Problem I: Renault S.A. is considering two different types of motors to operate a large assembly line. The motors are scheduled to be in service for 10 years, and both will deliver the same operational characteristics for the assembly line. At the end of the tenth year, the equipment will be returned to the manufacturer, with a predetermined salvage value. An interest rate of 7.771% compounded quarterly is to be used. Determine the equivalent annualized lifetime operating cost of each motor, including maintenance, electricity and salvage value, and then determine the cheapest motor. The purchase prices of both motors are equal, so that does not need to be considered.

	Motor #1	Motor #2
Maintenance	$4,000 per year	$6,000 first year, decreases $400 per year
Electricity	$3,000 per year for years 1-5, $6,000 per year for years 6-10	$3,000 first year, increases 4% per year
Salvage value	$600 at end of tenth year	of $800 at end of tenth year

Solution:

For each motor, the present value of the operating cost = Purchase Price (not considered here) + Present value of (Maintenance +Electricity –Salvage Value). There are several approaches.

Effective annual interest rate = $(1 + \frac{r}{m})^m$ -1

r=7.771%, m=4 ➔ Effective annual interest rate is 8%

Motor #1:

Present Cost= 4,000(P/A, 8%, 10)+ 3000(P/A, 8%, 10) +3000 (P/A,8%,5) (P/F,8%,5) - 600(P/F,8%,10) Present Cost= 7,000(6.7101)+3000(3.9927)(.6806)-600(.4632)=54,845

Annual Cost=54,845(A/P,8%,10)=58,266(.1490)

Annual Cost=$8,172

Motor #2:

Present Cost= 6,000(P/A, 8%, 10)-400(P/G, 8%, 10)+3000(P/F1, 8%, 4%, 10)-800(P/F,8%,10)

Present Cost= 6,000(6.7101)-400(25.9768)+3000(7.8590)-800(.4632)

Annual Cost=$53,076(A/P,8%,10)=53,076(.1490) Annual Cost=$7,908

Cheapest Motor: #2

The factors were obtained from the table supplied except for the P/F1, calculated using the formula: =7.8590

Problem II: Annual worth analysis and Find n

The multinational oil and gas company Total S.A. is considering two mutually exclusive equipment alternatives to increase its production volume. The respective financial estimates for each alternative are as follows.

Data	Equipment A	Equipment B
Initial Cost	$ 50 000	$106310
Annual Benefits	$ 16000	$ 24000
Salvage value	$ 9000	0

If the useful life of equipment A is 4 years, with an interest rate, i=10%, what is the useful life in years of equipment B that makes both the equipment equally desirable?

Solution:

AW (Alt. A) = 16,000 – (50,000) (A/P, 10%, 4) + 9,000(A/F, 10%, 4) = 16,000 - (50,000) (0.3155) + 9,000 (0.2155) = $2,164.50
AW (Alt. B) = 24,000 - (106,310) (A/P, 10%, n)
Equating, AW (Alt. A) = AW (Alt. B), we get, 24,000 - (106,310) (A/P, 10%, n) = 2,164.50 (A/P, 10%, n) = (24,000 - 2,164.50)/106,310 = 0.2054
From 10% interest table, it is found that n = 7.

Problem III: Present worth Analysis (LCM)

Al Sabeh Cement S.A.L. would like to choose between two types of machinery. Information on the two options is as shown in the table below. Which alternative would you recommend based on the Present worth analysis technique? (Assume an interest rate of 12%)

	Alternative 1	Alternative 2
First Cost	$ 63,000	$ 67,000
Maintenance and Operating Costs	$ 9,000	$ 12,000
Annual Benefits	$ 31,000	$ 37,000
Salvage Value	$ 19,000	$ 22,000
Useful Life in years	3	6

Solution

The Least Common multiple is 6; so this will be used as the analysis period.

	Alternative 1					Alternative 2				
Period	**First Cost**	**Salvage value**	**Annual Cost**	**Annual Benefit**	**Net Annual**	**First Cost**	**Salvage value**	**Annual Cost**	**Annual Benefit**	**Net Annual**
0	($63,000)					($67,000)				
1			($9,000)	$31,000	$22,000			($12,000)	$37,000	$25,000
2			($9,000)	$31,000	$22,000			($12,000)	$37,000	$25,000
3	($63,000)	$19,000	($9,000)	$31,000	$22,000			($12,000)	$37,000	$25,000
4			($9,000)	$31,000	$22,000			($12,000)	$37,000	$25,000
5			($9,000)	$31,000	$22,000			($12,000)	$37,000	$25,000
6		$19,000	($9,000)	$31,000	$22,000		$22,000	($12,000)	$37,000	$25,000

Alternative 1:

P = {-63,000*[1 + (P/F, 12%, 3)] + {19,000[(P/F, 12%, 3) + (P/F, 12%, 6)]} + {22,000(P/A, 12%, 6)}

P = {-63,000*[1 + 0.7118]} + {19,000[0.7118 + 0.5066]} + {22,000*4.111}

= -107,843.4 +23,149.6 +90,442

=$5,743.2

Alternative 2:

P = -67,000 + {22,000* [(P/F, 12%, 6)} + 25,000(P/A, 12%, 6)

P = -67,000 + 22,000(0.5066) + 25,000(4.111)

= -67,000 +11,145.2 +102,775

=$46,920.20

Choose Alt 2 because it maximizes the Net Present Worth