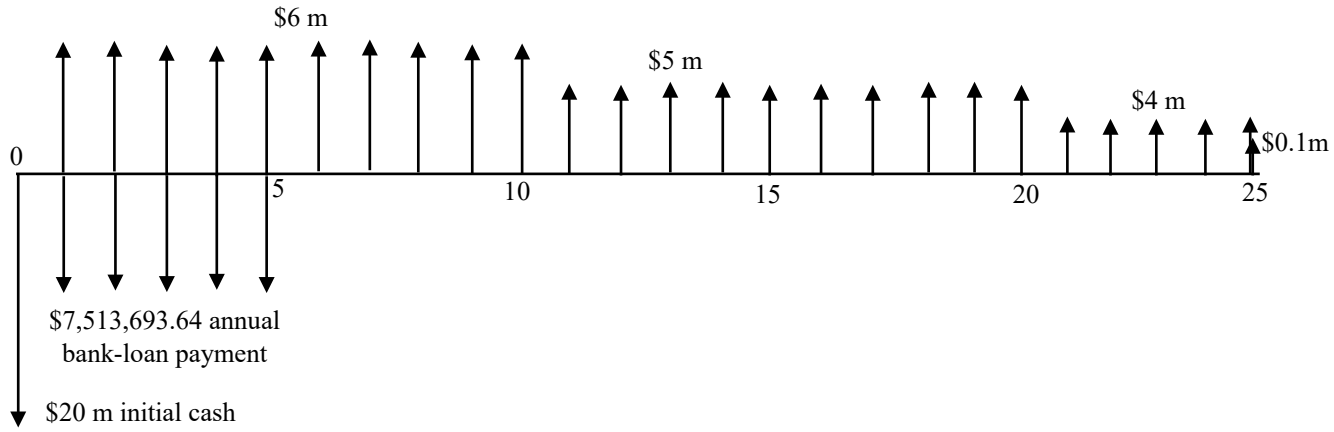
IE2111 ISE Principles and Practice II
Solutions to Assignment #2

(*a*)

MARR = 10%.
Total Initial Cost = \$65 million
Bank load = \$30 million
Loan interest rate = 8%
Initial Cash Payment = \$20 million.

Annual repayment amount = 30,000,000 [*A*/*P*, 8%, 5]
= 30,000,000 (0.250456455)
= **\$ 7,513,693.64**

(*b*) Cash flow diagram:



(*c*)

PW(10%) =	– 20, 000, 000	// Initial cash
	– 7,513,693.64 [*P*/*A*, 10%, 5]	// Loan repayments years 1 to 5
	+ 6,000,000 [*P*/*A*, 10%, 10]	// Profits for years 1 to 10
	+ 5,000,000 [*P*/*A*, 10%, 10] [*P*/*F*, 10%, 10]	// Profit for years 11 to 20
	+ 4,000,000 [*P*/*A*, 10%, 5] [*P*/*F*, 10%, 20]	// Profit for years 21 to 25
	+ 100,000 [*P*/*F*, 10%, 25]	// SV at EoY 25
=	– 20,000,000	
	– 7,513,693.64 (3.790786769)	
	+ 6,000,000 (6.144567106)	
	+ 5,000,000 (6.144567106)(0.385543289)	
	+ 4,000,000 (3.790786769) (0.148643628)	
	+ 100,000 (0.092295998)	
=	**\$ 2,492,710.07 > 0**	

Hence the project is financially feasible.

(*d*) The *IRR* is i such that

$$PW(i) = -20,000,000 - \$7,513,693.64\,[P/A, i\%, 5] + 6,000,000\,[P/A, i\%, 10]$$
$$+ 5,000,000\,[P/A, i\%, 10]\,[P/F, i\,\%, 10] + 4,000,000\,[P/A, i\,\%, 5]\,[P/F, i\%, 20]$$
$$+ 100,000\,[P/F, i\,\%, 25]$$

Using an equation solver: $i = 0.1091$

Hence *IRR* = **<u>10.91%</u>**

(*e*) To find the MIRR at financing rate 8% and reinvestment rate 10%:

$$|\,PW(\text{-}ve \text{ CF at } 8\%)\,| = 20,000,000 + (7,513,693.64 - 6,000,000)\,[P/A, 8\%, 5]$$
$$= 20,000,000 + 1,513,693.64\,(3.992710037)$$
$$= \$\,26,043,739.78$$

$$FW(+ve \text{ CF at } 10\%) = 6,000,000\,[F/A, 10\%, 5]\,[F/P, 10\%, 15]$$
$$+ 5,000,000\,[F/A, 10\%, 10]\,[F/P, 10\%, 5]$$
$$+ 4,000,000\,[F/A, 10\%, 5]$$
$$+ 100,000$$
$$= 6,000,000\,(6.1051)(4.1772482)$$
$$+ 5,000,000\,(15.9374246)(1.61051)$$
$$+ 4,000,000\,(6.1051)$$
$$+ 100,000$$
$$= \$\,305,872,415$$

$$MIRR = \sqrt[25]{\frac{305,872,415}{26,043,739.78}} - 1 = 0.10355$$

$$= \mathbf{\underline{10.355\%}}$$

(f) To find the discounted payback period, we compute

for $k = 1$ to 25:

$$PW_k(10\%) = F_0 + \sum_{j=1}^{k} \frac{F_j}{(1+0.1)^j}$$

k	F_k	$PW_k(10\%)$	Sign
0	-20,000,000.00	-20,000,000.00	< 0
1	-1,513,693.64	-21,376,085.12	< 0
2	-1,513,693.64	-22,627,071.60	< 0
3	-1,513,693.64	-23,764,332.03	< 0
4	-1,513,693.64	-24,798,205.16	< 0
5	-1,513,693.64	-25,738,089.81	< 0
6	6,000,000.00	-22,351,246.23	< 0
7	6,000,000.00	-19,272,297.52	< 0
8	6,000,000.00	-16,473,253.24	< 0
9	6,000,000.00	-13,928,667.53	< 0
10	6,000,000.00	-11,615,407.79	< 0
11	5,000,000.00	-9,862,938.30	< 0
12	5,000,000.00	-8,269,784.21	< 0
13	5,000,000.00	-6,821,462.31	< 0
14	5,000,000.00	-5,504,806.04	< 0
15	5,000,000.00	-4,307,845.79	< 0
16	5,000,000.00	-3,219,700.11	< 0
17	5,000,000.00	-2,230,476.77	< 0
18	5,000,000.00	-1,331,182.82	< 0
19	5,000,000.00	-513,642.86	< 0
20	5,000,000.00	229,575.28	> 0
21	4,000,000.00	770,097.56	> 0
22	4,000,000.00	1,261,481.45	> 0
23	4,000,000.00	1,708,194.09	> 0
24	4,000,000.00	2,114,296.48	> 0
25	4,100,000.00	2,492,710.07	> 0

$PW_{19}(10\%) =$ - \$ 513,642.86 < 0
$PW_{20}(10\%) =$ \$ 229,575.28 > 0

Discounted Payback period = 20 years.