

University of Saskatchewan
College of Engineering

GE348.3 Engineering Economics

2011 Midterm Examination

Time: 1:10pm – 2:10pm

October 25th, 2011

- Closed Book Exam
- A 8.5 x 11 sheet of paper with study notes on both sides is allowed
- Compounding Interest Factor Tables are attached
- Use non-communicating calculators only (no cell phones, PDAs or computers)
- Complete all work neatly in the exam booklet(s)
- Show all formulas and calculations
- Write your name and student number on all booklets
- This sheet is to be turned in with the exam booklet(s)
- Clearly state all your assumptions

Question	Marks Available	Marks Obtained
1	10	10
2	15	15
3	30	8
4	15	15
5	30	28
TOTAL	100	76

Instructor: Dr. Peter Park

Name: _____

Student: _____

1. Tom invested \$15,000 today in a savings account and he is expecting to receive \$25,000 10 years from now. What is the effective annual interest rate for this investment? What is the corresponding nominal interest rate if this interest is compounded monthly?
2. GE348 Inc. purchased a \$15,000 drilling machine today for a mining project and they are planning to use this machine over the next four years. The maintenance and operating costs for this machine is also \$15,000 per year starting at the end of first year for the same time period (i.e., from $t=1$ to $t=4$). What is the equivalent dollar value for this machine at year six (i.e., $t=6$) if we apply 9.569% nominal interest rate, compounded monthly? **Develop a cash flow diagram.**
3. Saskatoon House Depot (SHD) is a growing retail company that sells many house building related raw materials such as bricks, wooden fences, etc. They are planning to increase their storage space for raw materials. A neighbouring company has offered a contract allowing SHD to lease their storage facilities instantly with \$10,000 ($t=0$) for the first year leasing fee with an annual decrease in the leasing fee by \$1,000 each year. The decrease in the leasing fee is expected to start at the end of the first year ($t=1$) and will stop at the end of fifth year ($t=5$). The sixth year leasing fee will remain at the same level as the fifth year leasing fee. There is no fee for the seventh year. Suppose SHD wants to use the nearby company's storage facilities during the next seven years (until $t=7$) from now. What is the equivalent amount of annuities per year for leasing this facility over this seven-year period? Apply 12% effective annual interest rate for the calculation. **Develop a cash flow diagram and use the compounding interest factor tables to solve this question.**
4. What is the amount of \$X in years four and five in the following cash flows if the equivalent of lump sum present worth of these cash flows is known to be \$1,000? \$X is the same value for years four and five. Apply 15% effective annual interest rate. **Use the compounding interest factor tables to solve this question.**

Year	0	1	2	3	4	5
Cash Flows	-\$1,000	-\$1,500	\$1,000	0	\$X	\$X

5. You plan to purchase a \$300,000 condominium with a 10% down payment in downtown Saskatoon either with a 0.3% effective interest rate compounded monthly for the 25 years amortization period or with a 0.4% effective interest rate compounded monthly for the 30 years amortization period. What is the difference in the accumulated interest in the first three monthly payments between these two options?

