

GE 348

Engineering Economics

Midterm Examination

October 14, 1999

1 Hour 20 Minutes allowed for completion

Open Textbook ONLY

Do all work neatly (design note format) on the exam paper.

SHOW ALL CASH FLOW DIAGRAMS.

List answers in the box corresponding to each question.

SIGN EACH EXAM PAGE OF THE EXAMINATION

Question	Marks Obtained
1. /20	
2. /20	
3. /20	
4. /20	
5. /20	
Total /100	

NAME: ANSWER KEY

STUDENT #: _____

20 Marks

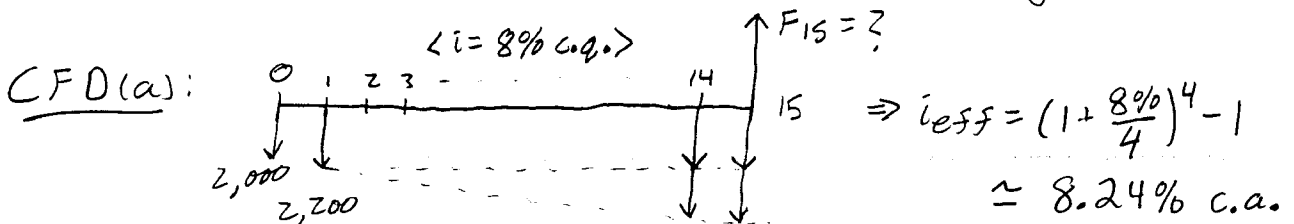
2. A couple decide to put away money for retirement. More specifically, they decide to deposit \$2,000 *right now*, \$2,200 one year from now, \$2,400 two years from now, \$2,600 three years from now, and so on for the next 15 years into an investment account that pays 8% compounded quarterly.

- a) How much money will have accumulated in the account by the end of 15 years?
- b) If the couple withdraws \$6,000 at the end of year 6, how much money will be in the account by the end of 15 years?

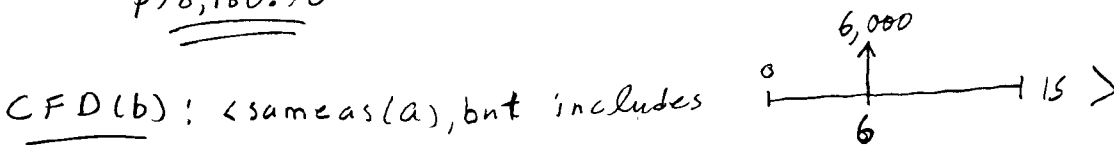
Given: Gradient Series deposit stream.
 $i = 8\% \text{ c.q.}$
 $n = 15 \text{ years.}$

Find: (a) F_{15} (accumulated balance).

(b) F_{15} - future value of \$6,000 withdrawal at end of year 6.



$$F_{15} = 2,000 (FIP, 8.24\%, 15) + 2,200 (FIA, 8.24\%, 15) + 200 (FIG, 8.24\%, 15) \approx \underline{\underline{\$98,160.90}}$$



