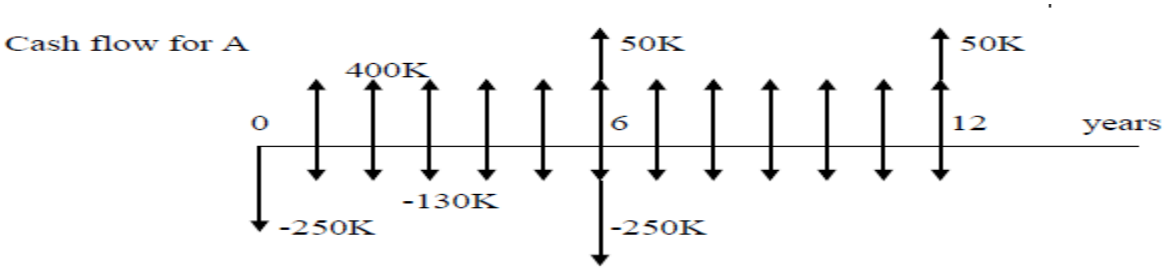
Tutorial 4

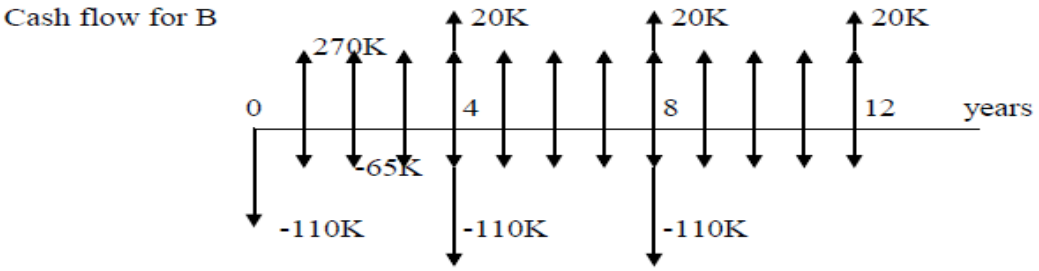
1- a) Which of the following alternatives should be chosen if MARR is %18 per year.

	A ($)	B($)
First cost	**-250,000**	**- 110,000**
Annual operating cost	**-130,000**	**- 65,000**
Annual revenues	**400,000**	**270,000**
Salvage value	**50,000**	**20,000**
Life	**6**	**4**

b) If the projects are independent, what will be your decision?

We have different lives for the alternatives. Comparison must be made over the same period, i.e. LCM of years since a study period is not stated. For these alternatives LCM = 12. Therefore, cash flows must be extended to 12 years by assuming that costs and revenues of Project A is repeated for another cycle (total of two cycles) and of Project B, another two cycles (total of three cycles). The resultant cash flows are as follows:

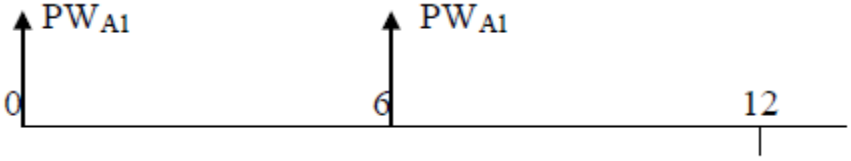




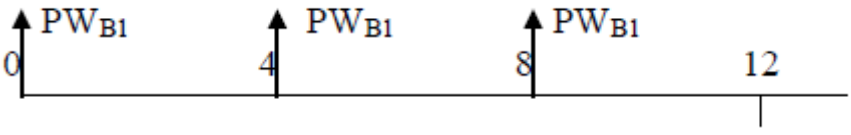
PW_A = -250,000 – 250,000(P/F,18%,6) + (400,000 – 130,000)(P/A,18%,12) + 50,000(P/F,18%,6) + 50,000(P/F,18%,12) = 976,944

PW_B = -110,000 – 110,000(P/F,18%,4) – 110,000(P/F,18%,8) + (270,000 – 65,000)(P/A,18%,12) + 20,000(P/F,18%,4) + 20,000(P/F,18%,8) + 20,000(P/F,18%,12) = 804,988

We select A as its PW is larger.
The solution can also be reached by the following method:
If we calculate the PW of each project for one cycle only, the cash flows reduce to:



Cash flow diagram for A where PW_{A1} is the PW of one cycle only given by,
PW_{A1} = -250,000 + (400,000 – 130,000)(P/A,18%,6) + 50,000(P/F,18%,6) = 712,873.5



Cash flow diagram for B where PW_{B1} is the PW of one cycle only given by,

$PW_{B1} = -110{,}000 + (270{,}000 - 65{,}000)(P/A,18\%,4) + 50{,}000(P/F,18\%,4) = 451{,}786$

Then,

$PW_A = PW_{A1}[1 + (P/F,18\%,6)] = 712873.5(1 + 0.37043) = 976{,}943$

$PW_B = PW_{B1}[1 + (P/F,18\%,4) + (P/F,18\%,8)] = 451786(1 + 0.5158 + 0.2660) = 804{,}992$

We have the same result.

(b) If projects are independent, we select both as their PW > 0.

2- Compare the alternatives below on the basis of their capitalized costs using an interest rate of %10 per year compounded semiannually.

	A	B	C
First Cost	-50,000	-300,000	-900,000
Maintenance cost per Semiannual period	-30,000	-10,000	-3,000
S.V	5,000	70,000	200,000
Life (years)	2	4	∞

The payment period for the periodic amounts is six months. We, therefore, have to measure **n** in terms of six-months and also use the interest rate applicable to six-month period (= 5% per six-month in this case).

As the alternatives have finite lives, we determine their AW's for one cycle prior to calculating their CC.

Alternative A with n = 4 (4 six-months in 2 years):

$AW_A = -50{,}000(A/P,5\%,4) - 30{,}000 + 5000(A/F,5\%,4) = -50{,}000(0.282) - 30{,}000 + 5{,}000(0.232)$

$= \$-42{,}940$

Then, $CC_A = -42{,}940/0.05 = \$-858{,}800$

Alternative B with n = 8:

$AW_B = -300{,}000(A/P,5\%,8) - 10{,}000 + 70{,}000(A/F,5\%,8)$

$= -300{,}000(0.1547) - 10{,}000 + 70{,}000(0.1047) = \$-49{,}081$ and $CC_B = -49{,}081/0.05 = \$-981{,}620$

Alternative C:

The CC of the salvage value for C is zero, since n is infinity.

$CC_C = -900{,}000 - 3{,}000/0.05 = \$-960{,}000$

Select Alternative A.