American University of Beirut, Faculty of Engineering and Architecture

INDE 301 Engineering Economy, Quiz N°1

1) What is the future worth of an annual series of $1300 for 39 years at an interest rate of 0.75% per year? a) Use interpolation, b) Use formula.

2) A small construction company expects its costs for maintenance of its heavy equipment to be $15,000 in year 1 and amounts increasing by $1000 each year thru year 5. At an interest rate of 10% per year, what is the equivalent annual worth of the maintenance costs?

3) What is the present worth of an energy cost of $10,000 in year one and amounts increasing by 6% per year thru year 10, if the interest rate is 12% per year?

4) **Bonus:** What is the equivalent annual worth (in years 1 thru 10) of repair costs of $15,000 in years 1 thru 4 and $20,000 in years 5 thru 9 at an interest rate of 10% per year?

Relations for Discrete Cash Flows with End-of-Period Compounding

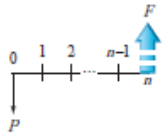
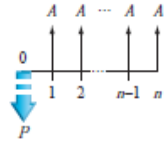
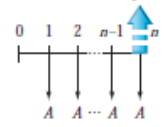
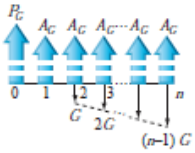
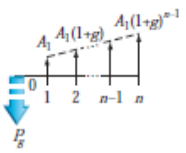
Type	Find/Given	Factor Notation and Formula	Relation	Sample Cash Flow Diagram
Single Amount	F/P Compound amount	$(F/P,i,n) = (1+i)^n$	$F = P(F/P,i,n)$	
	P/F Present worth	$(P/F,i,n) = \frac{1}{(1+i)^n}$	$P = F(P/F,i,n)$ (Sec. 2.1)	
Uniform Series	P/A Present worth	$(P/A,i,n) = \frac{(1+i)^n - 1}{i(1+i)^n}$	$P = A(P/A,i,n)$	
	A/P Capital recovery	$(A/P,i,n) = \frac{i(1+i)^n}{(1+i)^n - 1}$	$A = P(A/P,i,n)$ (Sec. 2.2)	
	F/A Compound amount	$(F/A,i,n) = \frac{(1+i)^n - 1}{i}$	$F = A(F/A,i,n)$	
	A/F Sinking fund	$(A/F,i,n) = \frac{i}{(1+i)^n - 1}$	$A = F(A/F,i,n)$ (Sec. 2.3)	
Arithmetic Gradient	P_G/G Present worth	$(P/G,i,n) = \frac{(1+i)^n - in - 1}{i^2(1+i)^n}$	$P_G = G(P/G,i,n)$	
	A_G/G Uniform series	$(A/G,i,n) = \frac{1}{i} - \frac{n}{(1+i)^n - 1}$ (Gradient only)	$A_G = G(A/G,i,n)$ (Sec. 2.5)	
Geometric Gradient	P_g/A_1 and g Present worth	$P_g = \begin{cases} \frac{A_1\left[1 - \left(\frac{1+g}{1+i}\right)^n\right]}{i-g} \\ A_1 \frac{n}{1+i} \end{cases}$ (Gradient and base A_1)	$g \neq i$ $g = i$ (Sec. 2.6)	

TABLE 3 Discrete Cash Flow: Compound Interest Factors 0.75% 0.75%

n	Single Payments: Compound Amount F/P	Single Payments: Present Worth P/F	Uniform Series Payments: Sinking Fund A/F	Uniform Series Payments: Compound Amount F/A	Uniform Series Payments: Capital Recovery A/P	Uniform Series Payments: Present Worth P/A	Arithmetic Gradients: Gradient Present Worth P/G	Arithmetic Gradients: Gradient Uniform Series A/G
1	1.0075	0.9926	1.00000	1.0000	1.00750	0.9926		
2	1.0151	0.9852	0.49813	2.0075	0.50563	1.9777	0.9852	0.4981
3	1.0227	0.9778	0.33085	3.0226	0.33835	2.9556	2.9408	0.9950
4	1.0303	0.9706	0.24721	4.0452	0.25471	3.9261	5.8525	1.4907
29	1.2420	0.8052	0.03100	32.2609	0.03850	25.9759	350.0867	13.4774
30	1.2513	0.7992	0.02985	33.5029	0.03735	26.7751	373.2631	13.9407
36	1.3086	0.7641	0.02430	41.1527	0.03180	31.4468	524.9824	16.6946
40	1.3483	0.7416	0.02153	46.4465	0.02903	34.4469	637.4693	18.5058
48	1.4314	0.6986	0.01739	57.5207	0.02489	40.1848	886.8404	22.0691
50	1.4530	0.6883	0.01656	60.3943	0.02406	41.5664	953.8486	22.9476
52	1.4748	0.6780	0.01580	63.3111	0.02330	42.9276	1022.59	23.8211