Now, $F_{15} = 98,160.90 - 6,000 (FIP, 8.24\%, 15-6)$

$= 98,160.90 - 6,000 (FIP, 8.24\%, 9)$ (a) $\$98,160.90$

$\approx 98,160.90 - 12,236.05$

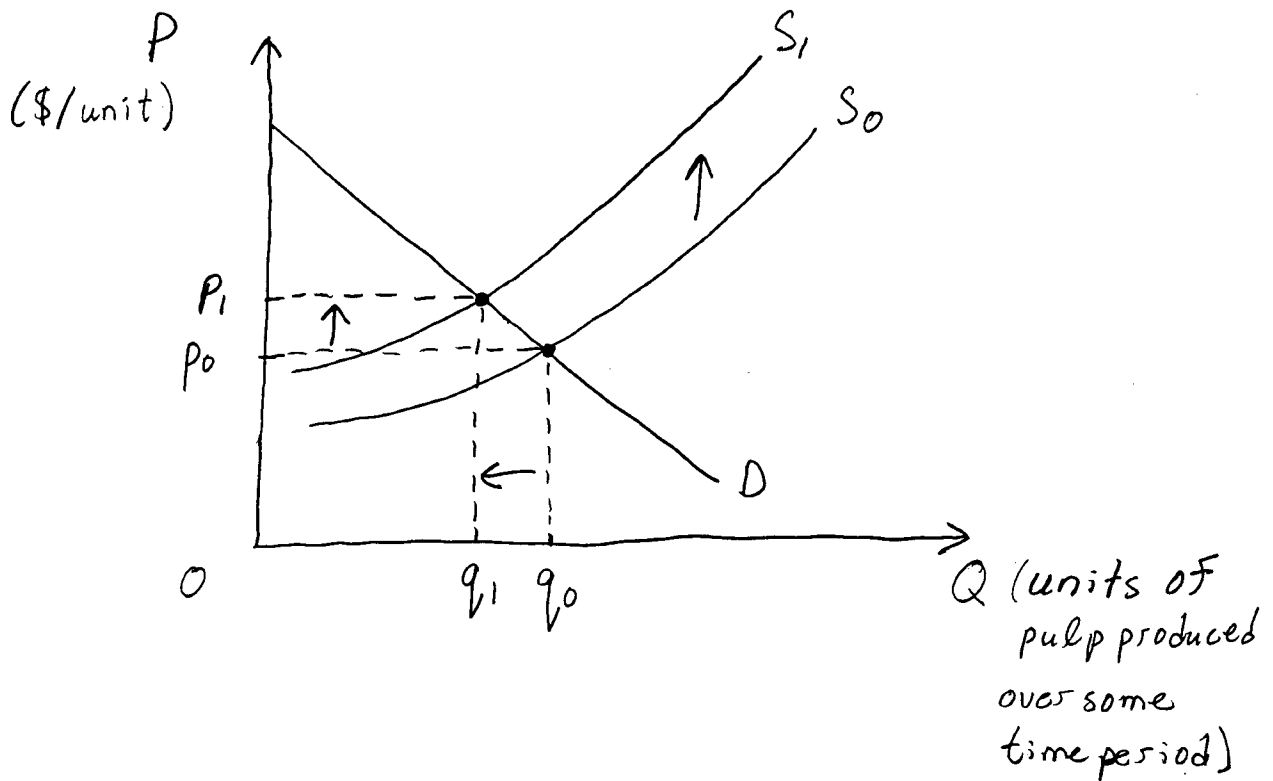
$= \underline{\underline{\$85,924.85}}$ (b) $\$85,924.85$

20 Marks

3. Your engineering firm has been contracted to evaluate the influence of stricter environmental legislation on the costs of producing bleached paper at a local pulp and paper mill. Based on your assessments, the mill will require new bleaching plant technology to meet the stricter standards. Unfortunately, this will increase the cost of producing bleached paper. Will this:

- Drive the price of bleached paper up or down?
- Cause an increase or decrease in the quantity of bleached paper demanded?

Illustrate these changes using demand and supply curves for the bleached paper produced by the mill.



(a)

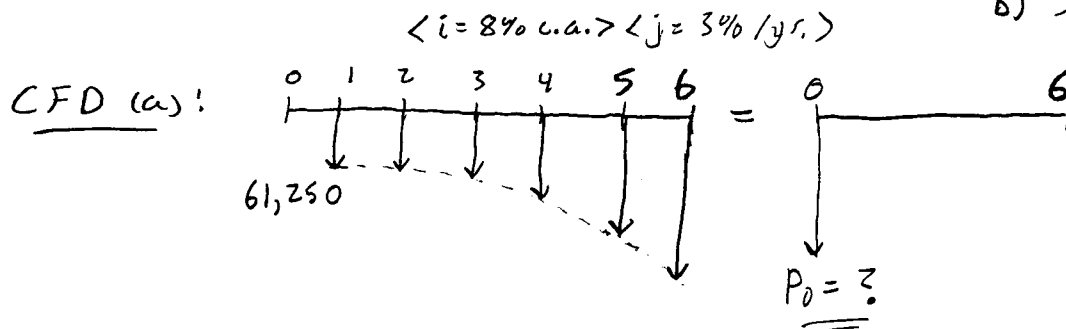
(b)

20 Marks

4. As part of a new contract CAW negotiated with GM, the wages of auto workers will rise to \$35 / hour beginning one year from today. Thereafter, wages will increase by 3% per year for 5 additional years. Given that the average worker is employed 35 hours per week, 50 weeks per year, what is the present value cost of the negotiated wage deal from GM's perspective? Answer this question using interest rates of: per worker
- a) 8% compounded annually.
- b) 3% compounded annually.

