ENGINEERING ECONOMY 6TH EDITION PDF, EPUB, EBOOK

Fabrycky, Walter J., Thuesen, G J, Gerald J. | 0132777231 | 9780132777230

9780073205342: Engineering Economy - Blank, Leland; Tarquin, Anthony: 0073205346 - AbeBooks

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\ Q i**! = 28.71 %. The table in Section 7.5 of Blank and Tarquin suggests that the composite rate i' should be greaterthan 28.71 %. However the effect from 1*2 = 48.25% may 43 cause the composite rate to be > 35%. Use the procedure in the case study to find a composite 44 rate without having to solve a polynomial equation. 45 Step 1: It was performed above in finding the two 1* roots., ,

46

Step 2; Make an initial guess of the composite rate; for example a value less than 35% or greaterthan 35% may be tried. Guess the composite rate of 33% and follow the project 49 net investment procedure fromt= 1 to t= 10. If F10 < 0 then the guessed value is too large. 5U Another value is then tried and the procedure is repeated till F10 > 0. Now Interpolate to find the rate 51 that makes F10 close to zero. This trial and error scheme is done conveniently on the spreadsheet.48, ,

47

l i'2;123 But, if i* k-1 < c < i* k and m > 2, then i' can be < or > c and i* k-1 < I' < r k.

121 [Step 2. From the given c and the two rvalues closest to the c (arbitrarily called 1' k-1 and i* k. k= 5, 3

m),

124 Step 3. Guess a starting value for i' according to the situation. Try to find two values of i'such that Fn < 0 and Fn 0. 125 Step 4. Interpolate or tweak the Fn until it is approximately zero. The corresponding i' is the solution.126

127 4) Use the same procedure as in part (1) with c = 35% then with c = 45%. Then place the Ftvalue in the appropriate year 128 as the cashflow. Use the IRR function to determine i* (which will be i) for the remaining cashflows. 129 For c = 35%, determine F1 through F4:,

130 131132 133 134135

F1= 200; F2 = 200(1.35) + 1 00 = 370; F3 = 370(1.35) + 50 = 549.50 F4= 549.50(1.35)- 1800 =-1058.18; now enterthis value as the cash flow in year 4.Year0 1

Cashflow-

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Same as above.

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Chapter 7

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Chapter 8 Rate of Return Analysis: Multiple AlternativesSolutions to Problems 8.1 (a) The rate of return on the increment has to be larger than 18%. (b) The rate of return on the increment has to be smaller than 10%. 8.2 Overall ROR: 30,000(0.20) + 70,000(0.14) = 100,000(x) x = 15.8% 8.3 There is no income associated with service alternatives. Therefore, the only way to obtain a rate of return is on the increment of investment. 8.4 The rate of return on the increment of investment is less than 0. 8.5 By switching the position of the two cash flows, the interpretation changes completely. The situation would be similar to receiving a loan in the amount of the difference between the two alternatives if the lower cost alternative is selected. The rate of return would represent the interest paid on the loan. Since it is higher than what the company would consider attractive (i.e., 15% or less), the loan should not be accepted. Therefore, select the alternative with the higher initial investment, A. 8.6 (a) Both processors should be selected because the rate of return on both exceeds the companys MARR. (b) The microwave model should be selected because the rate of return on increment of investment between the two is greater than 23%. 8.7 (a) Incremental investment analysis is not required. Alternative X should be selected because the rate of return on the increment is known to be lower than 20% (b) Incremental investment analysis is not required because only Alt Y has ROR greater than the MARR (c) Incremental investment analysis is not required. Neither alternative should be selected because neither one has a ROR greater than the MARR. (d) The ROR on the increment is less than 26%, but an incremental investment analysis is required to determine if the rate of return on the increment equals or exceeds the MARR of 20% (e) Incremental investment analysis is not required because it is known that the ROR on the increment is greater than 22%.

Chapter 8

1

8.8 Overall ROR: 100,000(i) = 30,000(0.30) + 20,000(0.25) + 50,000(0.20) i = 24% 8.9 (a) Size of investment in Y = 50,000 20,000 = $30,000 (b) 30,000(i) + 20,000(0.15) = 50,000(0.40) i = 56.7% 8.10 Year 0 1 2 3 4 5 6 8.11 Machine A -15,000 -1,600 -1600 -15,000 1600 + 3000 -1600 -1600 +3000 1600 Machine B -25,000 -400 -400 -400 -400 -400 +6000 400 BA -10,000 +1200 +1200 +13,200 +1200 +1200 +4200

The incremental cash flow equation is 0 = -65,000 + x(P/A,25%,4), where x is the difference in the operating costs of the processes. x = 65,000/2.3616 = $27,524 Operating cost of process B = 60,000 27,524 = $32,476

8.12

The one with the higher initial investment should be selected because it yields a rate of return that is acceptable, that is, the MARR. (a) Find rate of return on incremental cash flow. 0 = -3000 200(P/A,i,3) + 4700(P/F,i,3) i = 10.4% (Excel) (b) Incremental ROR is less than MARR; select Ford.

8.13

8.14

(a) 0 = -200,000 + 50,000(P/A,i,5) + 130,000(P/F,i,5) Solve for i by trial and error or Excel i = 20.3% (Excel) (b) i > MARR; select process Y.

