Solutions to end-of-chapter problems

Chapter 6

6.5 $AW_4 = -20{,}000(A/P,10\%,4) - 12{,}000 + 4000(A/F,10\%,4)$
$= -20{,}000(0.31547) - 12{,}000 + 4000(0.21547)$
$= \$-17{,}448$

$-17{,}448 = -20{,}000(A/P,10\%,6) - 12{,}000 - (20{,}000 - 4000)(P/F,10\%,4)(A/P,10\%,6) + S(A/F,10\%,6)$

$= -20{,}000(0.22961) - 12{,}000 - (20{,}000 - 4000)(0.6830)(0.22961) + S(0.12961)$

$(0.12961)S = 1{,}653.38$

$S = \$12{,}756$

6.10 (a) $CR = -285{,}000(A/P,12\%,10) + 50{,}000(A/F,12\%,10)$
$= -285{,}000(0.17698) + 50{,}000(0.05698)$
$= \$-47{,}590$ per year

At revenue of \$52,000 per year, yes, he did

(b) $AW = -285{,}000(A/P,12\%,10) + 50{,}000(A/F,12\%,10) + 52{,}000 - 10{,}000 - 1000(A/G,12\%,10)$
$= -285{,}000(0.17698) + 50{,}000(0.05698) + 42{,}000 - 1000(3.5847)$
$= \$-9{,}175$ per year

AW was negative

6.15 $AW_{Single} = -6000(A/P,10\%,4) - 6000(P/A,10\%,3)(A/P,10\%,4)$
$= -6000(0.31547) - 6000(2.4869)(0.31547)$
$= \$-6{,}600$

$AW_{Site} = -22{,}000(A/P,10\%,4)$
$= -22{,}000(0.31547)$
$= \$-6{,}940$

Buy the single-user license

6.18 $AW_{MF} = -33{,}000(A/P,10\%,3) - 8000 + 4000(A/F,10\%,3)$
$= -33{,}000(0.40211) - 8000 + 4000(0.30211)$
$= \$-20{,}061$

$AW_{UF} = -51{,}000(A/P,10\%,6) - 3500 + 11{,}000(A/F,10\%,6)$
$= -51{,}000(0.22961) - 3500 + 11{,}000(0.12961)$
$= \$-13{,}784$

Select the UF system

6.19 (a) $AW_{Joe} = -85{,}000(A/P,8\%,3) - 30{,}000 + 40{,}000(A/F,8\%,3)$
$= -85{,}000(0.38803) - 30{,}000 + 40{,}000(0.30803)$
$= \$-50{,}661$

$AW_{Watch} = -125{,}000(A/P,8\%,5) - 27{,}000 + 33{,}000(A/F,8\%,5)$
$= -125{,}000(0.25046) - 27{,}000 + 33{,}000(0.17046)$
$= \$-52{,}682$

Select robot Joeboy

(b) Spreadsheet and Goal Seek indicate that Watcheye's first cost must be $\leq$ \$-116,935.

	A	B	C
1	Year	Joeboy	Watcheye
2	0	-85,000	-116,935
3	1	-30,000	-27,000
4	2	-30,000	-27,000
5	3	10,000	-27,000
6	4		-27,000
7	5		6,000
8			
9	AW at 8%	-50,662	-50,662

Found using Goal Seek when cell C9 was set equal to cell B9 at \$-50,662

6.22 (a) $CR_{Semi2} = -80{,}000(A/P,10\%,5) + 13{,}000(A/F,10\%,5)$
$= -80{,}000(0.26380) + 13{,}000(0.16380)$
$= \$-18{,}975$ per year

$CR_{Auto1} = -62{,}000(A/P,10\%,5) + 2000(A/F,10\%,5)$
$= -62{,}000(0.26380) + 2000(0.16380)$
$= \$-16{,}028$ per year

Capital recovery for Auto1 is lower by \$2947 per year

(b) $AW_{Semi2} = -80{,}000(A/P,10\%,5) - [21{,}000 + 500(A/G,10\%,5)] + 13{,}000(A/F,10\%,5)$
$= -80{,}000(0.26380) - [21{,}000 + 500(1.8101)] + 13{,}000(0.16380)$
$= \$-40{,}880$ per year

$P_{g\text{-}Auto1} = -62{,}000 - 21{,}000\{1 - [(1 + 0.08)/(1 + 0.10)]^5\}/(0.10 - 0.08)$
$+ 2000(A/F,10\%,5)$
$= -62{,}000 - 21{,}000\{4.3831\} + 2000(0.16380)$
$= \$-153{,}718$

$AW_{Auto1} = -153{,}718(A/P,10\%,5)$
$= -153{,}718(0.26380)$
$= \$-40{,}551$ per year

