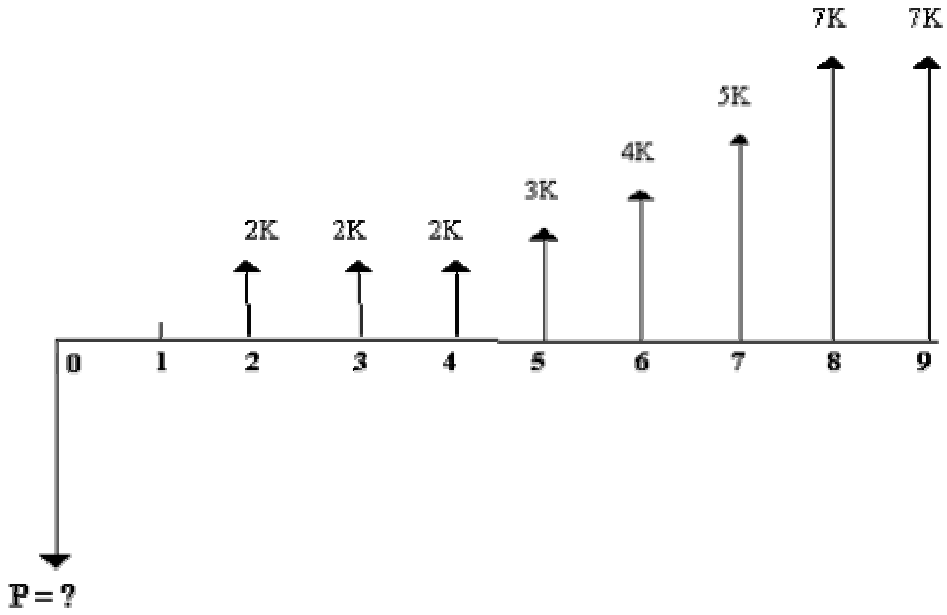
For the given cash flow below find the value of X that makes the inflow series equivalent to the outflow series. Use an interest rate of 8% compounded yearly.




A. X < $125
B. $125 <= X < $132
C. $132 < X <= $136
D. $136 < X <= $140
E. None of the above

**Problem 11**

If you wish to withdraw a series of cash amounts shown below, how much do you need to deposit today
(n = 0) in an account that earns a 10% annual interest?



(Note: *K= $1,000*)

A. $2000(P/A, 10%, 8)(P/F,10%,1) + $1000(P/G,10%,6)(P/F,10%,3)
B. $2000(P/A,10%,8)(P/F,10%,1) + $1000(P/G,10%,3)(P/F.10%,4) + $5000(P/A,10%,2)(P/F,10%,7)
C. 2000(P/A,10%,8)(P/F,10%,1) + $1000(P/G,10%,4)(P/F,10%,3) +$5000(P/A,10%,2)(P/F,10%,7)
D. $2000(P/A,10%,8)(P/F,10%,1) + $1000(P/G,10%,5)(P/F,10%,4) + $1000(P/F,10%,8)
E. $2000(P/A,10%,8)(P/F,10%,1) + $1000(P/G,10%,4)(P/F,10%,3) + $1000(P/F,10%,8)

**Problem 12**

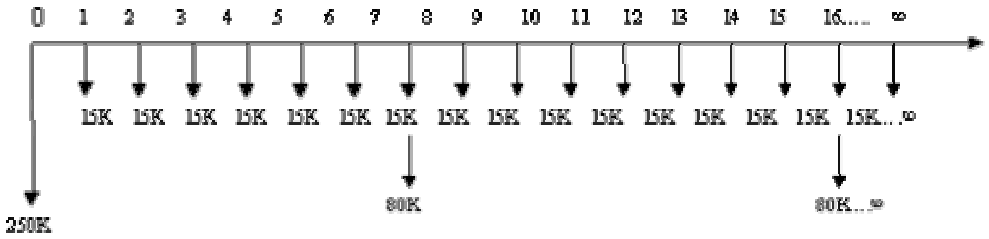
Micro-Tech Company is considering the expansion of its business by promoting a whole new product line. The expected annual taxable income before the expansion is estimated at $70,000. The expansion will bring in an additional annual revenue of $25,000, but it is expected to incur additional operating costs of $10,000 (excluding any depreciation expenses). This expansion requires the purchase of a new asset at a cost of $20,000. This new asset falls into the *MACRS* 3-year class. What is the expected annual net income for year 1 after the expansion?