Chapter 8

8.15 0 = -25,000 + 4000(P/A,i,6) + 26,000(P/F,i,3) 39,000(P/F,i,4) + 40,000(P/F,i,6) Solve for i by trial and error or Excel i = 17.4% (Excel) i > MARR; select machine requiring extra investment: variable speed 8.16 0 = -10,000 + 1200(P/A,i,4) + 12,000(P/F,i,2) + 1000(P/F,i,4) Solve for i by trial and error or Excel i = 30.3% (Excel) Select machine B. 8.17 0 = -17,000 + 400(P/A,i,6) + 17,000(P/F,i,3) + 1700(P/F,i,6) Solve for i by trial and error or Excel i = 6.8% (Excel) Select alternative P. 8.18 0 = -90,000 + 10,000(P/A,i,3) + 20,000(P/A,i,6) (P/F,i,3) + 5000(P/F,i,10) Solve for i by trial and error or Excel i = 10.5% (Excel) i < MARR; select alternative J. 8.19 Find P to yield exactly 50% and the take difference. 0 = -P + 400,000(P/F,i,1) + 600,000(P/F,i,2) + 850,000(P/F,i,3) P = 400,000(0.6667) + 600,000(0.4444) + 850,000(0.2963) = $785,175 Difference = 900,000 785,175 = $114,825 8.20 Let x = M & O costs. Perform an incremental cash flow analysis. 0 = -75,000 + (-x + 50,000)(P/A,20%,5) + 20,000(P/F,20%,5) 0 = -75,000 + (-x + 50,000)(2.9906) + 20,000(0.4019) x = $27,609 M & O cost for S = $-27,609

Chapter 8

3

8.21 0 = -22,000(A/P,i,9) + 4000 + (12,000 4000)(A/F,i,9) Solve for i by trial and error or Excel i = 14.3% (Excel) i > MARR; select alternative N 8.22 Find ROR for incremental cash flow over LCM of 4 years 0 = -50,000(A/P,i,4) + 5000 + (40,000 5000)(P/F, i,2)(A/P, i,4) + 2000(A/F,i,4) Solve for i by trial and error or Excel i = 6.1% (Excel) i < MARR; select semiautomatic machine 8.23 0 = -62,000(A/P,i,24) + 4000 + (10,000 4000)(A/F,i,24) Solve for i by trial and error or Excel i = 4.2% per month is > MARR = 2% per month Select alternative Y 8.24 0 = -40,000(A/P,i,10) + 8500 500(A/G,i,10) Solve for i by trial and error or Excel i = 10.5% is < MARR = 17% (Excel) Select Z1 8.25 Find ROR on increment of investment. 0 = -500,000(A/P,i,10) + 60,000 i = 3.5% < MARR Select design 1A 8.26 Develop a cash flow tabulation. Year 0 1 2 3 Lease, $ -108,000 -108,000 -108,000 0 Build, $ -50,000 270,000 0 0 +55,000 + 60,000 B L, $ -212,000 +108,000 +108,000 +115,000

(Excel)

0 = -212,000(A/P,i,3) + 108,000 + (115,000 - 108,000) (A/F,i,3)Chapter 8 4

Solve for i by trial and error or Excel i = 25.8% < MARR Lease space 8.27 Select the one with the lowest initial investment cost because none of the increments were justified. 8.28 (a) A vs DN: 0 = -30,000(A/P,i,8) + 4000 + 1000(A/F,i,8) Solve for i by trial and error or Excel i = 2.1% (Excel) Method A is not acceptable B vs DN: 0 = - 36,000(A/P,i,8) + 5000 + 2000(A/F,i,8) Solve for i by trial and error or Excel i = 3.4% (Excel) Method B is not acceptable C vs DN: 0 = - 41,000(A/P,i,8) + 8000 + 500(A/F,i,8) Solve for i by trial and error or Excel i = 11.3% (Excel) Method C is acceptable D vs DN: 0 = - 53,000(A/P,i,8) + 10,500 - 2000(A/F,i,8) Solve for i by trial and error or Excel i = 11.1% (Excel) Method D is acceptable (b) A vs DN: 0 = -30,000(A/P,i,8) + 4000 + 1000(A/F,i,8) Solve for i by trial and error or Excel i = 2.1% (Excel) Eliminate A B vs DN: 0 = - 36,000(A/P,i,8) + 5000 + 2000(A/F,i,8) Solve for i by trial and error or Excel i = 3.4% (Excel) Eliminate B C vs DN: 0 = - 41,000(A/P,i,8) + 8000 + 500(A/F,i,8) Solve for i by trial and error or Excel i = 11.3% (Excel) Eliminate DN (Excel)

Chapter 8

5

C vs D: 0 = - 12,000(A/P,i,8) + 2,500 - 2500(A/F,i,8) Solve for i by trial and error or Excel i = 10.4% (Excel) Eliminate D Select method C 8.29 Rank alternatives according to increasing initial cost: 2,1,3,5,4 1 vs 2: 0 = -3000(A/P,i,5) + 1500 (A/P,i,5) = 0.5000 i = 41.0% (Excel) Eliminate 2 3 vs1: 0 = -3500(A/P,i,5) + 1000 (A/P,i,5) = 0.2857 i = 13.2% (Excel) Eliminate 3 5 vs 1: 0 = -10,000(A/P,i,5) + 2500 (A/P,i,5) = 0.2500 i = 7.9% (Excel) Eliminate 5 4 vs1: 0 = -17,000(A/P,i,5) + 6000 (A/P,i,5) = 0.3529 i = 22.5% (Excel) Eliminate 1 Select machine 4 8.30 Alternatives are revenue alternatives. Therefore, add DN (a) DN vs 8: 0 = -30,000(A/P,i,5) + (26,500 14,000) + 2000(A/F,i,5) Solve for i by trial and error or Excel i = 31.7% (Excel) Eliminate DN 8 vs 10: 0 = -4000(A/P,i,5) + (14,500 12,500) + 500(A/F,i,5) Solve for i by trial and error or Excel i = 42.4% (Excel) Eliminate 8 10 vs 15: 0 = -4000(A/P,i,5) + (15,500 14,500) + 500(A/F,i,5) Solve for i by trial and error or ExcelChapter 8 6

