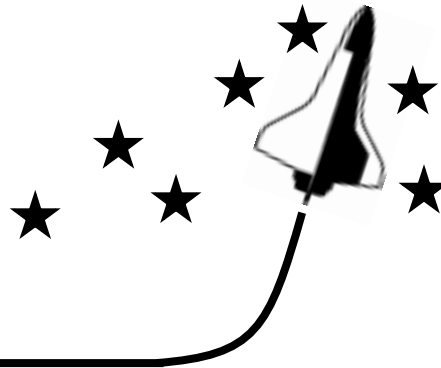


FACULTY NOTES

The LTAs and Spinoffs are designed so that each professor can implement them in a way that is consistent with his/her teaching style and course objectives. This may range from using the materials as out-of-class projects with minimal in-class guidance to doing most of the work in class. The LTAs and Spinoffs are amenable to small group cooperative work and typically benefit from the use of some learning technology. Since the objective of the LTAs and Spinoffs is to support the specific academic goals you have set for your students, the Faculty Notes are not intended to be prescriptive. The purpose of the Faculty Notes is to provide information that assists you to take full advantage of the LTAs and Spinoffs. This includes suggestions for instruction as well as answers for the exercises.



FACULTY NOTES

SPINOFF 12A

Finding the Rate of Return for Energy Savings Investment

Comments

The contractor invests \$12,000,000 in work and is paid back \$23,000,000. The \$11,000,000 can be considered return earned on the contractor's investment. The money comes from savings created by reduced energy consumption and deferred maintenance. Deferred maintenance means that by installing new equipment, replacement of the old equipment is delayed for the life of the new equipment.

The finance option on some calculators permits finding interest rates or present values. Amortization formulas for ordinary annuities include:

- $$p = \frac{Pr}{n \left[1 - \left(1 + \frac{r}{n} \right)^{-nt} \right]}$$

where n is the number of compounding periods per year, p is the payment every $1/n$ -th of a year for t years, r is the annual rate of interest, and P is the principal (present value).

- $$I = npt - P$$

where I is the interest paid over the term of t years.

Solutions

- 1) $\$3,000,000 \cdot (1.07)^2 + \$8,000,000 \cdot (1.07)^1 + \$1,000,000 = \$12,994,270$
- 2) The rate of return on the investment is 9.361%.
- 3) $\$666,666.67$
- 4) $\$83,333.33$
- 5) Option 1 - Solution using a calculator:
Value of first 12 investments on September 30, 1998 = $\$3,133,231.382$
Value of second 12 investments on September 30, 1999 = $\$8,355,283.685$
Value of third 12 investments on September 30, 2000 = $\$1,044,410.46$
Total value of investments on September 30, 2000 = $\$13,768,107.85$

Option 2 - Solution using a spreadsheet: The answer using a spreadsheet is on the next page.

Table Spreadsheet Solution

Monthly investments 1-36	Investment	Value at end of month	Value of all prior investments at end of month	Accumulated Value of Investments at end of month
1	250,000	251,666.6667	0	251,666.6667
2	250000	251,666.6667	253,344.4444	505,011.1111
3	250,000	251,666.6667	508,377.8519	760,044.5185
4	250,000	251,666.6667	765,111.482	1,016,778.149
5	250,000	251,666.6667	1,023,556.67	1,275,223.336
6	250,000	251,666.6667	1,283,724.825	1,535,391.492
7	250,000	251,666.6667	1,545,627.435	1,797,294.102
8	250,000	251,666.6667	1,809,276.062	2,060,942.729
9	250,000	251,666.6667	2,074,682.347	2,326,349.014
10	250,000	251,666.6667	2,341,858.007	2,593,524.674
11	250,000	251,666.6667	2,610,814.839	2,862,481.505
12	250,000	251,666.6667	2,881,564.715	3,133,231.382
13	666,666.67	671,111.1145	3,154,119.591	3,825,230.706
14	666,666.67	671,111.1145	3,850,732.244	4,521,843.358
15	666,666.67	671,111.1145	4,551,988.981	5,223,100.095
16	666,666.67	671,111.1145	5,257,920.762	5,929,031.877
17	666,666.67	671,111.1145	5,968,558.756	6,639,669.87
18	666,666.67	671,111.1145	6,683,934.336	7,355,045.451
19	666666.67	671,111.1145	7,404,079.087	8,075,190.202
20	666,666.67	671111.1145	8,129,024.803	8,800,135.917
21	666,666.67	671,111.1145	8,858,803.49	9,529,914.605
22	666,666.67	671,111.1145	9,593,447.369	10,264,558.48
23	666,666.67	671,111.1145	10,332,988.87	11,004,099.99
24	666,666.67	671,111.1145	11,077,460.65	11,748,571.77
25	83,333.33	83,888.88553	11,826,895.58	11,910,784.47
26	83,333.33	83,888.88553	11,990,189.7	12,074,078.58
27	83,333.33	83,888.88553	12,154,572.44	12,238,461.32
28	83,333.33	83,888.88553	12,320,051.07	12,403,939.95
29	83,333.33	83,888.88553	12,486,632.88	12,570,521.77
30	83,333.33	83,888.88553	12,654,325.25	12,738,214.13
31	83,333.33	83888.88553	12,823,135.56	12,907,024.45
32	83,333.33	83,888.88553	12,993,071.28	13,076,960.16
33	83,333.33	83,888.88553	13,164,139.9	13,248,028.78
34	83,333.33	83,888.88553	13,336,348.97	13,420,237.86
35	83,333.33	83,888.88553	13,509,706.11	13,593,595
36	83,333.33	83,888.88553	13,684,218.96	13,768,107.85

Answer: \$13,768,107.85

- 3) The rate of return on the investment is 9.725%. (Obtained using the finance option on a TI-83™ graphing calculator with present value of \$12,748,248.01 on September 30, 99)