Compound Interest Factors

$i = 10\%$

n	Single Payment		Uniform Payment Series				Arithmetic Gradient		n
	Compound Amount Factor Find F Given P F/P	Present Worth Factor Find P Given F P/F	Sinking Fund Factor Find A Given F A/F	Capital Recovery Factor Find A Given P A/P	Compound Amount Factor Find F Given A F/A	Present Worth Factor Find P Given A P/A	Gradient Uniform Series Find A Given G A/G	Gradient Present Worth Find P Given G P/G	
1	1.100	.9091	1.0000	1.1000	1.000	0.909	0	0	1
2	1.210	.8264	.4762	.5762	2.100	1.736	0.476	0.826	2
3	1.331	.7513	.3021	.4021	3.310	2.487	0.937	2.329	3
4	1.464	.6830	.2155	.3155	4.641	3.170	1.381	4.378	4
5	1.611	.6209	.1638	.2638	6.105	3.791	1.810	6.862	5
6	1.772	.5645	.1296	.2296	7.716	4.355	2.224	9.684	6
7	1.949	.5132	.1054	.2054	9.487	4.868	2.622	12.763	7
8	2.144	.4665	.0874	.1874	11.436	5.335	3.004	16.029	8
9	2.358	.4241	.0736	.1736	13.579	5.759	3.372	19.421	9
10	2.594	.3855	.0627	.1627	15.937	6.145	3.725	22.891	10
11	2.853	.3505	.0540	.1540	18.531	6.495	4.064	26.396	11
12	3.138	.3186	.0468	.1468	21.384	6.814	4.388	29.901	12
13	3.452	.2897	.0408	.1408	24.523	7.103	4.699	33.377	13
14	3.797	.2633	.0357	.1357	27.975	7.367	4.996	36.801	14
15	4.177	.2394	.0315	.1315	31.772	7.606	5.279	40.152	15
16	4.595	.2176	.0278	.1278	35.950	7.824	5.549	43.416	16
17	5.054	.1978	.0247	.1247	40.545	8.022	5.807	46.582	17
18	5.560	.1799	.0219	.1219	45.599	8.201	6.053	49.640	18
19	6.116	.1635	.0195	.1195	51.159	8.365	6.286	52.583	19
20	6.728	.1486	.0175	.1175	57.275	8.514	6.508	55.407	20
21	7.400	.1351	.0156	.1156	64.003	8.649	6.719	58.110	21
22	8.140	.1228	.0140	.1140	71.403	8.772	6.919	60.689	22
23	8.954	.1117	.0126	.1126	79.543	8.883	7.108	63.146	23
24	9.850	.1015	.0113	.1113	88.497	8.985	7.288	65.481	24
25	10.835	.0923	.0102	.1102	98.347	9.077	7.458	67.696	25
26	11.918	.0839	.00916	.1092	109.182	9.161	7.619	69.794	26
27	13.110	.0763	.00826	.1083	121.100	9.237	7.770	71.777	27
28	14.421	.0693	.00745	.1075	134.210	9.307	7.914	73.650	28
29	15.863	.0630	.00673	.1067	148.631	9.370	8.049	75.415	29
30	17.449	.0573	.00608	.1061	164.494	9.427	8.176	77.077	30
31	19.194	.0521	.00550	.1055	181.944	9.479	8.296	78.640	31
32	21.114	.0474	.00497	.1050	201.138	9.526	8.409	80.108	32
33	23.225	.0431	.00450	.1045	222.252	9.569	8.515	81.486	33
34	25.548	.0391	.00407	.1041	245.477	9.609	8.615	82.777	34
35	28.102	.0356	.00369	.1037	271.025	9.644	8.709	83.987	35
40	45.259	.0221	.00226	.1023	442.593	9.779	9.096	88.953	40
45	72.891	.0137	.00139	.1014	718.905	9.863	9.374	92.454	45
50	117.391	.00852	.00086	.1009	1163.9	9.915	9.570	94.889	50
55	189.059	.00529	.00053	.1005	1880.6	9.947	9.708	96.562	55
60	304.482	.00328	.00033	.1003	3034.8	9.967	9.802	97.701	60
65	490.371	.00204	.00020	.1002	4893.7	9.980	9.867	98.471	65
70	789.748	.00127	.00013	.1001	7887.5	9.987	9.911	98.987	70
75	1271.9	.00079	.00008	.1001	12709.0	9.992	9.941	99.332	75
80	2048.4	.00049	.00005	.1000	20474.0	9.995	9.961	99.561	80
85	3299.0	.00030	.00003	.1000	32979.7	9.997	9.974	99.712	85
90	5313.0	.00019	.00002	.1000	53120.3	9.998	9.983	99.812	90
95	8556.7	.00012	.00001	.1000	85556.9	9.999	9.989	99.877	95
100	13780.6	.00007	.00001	.1000	137796.3	9.999	9.993	99.920	100