i = 10.9% (Excel) Eliminate 15 10 vs 20: 0 = -14,000(A/P,i,5) + (19,500 14,500) + 1000(A/F,i,5) Solve for i by trial and error or Excel i = 24.2% (Excel) Eliminate 10 20 vs 25: 0 = -9000(A/P,i,5) + (23,000 19,500) + 1100(A/F,i,5) Solve for i by trial and error or Excel i = 29.0% (Excel) Eliminate 20 Purchase 25 m3 truck (b) For second truck, purchase truck that was eliminated next to last: 20 m3 8.31 (a) Select all projects whose ROR > MARR of 15%. Select A, B, and C (b) Eliminate alternatives with ROR < MARR; compare others incrementally: Eliminate D and E Rank survivors according to increasing first cost: B, C, A B vs C: i = 800/5000 = 16% > MARR C vs A: i = 200/5000 = 4% < MARR Select project C 8.32 (a) All machines have ROR > MARR of 12% and all increments of investment have ROR > MARR. Therefore, select machine 4. (b) Machines 2, 3, and 4 have ROR greater than 20%. Increment between 2 and 3 is justified, but not increment between 3 and 4. Therefore, select machine 3. 8.33 (a) Select A and C. (b) Proposal A is justified. A vs B yields 1%, eliminate B; A vs C yields 7%, eliminate C; A vs D yields 10%, eliminate A. Therefore, select proposal D (c) Proposal A is justified. A vs B yields 1%, eliminate B; A vs C yields 7%, eliminate C; A vs D yields 10%, eliminate D. Therefore, select proposal A

Eliminate B

Eliminate A

Chapter 8

8.34 (a) Find ROR for each increment of investment: E vs F: 20,000(0.20) + 10,000(i) = 30,000(0.35) i = 65% E vs G: 20,000(0.20) + 30,000(i) = 50,000(0.25) i = 28.3% E vs H: 20,000(0.20) + 60,000(i) = 80,000(0.20) i = 20% F vs G: 30,000(0.35) + 20,000(i) = 50,000(0.25) i = 10% F vs H: 30,000(0.35) + 50,000(i) = 80,000(0.20) i = 11% G vs H: 50,000(0.25) + 30,000(i) = 80,000(0.20) i = 11.7% (b) Revenue = A = Pi E: A = 20,000(0.20) = $4000 F: A = 30,000(0.35) = $10,500 G: A = 50,000(0.25) = $12,500 H: A = 80,000(0.20) = $16,000 (c) Conduct incremental analysis using results from part (a): E vs DN: i = 20% > MARR eliminate DN E vs F: i = 65% > MARR eliminate E F vs G: i = 10% < MARR eliminate G F vs H: i = 11% < MARR eliminate H Therefore, select Alternative F (d) Conduct incremental analysis using results from part (a). E vs DN: i = 20% >MARR, eliminate DN E vs F: i = 65% > MARR, eliminate E F vs G: i = 10% < MARR, eliminate G F vs H: i = 11% = MARR, eliminate F Select alternative H (e) Conduct incremental analysis using results from part (a). E vs DN: i = 20% > MARR, eliminate DN E vs F: i = 65% > MARR, eliminate E F vs G: i = 10% < MARR, eliminate G F vs H: i = 11% < MARR, eliminate HChapter 8 8

Select F as first alternative; compare remaining alternatives incrementally. E vs DN: i = 20% > MARR, eliminate DN E vs G: i = 28.3% > MARR, eliminate E G vs H: i = 11.7% < MARR, eliminate H Therefore, select alternatives F and G 8.35 (a) ROR for F: 10,000(0.25) + 15,000(0.20) = 25,000(i) i = 22% ROR for G: 25,000(0.22) + 5000(0.04) = 30,000(i) i = 19% Increment between E and G: 10,000(0.25) + 20,000(i) = 30,000(0.19) i = 16% Increment between E and H: 10,000(0.25) + 50,000(i) = 60,000(0.30) i = 31%

Increment between F and H: 25,000(0.22) + 35,000(i) = 60,000(0.30) i = 35.7% Increment between G and H: 30,000(0.19) + 30,000(i) = 60,000(0.30) i = 41% (b) Select all alternatives with ROR MARR of 21%; select E, F, and H. (c) Conduct incremental analysis using results from table and part (a). E vs DN: i = 25% > MARR, eliminate DN E vs F: i = 20% < MARR, eliminate F E vs G: i = 16% < MARR, eliminate G E vs H: i = 31% > MARR, eliminate E Select alternative H. FE Review Solutions 8.36 8.37 8.38 8.39 8.40 Answer is (a) Answer is (c) Answer is (c) Answer is (b) Answer is (d)9

Chapter 8

8.41 8.42 8.43

Answer is (b) Answer is (b) Answer is (b)

Extended Exercise Solution 1. PW at 12% is shown in row 29. Select #2 (n = 8) with the largest PW value. 2. #1 (n = 3) is eliminated. It has i* < MARR = 12%. Perform an incremental analysis of #1 (n = 4) and #2 (n = 5). Column H shows i* = 19.49%. Now perform an incremental comparison of #2 for n = 5 and n = 8. This is not necessary. No extra investment is necessary to expand cash flow by three years. The i* is infinity. It is obvious: select #2 (n = 8). 3. PW at 2000% > $0.05. i* is infinity, as shown in cell K45, where an error for IRR(K4:K44) is indicated. This analysis is not necessary, but shows how Excel can be used over the LCM to find a rate of return.Microsoft Excel - C8 - ext exer soln

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#2 (n = 8) 40 yr. CP (200,000)50.000 55.000 80.000

2(8)-to-2(5) Incrementalcash flow

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Engineering Economy, 6th Edition

รายละเอียดสินค้า Engineering Economy, 6th Edition

Blank and Tarquin moved to the number one book in May of 2004.

Approximately 80% of the end-of-chapter problems are either new or revised for the 6th edition.

Information on cost estimation, depreciation, and taxes has been updated for this edition.

International considerations have been updated and expanded upon.

The Online Learning Center (http://www.mhhe.com/blank6) includes resources for students and instructors. Resources will include: Glossary, Web links, FE Exam Problems and Quiz, Learning Objectives, Spreadsheet Exercises, Lecture Slides, Summaries, general textbook information, and more!

