Assignment 1 Key

50 Points (Due: 5:00PM Tuesday Feb. 9)

Assessment Goals: (Reading instructions; Following format guideline; Time management; Report quality; Calculation accuracy)

Show your work. No round down or up, use 2 decimals for dollar values and 4 decimals for factors.

PROBLEM:

Expenditures and income of a project over a 23 year period is given in the table below.

YEAR	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
TRANSACTION	-6543	2300		8200		810	-4100			1200	1890	

YEAR	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
TRANSACTION		-6342		1900			1500	-850		1230	-710	1000

For the interest rate of 12% compounded annually, perform the following steps for the project:

1. Plot the cash flow (5pts)

2. Calculate the present worth of the project using formulas for factors. (10 pts)

3. Calculate the present worth of the project using tables for factors and compare with answer in in part 2. Explain the reason for difference, if any. (10 pts)

4. Calculate future worth of the project at the end of year 2023 using tables. (10 pts)

5. Calculate future worth of the project at the end of year 2023 using the calculated value in part 3. (5 pts)

6. Calculate the equivalent value of the project at the end of year 2013. (10 pts)

1. Plot the cash flow (5pts)

Below is the plotted cash flow. Make sure that lines are proportional to the values. Here I used Excel and assumed each vertical grid is 500 and I marked them to make the counting easier. Then, for example, for the 1st transaction of -\$6543, I plotted an arrow pointing downward almost 13 grids.



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2. Calculate the present worth of the project using formulas for factors. (10 pts)

These transactions follow no specific patterns. So, the easiest approach is to find the present worth of each individual transaction and then add them all together. Since we are required to use the formulas, then the present worth of each individual transaction at the end of year *n* is:

$$P = F(1+i)^{-n}$$

Calculation example:

Transaction at the end of year 2010 is \$1,890, which its present worth at year 0 is calculated as $$1,890(1+.12)^{-10} = $1,890(0.3220) = 608.58 . Similar calculations for the other numbers are presented in the table below totaling to PW = -109.83

n	Transaction (\$)	(1+i) ⁻ⁿ	Present Worth (\$)
0	-6543	1.0000	-6543.00
1	2300	0.8929	2053.67
2	0	0.7972	0.00
3	8200	0.7118	5836.76
4	0	0.6355	0.00
5	810	0.5674	459.59
6	-4100	0.5066	-2077.06
7	0	0.4523	0.00
8	0	0.4039	0.00
9	1200	0.3606	432.72
10	1890	0.3220	608.58
11	0	0.2875	0.00
12	0	0.2567	0.00
13	-6342	0.2292	-1453.59
14	0	0.2046	0.00
15	1900	0.1827	347.13
16	0	0.1631	0.00
17	0	0.1456	0.00
18	1500	0.1300	195.00
19	-850	0.1161	-98.69
20	0	0.1037	0.00
21	1230	0.0926	113.90
22	-710	0.0826	-58.65
23	1000	0.0738	73.80

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3. Calculate the present worth of the project using tables for factors and compare with answer in in part 2. Explain the reason for difference, if any. (10 pts)

Since we are required to use the tables, then the present worth of each individual transaction at the end of year *n* is:

$$P = F\left(\frac{P}{F}, i, n\right)$$

Looking at the table values we realize that factors exactly match the 4 digit calculation through the formulas. Thus the present worth will be the same.

12%	TABLE 1	7 Note that this is not true in general. The only
	Single Paym	reason that in this case the values for the factors
	Jiligle Fayin	are the same is because we restricted the values
	Present	calculated through formulas to 4 digit decimal
	Worth	forms. For example, consider the same year 10
n	P/F	calculation where the factor value with more
1	0.8929	accurate number of desimals will be
2	0.7972	
3	0.7118	0.321973236590696 instead of 0.3220 resulting in
4	0.6355	present worth of 608.53 instead of 608.58
5	0.5674	
6	0.5066	
	0.4523	
8	0.4039	
9	0.3606	
10	0.3220	
12	0.2875	
12	0.2007	
13	0.2292	
14	0.2040	
16	0.1621	
17	0 1456	
18	0.1300	
19	0.1161	
20	0.1037	
21	0.0926	
22	0.0826	
23	0.0738	

4. Calculate future worth of the project at the end of year 2023 using tables. (10 pts)

5. Calculate future worth of the project at the end of year 2023 using the calculated value in part 3. (5 pts)

Similar approach except that formula and factors used are:

$$F = P(1+i)^{n}$$
$$F = P\left(\frac{F}{P}, i, n\right)$$

Don't forget that in here n is the number of years a transaction has to move to year 23 from the year it is located. For example, transaction at the end of year 10 has n=13 (i.e. 23-10=13) where transaction at year 0 has n=23. The calculation will result in Future worth of \$1,491.41 in both cases (also see the note about accuracy above).

Years to Move Forward	Transaction (\$)	(F/p,l,n) (1+i) ⁿ	Future Worth (\$)
23	-6543	13.5523	-88672.70
22	2300	12.1003	27830.69
21	0	10.8038	0.00
20	8200	9.6463	79099.66
19	0	8.6128	0.00
18	810	7.6900	6228.90
17	-4100	6.8660	-28150.60
16	0	6.1304	0.00
15	0	5.4736	0.00
14	1200	4.8871	5864.52
13	1890	4.3635	8247.02
12	0	3.8960	0.00
11	0	3.4785	0.00
10	-6342	3.1058	-19696.98
9	0	2.7731	0.00
8	1900	2.4760	4704.40
7	0	2.2107	0.00
6	0	1.9738	0.00
5	1500	1.7623	2643.45
4	-850	1.5735	-1337.48
3	0	1.4049	0.00
2	1230	1.2544	1542.91
1	-710	1.1200	-795.20
0	1000	1.0000	1000.00

6. Calculate the equivalent value of the project at the end of year 2013. (10 pts)

This is a combination of both present worth and future worth calculation. All transactions occurring BEFORE year 2013 need to be brought forward to year 2013 (that is future worth calculation) and all occurring AFTER year 2013 need to move backward to year 2013 (present worth calculation). For example, for transaction at the end of year 9 (\$1,200) we need to find its future worth with n=4 (from 9 to 13) and for transaction at the end of year 15 (\$1,900) we need to find its present worth with n=2 (from 15 to 13). The equivalent of the cash flow at year 13 is 3363.64+2497.89 -6342 = -480.47 (Don't forget that 6342 for year 13 is already a present value for year 13). Below are the calculations:

Years to Move Forward	Transaction (\$)	(F/p,I,n) (1+i) ⁿ	Future Worth (\$)
13	-6543	4.3635	-28550.34
12	2300	3.8960	8960.74
11	0	3.4785	0.00
10	8200	3.1058	25467.96
9	0	2.7731	0.00
8	810	2.4760	2005.53
7	-4100	2.2107	-9063.79
6	0	1.9738	0.00
5	0	1.7623	0.00
4	1200	1.5735	1888.22
3	1890	1.4049	2655.31
2	0	1.2544	0.00
1	0	1.1200	0.00
Years to Move Backward	Transaction (\$)	(P/F,I,n) (1+i) ⁻ⁿ	Present Worth (\$)
1	0	0.8929	0.00
2	1900	0.7972	1514.67
3	0	0.7118	0.00
4	0	0.6355	0.00
5	1500	0.5674	851.14
6	-850	0.5066	-430.64
7	0	0.4523	0.00
8	1230	0.4039	496.78
9	-710	0.3606	-256.03
10	1000	0.3220	321.97