Compound Interest Factors

$i = 12\%$

<i>n</i>	Single Payment		Uniform Payment Series				Arithmetic Gradient		<i>n</i>
	Compound Amount Factor	Present Worth Factor	Sinking Fund Factor	Capital Recovery Factor	Compound Amount Factor	Present Worth Factor	Gradient Uniform Series	Gradient Present Worth	
	Find <i>F</i> Given <i>P</i> <i>F/P</i>	Find <i>P</i> Given <i>F</i> <i>P/F</i>	Find <i>A</i> Given <i>F</i> <i>A/F</i>	Find <i>A</i> Given <i>P</i> <i>A/P</i>	Find <i>F</i> Given <i>A</i> <i>F/A</i>	Find <i>P</i> Given <i>A</i> <i>P/A</i>	Find <i>A</i> Given <i>G</i> <i>A/G</i>	Find <i>P</i> Given <i>G</i> <i>P/G</i>	
1	1.120	.8929	1.0000	1.1200	1.000	0.893	0	0	1
2	1.254	.7972	.4717	.5917	2.120	1.690	0.472	0.797	2
3	1.405	.7118	.2963	.4163	3.374	2.402	0.925	2.221	3
4	1.574	.6355	.2092	.3292	4.779	3.037	1.359	4.127	4
5	1.762	.5674	.1574	.2774	6.353	3.605	1.775	6.397	5
6	1.974	.5066	.1232	.2432	8.115	4.111	2.172	8.930	6
7	2.211	.4523	.0991	.2191	10.089	4.564	2.551	11.644	7
8	2.476	.4039	.0813	.2013	12.300	4.968	2.913	14.471	8
9	2.773	.3606	.0677	.1877	14.776	5.328	3.257	17.356	9
10	3.106	.3220	.0570	.1770	17.549	5.650	3.585	20.254	10
11	3.479	.2875	.0484	.1684	20.655	5.938	3.895	23.129	11
12	3.896	.2567	.0414	.1614	24.133	6.194	4.190	25.952	12
13	4.363	.2292	.0357	.1557	28.029	6.424	4.468	28.702	13
14	4.887	.2046	.0309	.1509	32.393	6.628	4.732	31.362	14
15	5.474	.1827	.0268	.1468	37.280	6.811	4.980	33.920	15
16	6.130	.1631	.0234	.1434	42.753	6.974	5.215	36.367	16
17	6.866	.1456	.0205	.1405	48.884	7.120	5.435	38.697	17
18	7.690	.1300	.0179	.1379	55.750	7.250	5.643	40.908	18
19	8.613	.1161	.0158	.1358	63.440	7.366	5.838	42.998	19
20	9.646	.1037	.0139	.1339	72.052	7.469	6.020	44.968	20
21	10.804	.0926	.0122	.1322	81.699	7.562	6.191	46.819	21
22	12.100	.0826	.0108	.1308	92.503	7.645	6.351	48.554	22
23	13.552	.0738	.00956	.1296	104.603	7.718	6.501	50.178	23
24	15.179	.0659	.00846	.1285	118.155	7.784	6.641	51.693	24
25	17.000	.0588	.00750	.1275	133.334	7.843	6.771	53.105	25
26	19.040	.0525	.00665	.1267	150.334	7.896	6.892	54.418	26
27	21.325	.0469	.00590	.1259	169.374	7.943	7.005	55.637	27
28	23.884	.0419	.00524	.1252	190.699	7.984	7.110	56.767	28
29	26.750	.0374	.00466	.1247	214.583	8.022	7.207	57.814	29
30	29.960	.0334	.00414	.1241	241.333	8.055	7.297	58.782	30
31	33.555	.0298	.00369	.1237	271.293	8.085	7.381	59.676	31
32	37.582	.0266	.00328	.1233	304.848	8.112	7.459	60.501	32
33	42.092	.0238	.00292	.1229	342.429	8.135	7.530	61.261	33
34	47.143	.0212	.00260	.1226	384.521	8.157	7.596	61.961	34
35	52.800	.0189	.00232	.1223	431.663	8.176	7.658	62.605	35
40	93.051	.0107	.00130	.1213	767.091	8.244	7.899	65.116	40
45	163.988	.00610	.00074	.1207	1358.2	8.283	8.057	66.734	45
50	289.002	.00346	.00042	.1204	2400.0	8.304	8.160	67.762	50
55	509.321	.00196	.00024	.1202	4236.0	8.317	8.225	68.408	55
60	897.597	.00111	.00013	.1201	7471.6	8.324	8.266	68.810	60
65	1581.9	.00063	.00008	.1201	13173.9	8.328	8.292	69.058	65
70	2787.8	.00036	.00004	.1200	23223.3	8.330	8.308	69.210	70
75	4913.1	.00020	.00002	.1200	40933.8	8.332	8.318	69.303	75
80	8658.5	.00012	.00001	.1200	72145.7	8.332	8.324	69.359	80
85	15259.2	.00007	.00001	.1200	127151.7	8.333	8.328	69.393	85
90	26891.9	.00004		.1200	224091.1	8.333	8.330	69.414	90
95	47392.8	.00002		.1200	394931.4	8.333	8.331	69.426	95
100	83522.3	.00001		.1200	696010.5	8.333	8.332	69.434	100