Table of Contents

Chapter 7: Rate of Return Analysis: Single Alternative
Chapter 8: Rate of Return Analysis: Multiple Alternatives
Chapter 9: Benefit/Cost Analysis and Public Sector Economics
Chapter 10: Making Choices: The Method, MARR, and Multiple Attributes
Level 3 Making Decisions on Real-World Projects
Chapter 11: Replacement and Retention Decisions
Chapter 12: Selection from Independent Projects Under Budget Limitation
Chapter 13: Breakeven Analysis
Level 4 Rounding Out the Study
Chapter 14: Effects of Inflation
Chapter 15: Cost Estimation and Indirect Cost Allocation
Chapter 16: Depreciation Methods
Chapter 17: After-Tax Economic Analysis
Chapter 18: Formalized Sensitivity Analysis and Expected Value Decisions
Chapter 19: More on Variation and Decision Making Under Risk
Appendix A Using Spreadsheets and Microsoft Excel
Appendix B Basics of Accounting Reports and Business Ratios
Bibliography
Compound Interest Factor Tables
Index

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Engineering Economy, 6th edition, provides undergraduate students and practicing professionals with a solid preparation in the financial understanding of engineering problems and projects, as well as the techniques needed for evaluating and making sound economic decisions. Information on cost estimation, depreciation, and taxes has been updated to conform to new tax laws and a majority of the end-of-chapter problems are revised or new to this edition.

Distinguishing pedagogical characteristics of this market-leading text include its easy-to-read writing style, chapter objectives, worked examples, integrated spreadsheets, case studies, Fundamentals of Engineering (FE) exam questions, and numerous end-of-chapter problems. Graphical cross-referencing is indicated so users are able to locate additional material on any one subject in the text.

While the chapters are progressive, over three-quarters can stand alone, allowing instructors flexibility for meeting course needs. A complete Online Learning Center (OLC) offers supplemental practice problems, spreadsheet exercises, review questions for the Fundamentals of Engineering (FE) exam, and more!

"synopsis" may belong to another edition of this title.

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Chapter 3

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Chapter 4 Nominal and Effective Interest RatesSolutions to Problems 4.1 (a) monthly (b) quarterly (c) semiannually 4.2 (a) quarterly (b) monthly (c) weekly 4.3 (a) 12 (b) 4 (c) 2 4.4 (a) 1 (b) 4 (c) 12 4.5 (a) r/semi = 0.5*2 = 1% (b) 2% (c) 4% 4.6 (a) i = 0.12/6 = 2% per two months; r/4 months = 0.02*2 = 4% (b) r/6 months = 0.02*3 = 6% (c) r/2 yrs = 0.02*12 = 24% 4.7 (a) 5% (b) 20% 4.8 (a) effective (b) effective (c) nominal (d) effective (e) nominal 4.9 i/6months = 0.14/2 = 7% 4.10 i = (1 + 0.04)4 1 = 16.99% 4.11 0.16 = (1 + r/2)2 1 r = 15.41% 4.12 Interest rate is stated as effective. Therefore, i = 18% 4.13 0.1881 = (1 + 0.18/m)m 1 Solve for m by trial and gives m = 2 4.14 i = (1 + 0.01)2 1 i = 2.01%

Chapter 4

1

4.15 i = 0.12/12 = 1% per month Nominal per 6 months = 0.01(6) = 6% Effective per 6 months = (1 + 0.06/6)6 1 = 6.15% 4.16 (a) i/week = 0.068/26 = 0.262% (b) effective 4.17 PP = weekly; CP = quarterly 4.18 PP = daily; CP = quarterly 4.19 From 2% table at n =12, F/P = 1.2682 4.20 Interest rate is effective From 6% table at n = 5, P/G = 7.9345 4.21 P = 85(P/F,2%,12) = 85(0.7885) = $67.02 million 4.22 F = 2.7(F/P,3%,60) = 2.7(5.8916) = $15.91 billion 4.23 P = 5000(P/F,4%,16) = 5000(0.5339) = $2669.50 4.24 P = 1.2(P/F,5%,1) = 1.2(0.9524) = $1,142,880 (in $million)

4.25 P = 1.3(P/A,1%,28)(P/F,1%,2) = 1.3(24.3164)(0.9803) = $30,988,577 4.26 F = 3.9(F/P,0.5%,120) = 3.9(1.8194) = $7,095,660,000

(in $million)

(in $billion)

4.27 P = 3000(250 150)(P/A,4%,8) = 3000(100)(6.7327) = $2,019,810Chapter 4

(in $million)

2

4.28 F = 50(20,000,000)(F/P,1.5%,9) = 1,000,000,000(1.1434) = $1.1434 billion 4.29 A = 3.5(A/P,5%,12) = 3.5(0.11283) = $394,905 (in $million)

4.30 F = 10,000(F/P,4%,4) + 25,000(F/P,4%,2) + 30,000(F/P,4%,1) = 10,000(1.1699) + 25,000(1.0816) + 30,000(1.04) = $69,939 4.31 i/wk = 0.25% P = 2.99(P/A,0.25%,40) = 2.99(38.0199) = $113.68 4.32 i/6 mths = (1 + 0.03)2 1 A = 20,000(A/P,6.09%,4) = 20,000 {[0.0609(1 + 0.0609)4]/[(1 + 0.0609)4-1]} = 20,000(0.28919) = $5784 4.33 F = 100,000(F/A,0.25%,8)(F/P,0.25%,3) = 100,000(8.0704) (1.0075) = $813,093 Subsidy = 813,093 800,000 = $13,093 4.34 P = (14.99 6.99)(P/A,1%,24) = 8(21.2434) = $169.95 4.35 First find P, then convert to A P = 150,000{1 [(1+0.20)10/(1+0.07)10}]}/(0.07 0.20) = 150,000(16.5197) = $2,477,955 A = 2,477,955(A/P,7%,10) = 2,477,955(0.14238) = $352,811Chapter 4 3

