

Solutions to ISE 2014 Test 2 - Spring 1996

Question 1

First, re-order the alternatives by first cost:

Cost Alternatives (must do)

Reamed = I; Trained = II; Forty Below = III

1. I  $\nleftrightarrow$   $\nleftrightarrow$  III

- Assume cotermination @ EOY 15
- Evaluate the PW of the incremental investments.

2. I  $\nleftrightarrow$

		<u>II - I</u>	
Thousands	I	$-\$2.25k - (-\$2.00k) = -\$250,000$	k = \$
	O&M	$-82,000 - (-100,000) = + 18,000$	
	MV	$100,000 - 50,000 = + 50,000$	

$$PW_{I, II}(MARR) = -\$250,000 + \$18,000 P/A, 12\%, 15^{6.2104} + \$50,000 P/F, 12\%, 15^{0.1827}$$

$$= \underline{\underline{-\$118,264}}$$

Keep I, Drop II

3. I  $\nleftrightarrow$  III

		<u>III - I</u>	
	I	$-\$2.3M - (-\$2.0M) = -\$300,000$	
	O&M	$-64,000 - (-100,000) = + 36,000$	
	MV	$225,000 - 50,000 = + 175,000$	

$$PW_{I, III}(MARR) = -\$300,000 + \$36,000(P/A, 12\%, 15) + \$175,000(P/F, 12\%, 15)$$

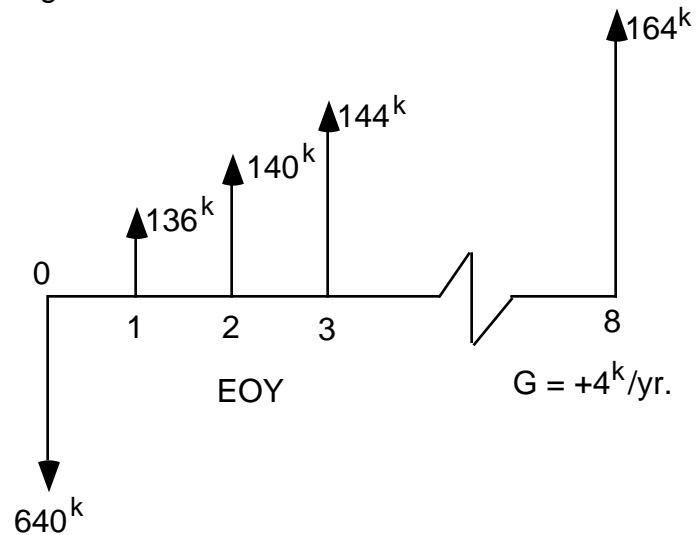
$$= \underline{\underline{-\$22,835}}$$

Keep I, Drop III

Choose Alt. I = Reamed
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## Question 2

(a) Cash Flow Diagram



$$R-E = 180^k(P/A, i, 8) - \{44^k(P/A, i, 8) - 4^k(P/G, i, 8)\}$$

$$\text{IRR: } 0 = -640^k + 136^k(P/A, i, 8) + 4^k(P/G, i, 8)$$

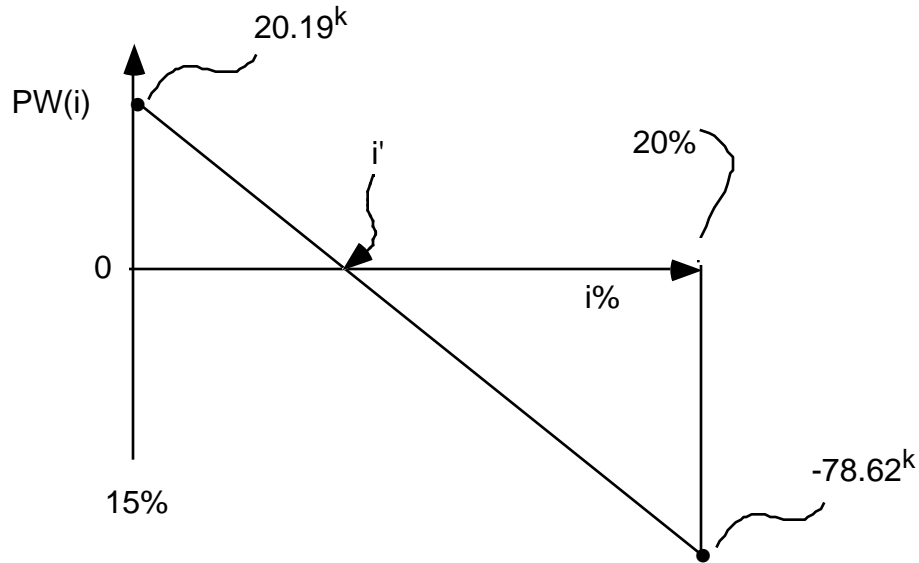
$$\text{Guess 10\%: } 0 < -640^k + 136^k(5.3349) + 4^k(16.03) = 149.67^k$$

