THE HONG KONG POLYTECHNIC UNIVERSITY
HONG KONG COMMUNITY COLLEGE

Subject Title : Engineering Economics **Subject Code** : CCN3134

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Numerical Answers

Question B1

(a)(ii) The opportunity cost for Annie to accept the offer as a draftsman is \$25,000.

(c)(i) Total fixed cost, CF = \$7,600

Total variable cost = \$10,550

Variable cost per unit, C_v = \$211

Total cost CT = 7,600 + 211*D*

(c)(ii) C_{2012}(50 shops/month × 12) = \$ 18,150/month × 12 = \$217,800

C_{2017} = \$217,800 $(1.1)^5$ = \$350,769.078

Question B2

(b)(ii) For the \$20,000 annuity:
PV_0 = \$20,000(P/A, 12%, 20) = \$149,388.8

For the increasing uniform gradient, G = \$1,000:
PV_0 = $PV_{(0)}$ (P/F, 12%, 1) = = \$1,000(P/G, 12%, 19) (P/F, 12%, 1) = \$38,392.8249

The present-equivalent value (PV) at time zero is:
= \$149,388.8 + \$38,392.8249 ≈ \$18,7781.62

(c) Effective interest rate = $e^{8\%} - 1$ = 8.33%

Future value = \$20,000 (F/P, 8.33%, 10) = \$20,000 $(1.0833)^{10}$ ≈ \$44,516.13

Question B3

(a) PW(Project A, 15%)
= –\$10,000 + \$6,000(P/F,15%,1) + \$4,000(P/F,15%,2) + \$2,000(P/F, 15%,3)
+ \$1,000(P/F,15%,4) = \$128.8

PW(Project A, 20%)
= –$10,000 + $6,000(P/F,20%,1) + $4,000(P/F,20%,2) + $2,000(P/F,20%,3)
+ $1,000(P/F,20%,4) = –$582.9

Thus, IRR(Project A) = 15.90%

PW(Project B, 10%)
= –$10,000 + $1,000(P/F,10%,1) + $3,000(P/F,10%,2) + $4,000(P/F,10%,3)
+ $7,000(P/F,10%,4) = $1,174.5

PW(Project B, 15%)
= –$10,000 + $1,000(P/F,15%,1) + $3,000(P/F,15%,2) + $4,000(P/F,15%,3)
+ $7,000(P/F,15%,4) = –$229.5

Thus, IRR(Project B) = 14.18%

(b) PW (Project A, cost) = $10,000
FW (Project A, revenue)
= $6,000(F/P,10%,3) + $4,000(F/P,10%,2) + $2,000(F/P,10%,1) + $1,000 = $16,026

Thus, ERR(Project A) = 12.51%

PW (Project B, cost) = $10,000
FW (Project B, revenue)
= $1,000(F/P,10%,3) + $3,000(F/P,10%,2) + $4,000(F/P,10%,1) + $7,000 = $16,361

Thus, ERR(Project B) = 13.10%

Question B4

(e) Remaining Projects should be ranked from F, C, to E, and F will be the base alternative.

<u>Considering Projects C & F</u>:
PW(C–F, 15%)
= –$30,000 + $10,000(P/A,15%,5) = $3,521.6

PW(C–F, 20%)
= –$30,000 + $10,000(P/A,20%,5) = –$30,000 + $10,000(2.99061) = –$93.9

IRR(C–F) = 19.87% > MARR

Considering Projects C & E:
PW(E–C, 0%) = –$10,000 + $10,000(P/F,0%,5) = $0

➔ IRR = 0% < MARR → Choose C!

Question B5

(a)(i) SL method:
Depreciation expense per year (also at the end of year 4)
= ($50,000 – $2,000) / 5 = $9,600

Accumulated depreciation at the end of year 4 = $38,400

Book value at the end of year 4 = $50,000 – $38,400 = $11,600

(a)(ii) UoP method:
Depreciation expense per unit of production
= ($50,000 – $2,000) / 1,600 = $30

Depreciation expense at the end of year 4
= ($50,000 – $2,000)(300 / 1,600) = $9,000

Accumulated depreciation at the end of year 4
= ($50,000 – $2,000)(1,400 / 1,600) = $42,000

Book value at the end of year 4 = $50,000 – $42,000 = $8,000

(a)(iii) 200% DB method with SL:

End of Year	BV (at the beginning of year)	200% DB	SL	Depreciation selected
1	50,000	20,000	9,600	20,000
2	30,000	12,000	7,000	12,000
3	18,000	7,200	5,333	7,200
4	10,800	4,320	4,400	4,400
5	6,400	2,560	4,400	4,400

Depreciation expense at the end of year 4 = $4,400

Accumulated depreciation at the end of year 4 = $43,600

Book value at the end of year 4 = $50,000 – $43,600 = $6,400

Switch-over from DDB to SL occurs at year 4.

(b) Returns of US dollars = Returns of Japanese Yen
➔ (1 + 5%)(1 + rate of change of US) = (1 + 1%)

➔ Rate of change of US = 1.01/1.05 – 1 = –3.81%

Therefore, the US dollar is expected to depreciate by 3.81% in this year.

Or

(1 + 5%) = (1 + 1%)(1 + rate of change of Japanese Yen)
➔ Rate of change of Yen = 1.05/1.01 – 1 = 3.96%

Therefore, the Japanese Yen is expected to appreciate by 3.96% in this year.

Question B6

(a)(i) Challenger Economic Life:

When N = 1,
→ EUAC = [$100,000(F/P,10%,1) + $50,000 – $30,000](A/F,10%,1) = $130,000

When N = 2,
→ EUAC = [$100,000(F/P,10%,2) + $50,000(F/P,10%,1) + $60,000 – $30,000] (A/F,10%,2) = $98,097

When N = 3,
→ EUAC = [$100,000(F/P,10%,3) + $50,000(F/P,10%,2) + $60,000(F/P,10%,1) + $72,000 – $30,000](A/F,10%,3) = $91,113

When N = 4,
→ EUAC = [$100,000(F/P,10%,4) + $50,000(F/P,10%,3) + $60,000(F/P,10%,2) + $72,000(F/P,10%,1) + $86,400 – $30,000](A/F,10%,4) = $90,760

When N = 5,
→ EUAC = [$100,000(F/P,10%,5) + $50,000(F/P,10%,4) + $60,000(F/P,10%,3) + $72,000(F/P,10%,2) + $86,400(F/P,10%,1) + $103,680 – $30,000] (A/F,10%,5) = $93,359

Thus, the economic life of the new production line is 4 years, as it attains the lowest EUAC.

(a)(ii) Defender Economic Period:

Year	MV (Market Value)	Loss in MV	Cost of Capital	Operating Cost	Marginal Cost
0	$50,000	–	–	–	–
1	$40,000	$10,000	$5,000	$50,000	$65,000
2	$30,000	$10,000	$4,000	$68,000	$82,000
3	$20,000	$10,000	$3,000	$86,000	$99,000
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The most economical period to keep the defender is 2 years as the marginal cost of defender will be larger than the EUAC of the challenger in part (a)(i).

(b) Benefits = $20(P/A,10%,∞)(P/F,10%,1) = $181.82 million

Costs = $30 + $50(P/F,10%,1) + $30(P/F,10%,2) = $100.25 million

B/C ratio = 1.81 > 1, this project is beneficial to the economy.