4.36 P = 80(P/A,3%,12) + 2(P/G,3%,12) P = 80(9.9540) + 2(51.2482) = $898.82 4.37 2,000,000 = A(P/A,3%,8) + 50,000(P/G,3%,8) 2,000,000 = A(7.0197) + 50,000(23.4806) A = $117,665 4.38 P = 1000 + 2000(P/A,1.5%,12) + 3000(P/A,1.5%,16)(P/F,1.5%,12) = 1000 + 2000(10.9075) + 3000(14.1313)(0.8364) = $58,273 4.39 First find P in quarter 1 and then use A/P to get A in quarters 0-8. P-1 = 1000(P/F,4%,2) + 2000(P/A,4%,2)(P/F,4%,2) + 3000(P/A,4%,4)(P/F,4%,5) = 1000(0.9246) + 2000(1.8861)(0.9246) + 3000(3.6299) (0.8219) = $13,363 A = 13,363(A/P,4%,9) = 13,363(0.13449) = $1797.19 4.40 Move deposits to end of compounding periods and then find F. F = 1800(F/A,3%,30) = 1800(47.5754) = $85,636 4.41 Move withdrawals to beginning of periods and then find F. F = (10,000 1000) (F/P,4%,6) 1000(F/P,4%,5) 1000(F/P,4%,3) = 9000(1.2653) 1000(1.2167) 1000(1.1249) = $9046 4.42 Move withdrawals to beginning of periods and deposits to end; then find F. F = 1600(F/P,4%,5) +1400(F/P,4%,4) 2600(F/P,4%,3) + 1000(F/P,4%,2) -1000(F/P,4%,1) = 1600(1.2167) + 1400(1.1699) 2600(1.1249) + 1000(1.0816) 1000(1.04) = $701.44 4.43 Move monthly costs to end of quarter and then find F. Monthly costs = 495(6)(2) = $5940 End of quarter costs = 5940(3) = $17,820 F = 17,820(F/A,1.5%,4) = 17,820(4.0909) = $72,900Chapter 4 4

4.44 i = e0.13 1 = 13.88% 4.45 i = e0.12 1 = 12.75% 4.46 0.127 = er 1 r/yr = 11.96% r /quarter = 2.99%

4.47 15% per year = 15/12 = 1.25% per month i = e0.0125 1 = 1.26% per month F = 100,000(F/A,1.26%,24) = 100,000{[1 + 0.0126)24 1]/0.0126} = 100,000(27.8213) = $2,782,130 4.48 18% per year = 18/12 = 1.50% per month i = e0.015 1 = 1.51% per month P = 6000(P/A,1.51%,60) = 6000{[(1 + 0.0151)60 1]/[0.0151(1 + 0.0151)60]} = 6000(39.2792) = $235,675 4.49 i = e0.02 1 = 2.02% per month A = 50(A/P,2.02%,36) = 50{[0.0202(1 + 0.0202)36]/[(1 + 0.0202)36 1]} = 50(0.03936) = $1,968,000

4.50 i = e0.06 1 = 6.18% per year P = 85,000(P/F,6.18%,4) = 85,000[1/(1 + 0.0618)4 = 85,000(0.78674) = $66,873 4.51 i = e0.015 1 = 1.51% per month 2P = P(1 + 0.0151)n 2.000 = (1.0151) n Take log of both sides and solve for n n = 46.2 monthsChapter 4 5

4.52 Set up F/P equation in months. 3P = P(1 + i)60 3.000 = (1 + i)60 1.01848 = 1 + i i = 1.85% per month (effective) 4.53 P = 150,000(P/F,12%,2)(P/F,10%,3) = 150,000(0.7972)(0.7513) = $89,840 4.54 F = 50,000(F/P,10%,4)(F/P,1%,48) = 50,000(1.4641)

(1.6122) = $118,021

4.55 (a) First move cash flow in years 0-4 to year 4 at i = 12%. F = 5000(F/P,12%,4) + 6000(F/A,12%,4) = 5000(1.5735) + 6000(4.7793) = $36,543 Now move the total to year 5 at i = 20%. F = 36,543(F/P,20%,1) + 9000 = 36,543(1.20) + 9000 = $52,852 (b) Substitute A values for annual cash flows, including year 5 with the factor (F/P,20%,0) = 1.00 52,852 = A{[(F/P,12%,4) + (F/A,12%,4)](F/P,20%,1) + (F/P,20%,0)} = A{[(1.5735) + (4.7793)](1.20) + 1.00} = A(8.62336) A = $6129 per year for years 0 through 5 (a total of 6 A values). 4.56 First find P. P = 5000(P/A,10%,3) + 7000(P/A,12%,2)(P/F,10%3) = 5000(2.4869) + 7000(1.6901)(0.7513) = 12,434.50 + 8888.40 = $21,323Chapter 4 6

Now substitute A values for cash flows. 21,323 = A(P/A,10%,3) + A(P/A,12%,2)(P/F,10%3) = A(2.4869) + A(1.6901)(0.7513) = A(3.7567) A = $5676

FE Review Solutions 4.57 Answer is (b) 4.58 Answer is (d) 4.59 i/yr = (1 + 0.01)12 1 = 0.1268 = 12.68% Answer is (d) 4.60 i/quarter = e0.045 1 = 0.0460 = 4.60% Answer is (c) 4.61 Answer is (d) 4.62 Answer is (a) 4.63 Find annual rate per year for each condition. i/yr = 22% simple i/yr = (1 + 0.21/4)4 1 = 0.2271 = 22.7 % i/yr = (1 + 0.21/12)12 1 = 0.2314 = 23.14 % i/yr = (1 + 0.22/2)2 1 = 0.2321 = 23.21 % Answer is (a) 4.64 i/semi-annual = e0.02 1 = 0.0202 = 2.02% Answer is (b) 4.65 Answer is (c) 4.66 P = 30(P/A,0.5%,60) = $1552 Answer is (b)