(Note: *The Business expansion occurs at year 0 (now)*)
**(Use the tax table given in Table 8.1, page 419)**

A. less than $62,000
B. between $62,001 and $63,000
C. between $63,001 and $64,000
D. between $64,001 and $65,000
E. greater than $65,001

**Problem 13**

Company Z is considering the purchase of a new equipment for a replacement. Its initial cost is $250,000. The equipment requires an annual maintenance cost of $15,000. Also to be taken into account is an additional overhauling cost (at the end of every 7 years) of $80,000. The company plans to use the equipment for an infinite period. Find the capitalized equivalent cost of this investment at an interest rate of 12%.

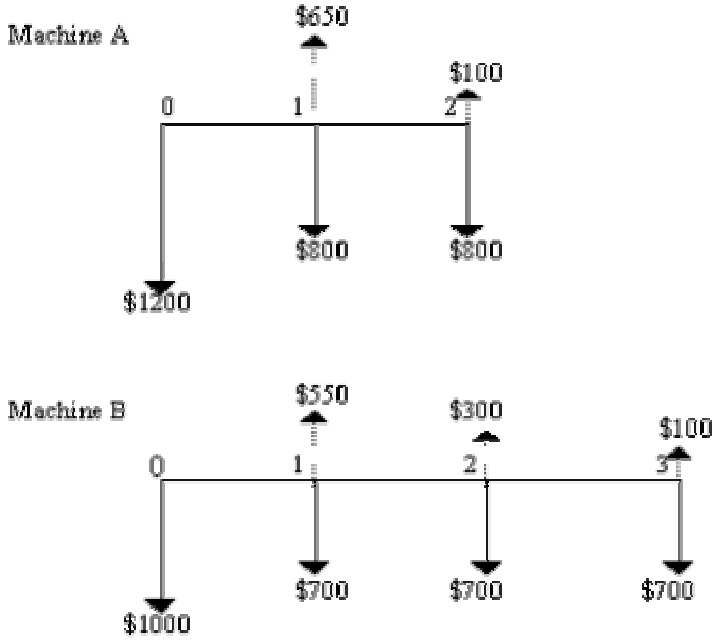



A. less than $439,000
B. between $439,001and $442,000
C. between $442,001 and $445,000
D. between $445,001 and $448,000
E. greater than $448,001

**Problem 14**

Consider two mutually exclusive machines, A and B. The service life of machine A is 2 years and that of machine B is 3 years. Assume that both machines will be available in the market for the same investment cost, salvage value and operating cost in the future. The expected salvage value at the end of each year is shown in dotted cash flows.

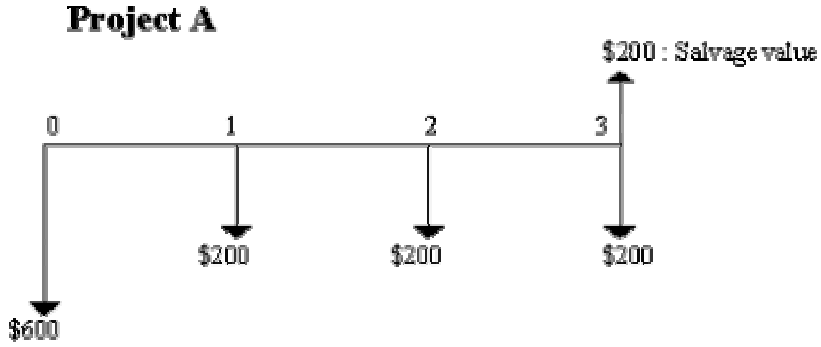
Given MARR=10%, which project should be selected if the study period is 3 years?