Select Auto1 by a relatively small margin

6.28 (a) $AW_X = -90{,}000(A/P,10\%,3) - 40{,}000 + 7000(A/F,10\%,3)$
$= -90{,}000(0.40211) - 40{,}000 + 7000(0.30211)$
$= \$-74{,}075$

$AW_Y = -400{,}000(A/P,10\%,10) - 20{,}000 + 25{,}000(A/F,10\%,10)$
$= -400{,}000(0.16275) - 20{,}000 + 25{,}000(0.06275)$
$= \$-83{,}531$

$AW_Z = -650{,}000(0.10) - 13{,}000 - 80{,}000(A/F,10\%,10)$
$= -650{,}000(0.10) - 13{,}000 - 80{,}000(0.06275)$
$= \$-83{,}020$

Select Alternative X

(b) Goal Seek (right figure, row 2) finds the required first costs for Y = \$-341,912 and Z = \$-560,564 by setting both AW values to $AW_x = \$-74{,}076$ and solving.

	A	B	C	D
1	Year	X	Y	Z
2	0	-90,000	-400,000	-650,000
3	1	-40,000	-20,000	-13,000
4	2	-40,000	-20,000	-13,000
5	3	-33,000	-20,000	-13,000
6	4		-20,000	-13,000
7	5		-20,000	-13,000
8	6		-20,000	-13,000
9	7		-20,000	-13,000
10	8		-20,000	-13,000
11	9		-20,000	-13,000
12	10		5,000	-93,000
13	AW at 10%	-74,076	-83,530	-83,020
14				
15	AW for infinite life Z:			
16	=-650000*(0.1) -13000 - PMT(10%,10,,-80000)			
17				

	A	B	C	D
1	Year	X	Y	Z
2	0	-90,000	-341,912	-560,564
3	1	-40,000	-20,000	-13,000
4	2	-40,000	-20,000	-13,000
5	3	-33,000	-20,000	-13,000
6	4		-20,000	-13,000
7	5		-20,000	-13,000
8	6		-20,000	-13,000
9	7		-20,000	-13,000
10	8		-20,000	-13,000
11	9		-20,000	-13,000
12	10		5,000	-93,000
13	AW at 10%	-74,076	-74,076	-74,076
14				

6.31 First find the present worth of all costs and then convert to annual worth over 20 years.

$PW = -2.6(P/F,6\%,1) - 2.0(P/F,6\%,2) - 7.5(P/F,6\%,3) - 10.0(P/F,6\%,4)$
$- 6.3(P/F,6\%,5) - 1.36(P/A,6\%,15)(P/F,6\%,5) - 3.0(P/F,6\%,10)$
$- 3.7(P/F,6\%,18)$
$= -2.6(0.9434) - 2.0(0.8900) - 7.5(0.8396) - 10.0(0.7921) - 6.3(0.7473)$
$- 1.36(9.7122)(0.7473) - 3.0(0.5584) - 3.7(0.3503)$
$= \$-36{,}000{,}921$

Annual LCC $= -36{,}000{,}921(A/P,6\%,20)$
$= -36{,}000{,}921(0.08718)$
$= \$-3{,}138{,}560$ per year

6.32 Annual LCC_A = -750,000(A/P,6%,20) - 72,000 - 24,000
– 150,000[(P/F,6%,5) + (P/F,6%,10) + (P/F,6%,15)](A/P,6%,20)
= -750,000(0.08718) - 72,000 - 24,000
– 150,000[0.7473 + 0.5584 + 0.4173](0.08718)
= $-183,917

Annual LCC_B = -1,100,000(A/P,6%,20) – 36,000 – 12,000
= -1,100,000(0.08718) – 36,000 – 12,000
= $-143,898

Select Proposal B

6.33 PW_M = -250,000 – 150,000(P/A,8%,4) – 45,000 – 35,000(P/A,8%,2)
-50,000(P/A,8%,10) – 30,000(P/A,8%,5)
= -250,000 – 150,000(3.3121) – 45,000 – 35,000(1.7833)
-50,000(6.7101) – 30,000(3.9927)
= $-1,309,517

Annual LCC_M = -1,309,517(A/P,8%,10)
= -1,309,517(0.14903)
= $-195,157

PW_N = -10,000 – 45,000 - 30,000(P/A,8%,3) – 80,000(P/A,8%,10)
- 40,000(P/A,8%,10)
= -10,000 – 45,000 - 30,000(2.5771) – 80,000(6.7101) - 40,000(6.7101)
= $-937,525

Annual LCC_N = -937,525(A/P,8%,10)
= -937,525(0.14903)
= $-139,719

Annual LCC_O = $-175,000

Select Alternative N