Chapter 4

7

4.67 P = 7 + 7(P/A,4%,25) = $116.3547 million Answer is (c) 4.68 Answer is (a) 4.69 Answer is (d) 4.70 PP>CP; must use i over PP of 1 year. Therefore, n = 7 Answer is (a) 4.71 P = 1,000,000 + 1,050,000{[1- [(1 + 0.05)12/(1 + 0.01)12]}/(0.01-0.05) = $16,585,447 Answer is (b) 4.72 Answer is (d) 4.73 Deposit in year 1 = 1250/(1 + 0.05)3 = $1079.80 Answer is (d)

4.74 A = 40,000(A/F,5%,8) = 40,000(0.10472) = $4188.80 Answer is (c) 4.75 A = 800,000(A/P,3%,12) = 800,000(0.10046) = $80,368 Answer is (c)

Case Study Solution 1. Plan C:15-Year Rate - The calculations for this plan are the same as those for plan A, except that i = 9 % per year and n = 180 periods instead of 360. However, for a 5% down payment, the P&I is now $1488.04 which will yield a total payment of $1788.04. This is greater than the $1600 maximum payment available. Therefore, the down payment will have to be increased to $25,500, making the loan amount $124,500. This will make the P&I amount $1300.06 for a total monthly payment of $1600.06.Chapter 4 8

The amount of money required up front is now $28,245 (the origination fee has also changed). The plan C values for F1C, F2C, and F3C are shown below. F1C = (40,000 28,245)(F/P,0.25%,120) = $15,861.65 F2C = 0 F3C = 170,000 [124,500(F/P,9.5%/12,120) 1300.06(F/A,9.5%/12,120) = $108,097.93 FC = F1C + F2C + F3C = $123,959.58 The future worth of Plan C is considerably higher than either Plan A ($87,233) or Plan B ($91,674). Therefore, Plan C with a 15-year fixed rate is the preferred financing method. 2. Plan A Loan amount = $142,500 Balance after 10 years = $129,582.48 Equity = 142,500 129,582.48 = $12,917.52 Total payment made = 1250.56(120) = $150,067.20 Interest paid = 150,067.20 12,917.52 = $137,149.68 3. Amount paid through first 3 yrs = 1146.58 (36) = $41,276.88 Principal reduction through first 3 yrs = 142,500 139,297.08 = $3,202.92 Interest paid first 3 yrs = 41,276.88 3202.92 = $38,073.96 Amount paid year 4 = 1195.67(12) = 14,348.04 Principal reduction year 4 = 139,297.08 138,132.42 = 1164.66 Interest paid year 4 = 14,348.04 1164.66 = 13,183.38 Total interest paid in 4 years = 38,073.96 + 13,183.38 = $51,257.34 4. Let DP = down payment Fixed fees = 300 + 200 + 200 + 350 + 150 + 300 = $1500 Available for DP = 40,000 1500 (loan amount)(0.01) where loan amount = 150,000 DPChapter 4 9

DP = 40,000 1500 - (150,000 DP)(0.01) = 40,000 1500 1500 + 0.01DP 0.99DP = 37,000 DP = $37,373.73 check: origination fee = (150,000 37,373.73)(0.01) = 1126.26 available DP = 40,000 1500 1126.26 = $37,373.73 5. Amount financed = $142,500 Monthly P&I @ 10% = $1,250.56 Monthly P&I @ 11% = 142,500(A/P,11%/12, 60) A = (142,500) (0.009167)(1 + 0.009167)360 = $1357.06 (1 + 0.009167)360 1 Monthly P&I @ 12% = $1465.77 Monthly P&I @ 13% = $1576.33 Monthly P&I @ 14% = $1688.44 Increase varies: 10% to 11% = $106.50 11% to 12% = 108.71 12% to 13% = 110.56 13% to 14% = 112.11 Increase from one interest rate to the other ----106.50

108.71 110.56 112.11

6. In buying down interest, you must give lender money now instead of money later. Therefore, to go from 10% to 9%, lender must recover the additional 1% now. 103.95/month P&I @ 10% = 1250.54 P&I @ 9% = 1146.59 Difference = $103.95/month P = 103.95(P/A,10%/12,360) = 103.95(113.9508) = $11,845.19 P 1 2 3 . . . . . 360 month

Chapter 4

10

Chapter 5 Present Worth AnalysisSolutions to Problems 5.1 A service alternative is one that has only costs (no revenues). 5.2 (a) For independent projects, select all that have PW 0; (b) For mutually exclusive projects, select the one that has the highest numerical value. 5.3 (a) Service; (b) Revenue; (c) Revenue; (d) Service; (e) Revenue; (f) Service 5.4 (a) Total possible = 25 = 32 (b) Because of restrictions, cannot have any combinations of 3,4, or 5. Only 12 are acceptable: DN, 1, 2, 3, 4, 5, 1&3, 1&4, 1&5, 2&3, 2&4, and 2&5. 5.5 Equal service means that the alternatives end at the same time. 5.6 Equal service can be satisfied by using a specified planning period or by using the least common multiple of the lives of the alternatives. 5.7 Capitalized cost represents the present worth of service for an infinite time. Real world examples that might be analyzed using CC would be Yellowstone National Park, Golden Gate Bridge, Hoover Dam, etc. 5.8 PWold = -1200(3.50)(P/A,15%,5) = -

4200(3.3522) = $-14,079 PWnew = -14,000 1200(1.20)(P/A,15%,5) = -14,000 1440(3.3522) = $-18,827 Keep old brackets 5.9 PWA = -80,000 30,000(P/A,12%,3) + 15,000(P/F,12%,3) = -80,000 30,000(2.4018) + 15,000(0.7118) = $-141,377