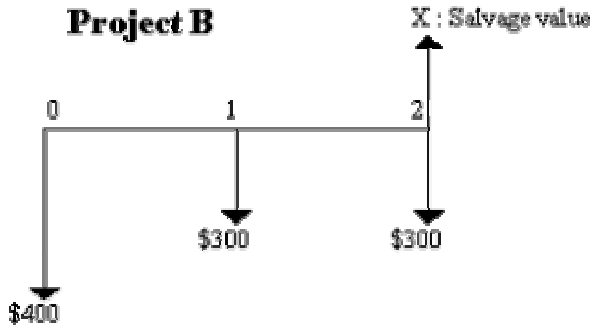


A. A
B. B
C. Either A or B
D. Neither A nor B
E. Information insufficient to analyze

**Problem 15**

Consider two mutually exclusive projects A and B.




Assume that each project can be repeated indefinitely with the same cash flows. Find the salvage value(X) of project B that would make both the projects equivalent at a MARR of 10%.

A. X < $200
B. $200 <= X < $250
C. $250 <= X < $300
D. $300 <= X < $350
E. X >= $350

**Problem 16**

For the project given below find the net cash flow at the end of year 4:

| | |
|---|---|
| Project life ( years ) | 5 |
| Capital Investment at year 0 | $100,000 |
| Annual revenue | $75,000 |
| Annual expenses ( excluding depreciation ) | $20,000 |
| Salvage value at the end of the year | $10,000 |
| Tax rate | 40% |
| Depreciater method | 7-year MACRS |

A. less than $39,000
B. between $39,001 and $43,000
C. between $43,001 and $47,000
D. between $47,001 and $51,000
E. greater than $51,001

**Problem 17**

Suppose that in Problem No. 16, the firm borrows the entire capital investment at 10% interest rate over a period of 5 years. In addition , an amount of $20,000 is required as working capital at year 0 which will be recovered at the end of the project life. The required principal and interest payments for year 5 are as follows.

Principal Payment in year 5: $23,982
Interest Payment in year 5 : $2,398

What will be the net cash flow at the end of year 5?

A. less than $35,000
B. between $35,001 and $40,000
C. between $40,001 and $45,000
D. between $45,001 and $50,000
E. greater than $50,001

**Problem 18**

Assume that you deposited $100,000 in a savings account paying an interest of 6% compounded monthly. You wish to withdraw $2,000 at the end of each month. How many months will it take to deplete the balance?

A. less than 47 months
B. between 48 and 51 months
C. between 52 and 55 months
D. between 56 and 59 months
E. greater than 60 months

**Problem 19**

The city of Auburn needs to maintain its police cars. At present it has a contract with a local garage to do regular repair works and other routine maintenance works. The garage bills the city about $1,100 per car per year. As an alternative, the town is considering owning a small garage with two mechanics. The town has to spend $150,000 to buy the garage and furnish it. The annual cost of operating and maintaining the garage is about $60,000. In addition to the above expenses, another $500/car/year has to be spent on parts and other accessories. The garage has an estimated service life of 20 years and a salvage value of $50,000.

Find the minimum number of cars that the city has to maintain to justify the investment in the new garage. Use an interest rate of 6%.

A. less than 110
B. between 111 and 116
C. between 117 and 122
D. between 123 and 128
E. greater than 129

**Problem 20**

Consider the following two mutually exclusive investment alternatives

| **Alternative** | **A** | **B** |
|---|---|---|
| Capital Investment | $100,000 | $3,000 |
| Annual Cost | $5,000 | $17,500 |
| Life | Infinite | Infinite |
| Salvage Value | $0 | $0 |

At what MARR will you be indifferent between the two alternatives?
(Choose from the given choices the range within which the MARR falls).

A. 0%-8%
B. 8.1%-10%
C. 10.1%-12%
D. 12.1%-14%
E. 14.1%-25%