Given: • New wage contract where $A_1 = \$35/\text{hr.}$ (35 hrs./wk)
 (50 wks./yr.) = $\$61,250/\text{yr.}$
 • $j = 3\%/\text{year}$
 • $n = 6 \text{ years}$

Find: PV cost of wage deal per worker at: a) 8% c.a.
 b) 3% c.a.



$$P_0 = A_1 (P_0 | A_1, i, j, n)$$

$$= 61,250 (P_0 | A_1, 8\%, 3\%, 6) \approx 61,250 (4.9509)$$

$$\approx \underline{\underline{\$303,242.02}}/\text{worker}$$

CFD (b): $\langle \text{same, but } i = 3\% \text{ c.a.} \rangle$

$$P_0 = A_1 (P_0 | A_1, i, j, n)$$

$$= 61,250 (P_0 | A_1, 3\%, 3\%, 6)$$

$$\approx 61,250 (5.8252)$$

$$\approx \underline{\underline{\$356,796.12}}/\text{worker}$$

(a) $\$303,242.02$

(b) $\$356,796.12$

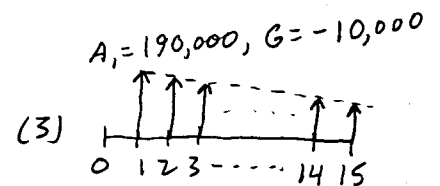
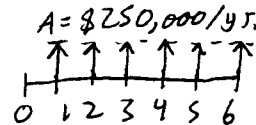
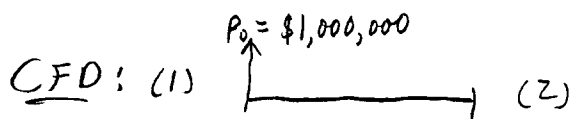
20 Marks

5. You have just won the lottery! However, the manner in which you receive payment is up to you. You can either collect: (1) \$1,000,000 right now, (2) 6 payments of \$250,000 a year (beginning one year from today), or (3) 15 annual payments beginning at \$190,000 next year and *decreasing* by \$10,000 a year thereafter. Assuming you want to maximize the present value of your lottery winnings, which payment plan (i.e., 1, 2 or 3) would you choose given an opportunity cost of money of:

- a) 10% compounded annually.
b) 7% compounded annually.

Given: Info. regarding possible lottery payment schemes.

Find: Highest PV total at: (a) 10% c.a.
(b) 7% c.a.



(a) $i = 10\%$ c.a.: (1) $P_0 = \$1,000,000$

(2) $P_0 = A(P/A, 10\%, 6) \approx 250,000(4.3553)$

$\approx \underline{\underline{\$1,088,815.17}} \Rightarrow \underline{\underline{\text{BEST!}}}$

(3) $P_0 = A(P/A, 10\%, 15) - G(P/G, 10\%, 15)$

$\approx 190,000(7.6061) - 10,000(40.1520)$

$\approx \$1,043,635.23$

(b) $i = 7\%$ c.a.: (1) $P_0 = \$1,000,000$

(2) $P_0 = A(P/A, 7\%, 6) \approx 250,000(4.7665) \approx \$1,191,634.91$

(3) $P_0 = A(P/A, 7\%, 15) - G(P/G, 7\%, 15)$ (a)

$\approx 190,000(9.1079) - 10,000(52.4461)$

$\approx \underline{\underline{\$1,206,043.13}} \Rightarrow \underline{\underline{\text{BEST!}}}$ (b)

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