Chapter 5

1

PWB = -120,000 8,000(P/A,12%,3) + 40,000(P/F,12%,3) = -120,000 8,000(2.4018) + 40,000(0.7118) = $-110,742 Select Method B 5.10 Bottled water: Cost/mo = -(2)(0.40)(30) = $24.00 PW = -24.00(P/A,0.5%,12) = -24.00(11.6189) = $-278.85 Municipal water: Cost/mo = -5(30)(2.10)/1000 = $0.315 PW = -0.315(P/A,0.5%,12) = -0.315(11.6189) = $-3.66 5.11 PWsingle = -4000 - 4000(P/A,12%,4) = -4000 - 4000(3.0373) = $-16,149 PWsite = $-15,000 Buy the site license 5.12 PWvariable = -250,000 231,000(P/A,15%,6) 140,000(P/F,15%,4) + 50,000(P/F,15%,6) = -250,000 231,000(3.7845) 140,000(0.5718) + 50,000(0.4323) = $-1,182,656 PWdual = -224,000 235,000(P/A,15%,6) 26,000(P/F,15%,3) + 10,000(P/F,15%,6) = -224,000 235,000(3.7845) 26,000(0.6575) + 10,000(0.4323) = $-1,126,130 Select dual speed machine 5.13 PWJX = -205,000 29,000(P/A,10%,4) 203,000(P/F,10%,2) + 2000(P/F,10%,4) = -205,000 29,000(3.1699) 203,000(0.8264) + 2000(0.6830) = $-463,320 PWKZ = -235,000 27,000(P/A,10%,4) + 20,000(P/F,10%,4) = -235,000 27,000(3.1699) + 20,000(0.6830) = $-306,927 Select material KZChapter 5 2

5.14

PWK = -160,000 7000(P/A,2%,16) 120,000(P/F,2%,8) + 40,000(P/F,2%,16) = -160,000 7000(13.5777) 120,000(0.8535) + 40,000(0.7284) = $-328,328 PWL = -210,000 5000(P/A,2%,16) + 26,000(P/F,2%,16) = -210,000 5000(13.5777) + 26,000(0.7284) = $-258,950 Select process L

5.15

PWplastic = -75,000 - 27,000(P/A,10%,6) - 75,000(P/F,10%,2) - 75,000(P/F,10%,4) = -75,000 - 27,000(4.3553) - 75,000(0.8264) - 75,000(0.6830) = $-305,798 PWaluminum = -125,000 12,000(P/A,10%,6) 95,000(P/F,10%,3) + 30,000(P/F,10%,6) = -125,000 12,000(4.3553) 95,000(0.7513) + 30,000(0.5645) = $-231,702 Use aluminum case

5.16

i/year = (1 + 0.03)2 1 = 6.09% PWA = -1,000,000 - 1,000,000(P/A,6.09%,5) = -1,000,000 - 1,000,000(4.2021) (by equation) = $-5,202,100 PWB = -600,000 600,000(P/A,3%,11) = -600,000 600,000(9.2526) = $-6,151,560 PWC = -1,500,000 500,000(P/F,3%,4) 1,500,000(P/F,3%,6) - 500,000(P/F,3%,10) = -1,500,000 500,000(0.8885) 1,500,000(0.8375) 500,000(0.7441) = $-3,572,550 Select plan C

5.17

FWsolar = -12,600(F/P,10%,4) 1400(F/A,10%,4) = -12,600(1.4641) 1400(4.6410) = $-24,945 FWline = -11,000(F/P,10%,4) 800(F/P,10%,4) = -11,000(1.4641) 800(4.6410) = $-19,818 Install power line

Chapter 5

3

5.18

FW20% = -100(F/P,10%,15) 80(F/A,10%,15) = -100(4.1772) 80(31.7725) = $-2959.52 FW35% = -240(F/P,10%,15) 65(F/A,10%,15) = -240(4.1772) 65(31.7725) = $-3067.74 20% standard is slightly more economical

5.19

FWpurchase = -150,000(F/P,15%,6) + 12,000(F/A,15%,6) + 65,000 = -150,000(2.3131) + 12,000(8.7537) + 65,000 = $-176,921 FWlease = -30,000(F/A,15%,6)(F/P,15%,1) = - 30,000(8.7537)(1.15) = $-302,003 Purchase the clamshell

5.20

FWHSS = -3500(F/P,1%,6) 2000(F/A,1%,6) 3500(F/P,1%,3) = -3500(1.0615) 2000(6.1520) 3500(1.0303) = $-19,625 FWgold = -6500(F/P,1%,6) 1500(F/A,1%,6) = -6500(1.0615) 1500(6.1520) = $-16,128 FWtitanium = -7000(F/P,1%,6) 1200(F/A,1%,6) = -7000(1.0615) 1200(6.1520) = $-14,813 Use titanium nitride bits

5.21

FWA = -300,000(F/P,12%,10) 900,000(F/A,12%,10) = -300,000(3.1058) 900,000(17.5487) = $-16,725,570 FWB = -1,200,000(F/P,12%,10) 200,000(F/A,12%,10) 150,000(F/A,12%,10) = -1,200,000(3.1058) 200,000(17.5487) 150,000(17.5487) = $-9,869,005 Select Plan B

Chapter 5

4

5.22

CC = -400,000 400,000(A/F,6%,2)/0.06 = -400,000 400,000(0.48544)/0.06 =$-3,636,267 CC = -1,700,000 350,000(A/F,6%,3)/0.06 = -1,700,000 350,000(0.31411)/0.06 = $-3,532,308 CC = -200,000 25,000(P/A,12%,4)(P/F,12%,1) [40,000/0.12])P/F,12%,5) = -200,000 25,000(3.0373)(0.8929) [40,000/0.12])(0.5674) = $-456,933 CC = -250,000,000 800,000/0.08 [950,000(A/F,8%,10)]/0.08 - 75,000(A/F,8%,5)/0.08 = -250,000,000 800,000/0.08 [950,000(0.06903)]/0.08 -75,000(0.17046)/0.08 = $-251,979,538 Find AW and then divide by i. AW = [-82,000(A/P,12%,4) 9000 +15,000(A/F,12%,4)] = [-82,000(0.32923) 9000 +15,000(0.20923)]/0.12 = $-32,858.41 CC = -32,858.41/0.12 = $-273,820

5.23

5.24

5.25

5.26

5.27

(a) P29 = 80,000/0.08 = $1,000,000 (b) P0 = 1,000,000(P/F,8%,29) = 1,000,000(0.1073) = $107,300

