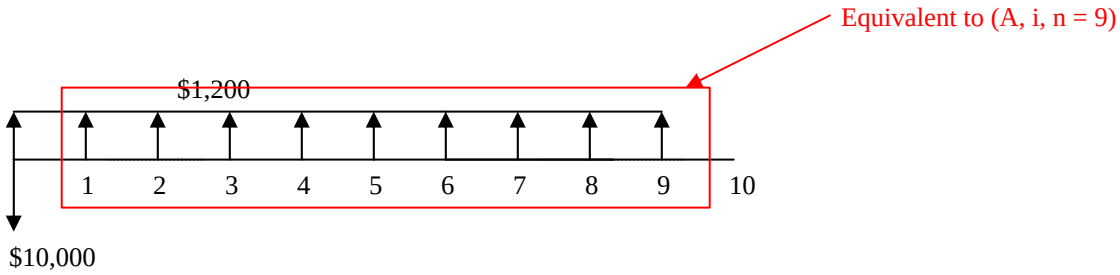
CE 167 Midterm #1
Fall 2003
Prof. C.W. Ibbs

Directions:

- **Put your name on your bluebook.**
- **This exam is to be completed in a bluebook – answers not recorded in a bluebook will not be graded.**
- **Place the exam on the inside of you bluebook when finished.**
- **Read the question thoroughly before answering. Point totals for each question are listed.**
- **Write legibly and express yourself logically and explicitly. Write short, concise answers.**
- **If you have a question regarding any portion of this exam, approach the proctor privately.**

Question #1 [10 points]

You have the opportunity to invest $10,000 now. Find the IRR if you receive $1,200 per year at the beginning of the year for 10 years.



IRR = i @ NPV = 0

NPV = 0 = -$10,000 + $1,200 + $1,200(P/A, i, 9)

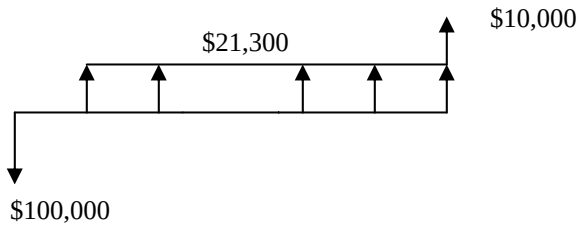
NPV = -$8,800 + $1,200(P/A, i, 9)

(P/A, i, 9) = 7.333 -> i ≈ 4.5%

Question #2 [25 points total]

You are considering buying a bulldozer for $100,000. You expect this investment to provide a yearly benefit of $21,300 for five years, and can be sold at the end of the fifth year for $10,000. The current interest rate for construction equipment is 5%.

(a) What is the net present value of this investment? [10 points]



NPV = -$100,000 + $21,300(P/A, 5%, 5) + $10,000(P/F, 5%, 5)

NPV = -$100,000 + $21,300(4.3294) + ($10,000)(0.7835)

NPV ≈ $50

(b) Conduct a sensitivity analysis on the interest rate and the annuity. Discuss your results in 1 to 2 paragraphs. [15 points]

For i +25%:

NPV = -$100,000 + $21,300(P/A, 6.25%, 5) + $10,000(P/F, 6.25%, 5)

NPV = -$100,000 + $21,300(4.1839) + $10,000(0.7385) = -$3,500

For i -25%:

NPV = -$100,000 + $21,300(P/A, 3.75%, 5) + $10,000(P/F, 3.75%, 5)

NPV = -$100,000 + $21,300(4.4833) + $10,000(0.8319) = $3,813

The investment is negatively valued if:

- **The necessary amount of the initial investment increases**
- **The yearly benefit decreases**
- **Interest rates increase**

Likewise, the investment becomes positively valued if:

- **The necessary amount of the initial investment decreases**
- **The yearly benefit increases**
- **Interest rates decline**

Because changes in the initial investment impact the net present value of the investment the most, it is the most sensitive factor (followed closely by the amount of the yearly benefit). Swings in the interest rate impact the net

present value of the investment the least, and therefore are less critical to purchasing decisions.

Question #3 [20 points]

Consider four mutually exclusive alternatives that each have an 8-year useful life:

	A	B	C	D
Initial Cost	$1,000	$800	$600	$500
Uniform annual Benefit	$50	$113	$92	$130
Salvage Value	$0	$500	$500	$0

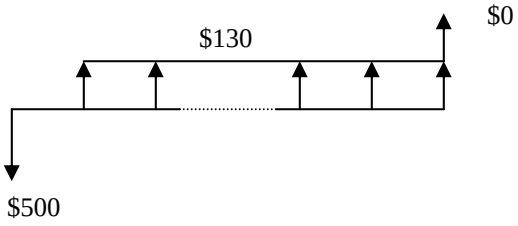
If the minimum attractive rate of return is 8%, which alternative should be selected and why?