(i too low)

$$\text{Guess 20\%: } 0 > -640^k + 136^k(3.8372) + 4^k(9.88) = -78.62^k$$

$$\text{Guess 15\%: } 0 < -640^k + 136^k(4.4873) + 4^k(12.48) = 20.19^k$$

Question 2 continued



$$\frac{i - 0.15}{20.19^k - 0} = \frac{0.20 - 0.15}{20.19^k - (-78.62^k)}$$

$$i - 0.15 = \frac{20.19^k}{98.81^k} (0.05)$$

or  $i = \underline{0.16}$  (16%)

(b)

$$= \sum_{k=0} (R-E) - I \quad 0$$

$$= (136^k + 140^k + 144^k + 148^k + 152^k) - 640^k > 0$$

= 5 yrs.

### Question 3

- Assume Repeatability

#### Caterpillar

$$\begin{aligned} AW(15\%) &= -\$22,000 A/P, 15\%, 4^{0.3503} + \$7,000 + \$4,000 A/F, 15\%, 4^{0.2003} \\ &= -\$7706.6 + \$7,000 + \$801.20 \\ &= \underline{+\$94.60} \end{aligned}$$

#### Deere

$$\begin{aligned} AW(15\%) &= -\$26,200 A/P, 15\%, 10^{0.1993} + \$7,500 + \$5,000 A/F, 15\%, 10^{0.0493} \\ &= -\$5221.66 + \$7,500 + \$246.50 \end{aligned}$$

= +\$2524.84
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Choose Deere
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#### Komatsu

$$\begin{aligned} AW(15\%) &= -\$17,000 A/P, 15\%, 5^{0.2983} + \$6,200 + \$3,500 A/F, 15\%, 5^{0.1483} \\ &= -\$5071.10 + \$519.05 \\ &= \underline{+\$1647.95} \end{aligned}$$

#### Question 4

(a)

$$\begin{aligned}\text{Cost/Pound} &= \$0.45 + \$0.40 + \$0.25 + 0.75(\$0.40) \\ &= \$1.40\end{aligned}$$

$$\begin{aligned}\text{Selling Price/Pound} &= \$1.40 + 0.2(\$1.40) \\ &= \underline{\underline{\$1.68}}\end{aligned}$$

(b) Let A = 3 million pound capacity plant

$$\begin{aligned}\text{Eight years ago: } C_A &= \$6 \text{ million } (3/1.8)^{0.84} \\ &= \$6 \text{ million } (1.536) \\ &= \$9.22 \text{ million}\end{aligned}$$

$$\text{Now: } C_A = \$9.22 \text{ million } (261/124) = \underline{\underline{\$19.4 \text{ million}}}$$

(c)

$$\text{Profit in yrs. 1-10} = 0.2 (\$1.40)(3.2 \times 10^6) = \$896,000/\text{yr.}$$

$$\text{Profit in yrs. 11-15} = 0.2 (\$1.40)(2.5 \times 10^6) = \$700,000/\text{yr.}$$

$$\begin{aligned}\text{PW}(6\%) &= -\$19.4\text{M} + 0.896\text{M}(P/A, 6\%, 10) && (\text{M} = \$ \text{Millions}) \\ &\quad + 0.7\text{M}(P/A, 6\%, 5)(P/F, 6\%, 10) \\ &= \text{NEG} && [\text{PW}(0\%) = -6.94\text{M}]\end{aligned}$$

By inspection, PW(0%) is negative so the proposed plant is a real loser! It will not be profitable.