Step 1: Arrange investments in increasing order of cost:

D	C	B	A
$500	$600	$800	$1000

Step 2: Calculate the IRR of each alternative (approximately +/- 1%)

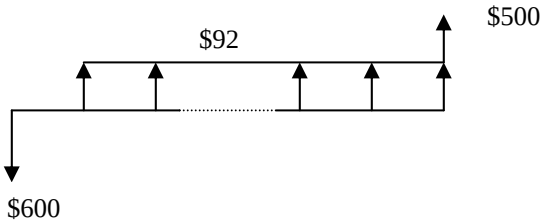
D)



NPV = 0 = -$500 + $130(P/A, i%, 8) + $0(P/F, i%, 8)

IRR_D = 20%

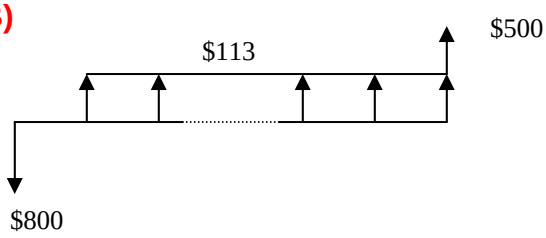
C)



NPV = 0 = -$600 + $92(P/A, i%, 8) + $500(P/F, i%, 8)

IRR_C = 14%

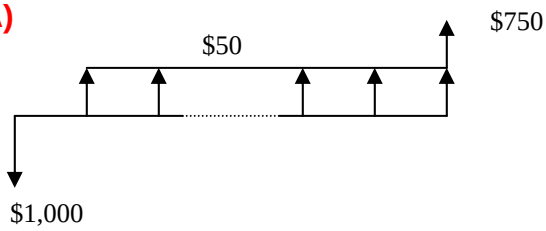
B)



NPV = 0 = -$800 + $113(P/A, i%, 8) + $500(P/F, i%, 8)

IRR_B = 11%

A)



A Drops out automatically upon inspection.

NPV = 0 = -$1,000 + $50(P/A, i%, 8) + $750(P/F, i%, 8)

IRR_A = 2%

D	C	B	A
20%	14%	11%	2%

<u>Step 3</u>: Discard any investment where IRR < MARR. A is the only investment where IRR < MARR, so it is rejected. B, C, and D must be further evaluated.

<u>Step 4</u>: Calculate the IRR of each *incremental* investment

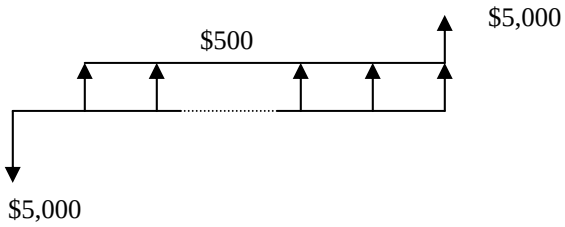
	C challenges D	B challenges D
(Δ)investment	$100	$300
(Δ)salvage	$500	$500
(Δ)annual benefit	$-38	$-17
(Δ)IRR	4%	2%

IRR>MARR	**No**	**No**

Because neither C nor B is worth the additional incremental investment, D is the best alternative. Put another way, D is the largest investment that meets the IRR hurdle. Choose Option D.

Question #4 [10 points]

What are the nominal and effective interest rates for a municipal bond that requires a $5,000 investment and pays $500 quarterly for 5 years?



The effective interest rate = IRR

NPV = 0 = -$5,000 + $500(P/A, i, 20) + $5,000(P/F, i, 20)

i = 10% when NPV = 0. 10% is the effective interest rate.

$i_{eff} = [1 + (N/m)]^m - 1$

0.10 = [1 + (N/4)]4 – 1 = 9.645%

Question #5 [10 points]

Describe three advantages and three disadvantages of the competitive low-bid system of contracting (be specific).

Advantages:

- **Owner gets lowest price**
- **Bids are uniform (all parties submit bids for the same scope of work)**
- **Ample legal precedence in public sector**

Disadvantages:

- **Design must be significantly completed**
- **Potentially adversarial relationship between owner/contractor or designer/contractor**

- **Potential bid shopping**
- **Potential underbidding which may lead to excessive change order submittals or financial insolvency by the contactor**

Question #6 [10 points]

Name five key elements of a legally enforceable contract.

- **Legal competent parties**
- **Legal subject matter**
- **Offer**
- **Acceptance**
- **Consideration**

Question # 7 [10 points]

Under what circumstances would you use the IRR analysis method vs. the net present value method?

Use the IRR method when the interest rate is unknown. If the interest rate is known, then use NPV.

Question #8 [5 points]

What is the parole evidence rule?

From Bartholomew:

Parole evidence is evidence of the intent of the parties other than the express provisions of the contract itself. For example:

- **Previous oral or written understandings or agreements between parties, such as records of the negotiations leading to contract formation. This category also includes letters and other written forms of communications.**
- **Course of performance and course of dealing.**
- **Customs and trade practices of the industry.**