5.28

Find AW of each plan, then take difference, and divide by i. AWA = -50,000(A/F,10%,5) = -50,000(0.16380) = $-8190 AWB = -100,000(A/F,10%,10) = -100,000(0.06275) = $-6275 CC of difference = (8190 - 6275)/0.10 = $19,150

Chapter 5

5

5.29

CC = -3,000,000 50,000(P/A,1%,12) 100,000(P/A,1%,13)(P/F,1%,12) - [50,000/0.01](P/F,1%,25) = -3,000,000 50,000(11.2551) 100,000(12.1337)(0.8874) - [50,000/0.01](0.7798) = $-8,538,500 CCpetroleum = [-250,000(A/P,10%,6) 130,000 + 400,000 + 50,000(A/F,10%,6)]/0.10 = [-250,000(0.22961) 130,000 + 400,000 + 50,000(0.12961)]/0.10 = $2,190,780 CCinorganic = [-110,000(A/P,10%,4) 65,000 + 270,000 + 20,000(A/F,10%,4)]/0.10 = [-110,000(0.31547) 65,000 + 270,000 + 20,000(0.21547)]/0.10 = $1,746,077 Petroleum-based alternative has a larger profit.

5.30

5.31

CC = 100,000 + 100,000/0.08 = $1,350,000 CCpipe = -225,000,000 10,000,000/0.10 [50,000,000(A/F,10%,40)]/0.10 = -225,000,000 10,000,000/0.10 [50,000,000(0.00226)]/0.10 = $-326,130,000 CCcanal = -350,000,000 500,000/0.10 = $-355,000,000 Build the pipeline

5.32

5.33 CCE = [-200,000(A/P,3%,8) + 30,000 + 50,000(A/F,3%,8)]/0.03 = [-200,000(0.14246) + 30,000 + 50,000(0.11246)]/0.03 = $237,700 CCF = [-300,000(A/P,3%,16) + 10,000 + 70,000(A/F,3%,16)]/0.03 = [-300,000(0.07961) + 10,000 + 70,000(0.04961)]/0.03 = $-347,010 CCG = -900,000 + 40,000/0.03 = $433,333 Select alternative G.Chapter 5 6

5.34 No-return payback refers to the time required to recover an investment at i = 0%. 5.35 The alternatives that have large cash flows beyond the date where other alternatives recover their investment might actually be more attractive over the entire lives of the alternatives (based on PW, AW, or other evaluation methods). 5.36 0 = - 40,000 + 6000(P/A,8%,n) + 8000(P/F,8%,n) Try n = 9: 0 +1483 Try n = 8: 0 -1198 n is between 8 and 9 years 5.37 0 = -22,000 + (3500 2000)(P/A,4%,n) (P/A,4%,n) = 14.6667 n is between 22 and 23 quarters or 5.75 years 5.38 0 = -70,000 + (14,000 1850)(P/A,10%,n) (P/A,10%,n) = 5.76132 n is between 9 and 10; therefore, it would take 10 years. 5.39 (a) n = 35,000/(22,000 17,000) = 7 years (b) 0 = -35,000 + (22,000 17,000)(P/A,10%,n) (P/A,10%,n) = 7.0000 n is between 12 and 13; therefore, n = 13 years. 5.40 250,000 500n + 250,000(1 + 0.02)n = 100,000 Try n = 18: 98,062 < 100,000 Try n = 19: 104,703 > 100,000 n is 18.3 months or 1.6 years. 5.41 Payback: Alt A: 0 = -300,000 + 60,000(P/A,8%,n) (P/A,8%,n) = 5.0000 n is between 6 and 7 years Alt B: 0 = -300,000 + 10,000(P/A,8%,n) + 15,000(P/G,8%,n) Try n = 7: 0 > -37,573 Try n = 8: 0 < +24,558 n is between 7 and 8 years Select AChapter 5 7

PW for 10 yrs: Alt A: PW = -300,000 + 60,000(P/A,8%,10) = - 300,000 + 60,000(6.7101) = $102,606 Alt B: PW = -300,000 + 10,000(P/A,8%,10) + 15,000(P/G,8%,10) = -300,000 + 10,000(6.7101) + 15,000(25.9768) = $156,753 Select B Income for Alt B increases rapidly in later years, which is not accounted for in payback analysis. 5.42 LCC = -6.6 3.5(P/F,7%,1) 2.5(P/F,7%,2) 9.1(P/F,7%,3) 18.6(P/F,7%,4) - 21.6(P/F,7%,5) - 17(P/A,7%,5)(P/F,7%,5) 14.2(P/A,7%,10)(P/F,7%,10) - 2.7(P/A,7%,3)(P/F,7%,17) = -6.6 3.5(0.9346) 2.5(0.8734) 9.1(0.8163) 18.6(0.7629) - 21.6(0.7130) - 17(4.1002)(0.7130) 14.2(7.0236)(0.5083) - 2.7(2.6243)(0.3166) = $-151,710,860 5.43 LCC = 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 5.44 LCCA = -750,000 (6000 + 2000)(P/A,0.5%,240) 150,000[(P/F,0.5%,60) + (P/F,0.5%,120) + (P/F,0.5%,180)] = -750,000 (8000)(139.5808) 150,000[(0.7414) + (0.5496) + (0.4075)] = $-2,121,421 LCCB = -1.1 (3000 + 1000)(P/A,0.5%,240) = -1.1 (4000) (139.5808) = $-1,658,323 Select proposal B. 5.45 LCCA = -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) = $-1,309,517Chapter 5 8

LCCB = -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 LCCC = -175,000(P/A,8%,10) = -175,000(6.7101) = $-1,174,268 Select alternative B. 5.46 I = 10,000(0.06)/4 = $150 every 3 months 5.47 800 = (V)(0.04)/2 V = $40,000 5.48 1500 = (20,000)(b)/2 b = 15% 5.49 Bond interest rate and market interest rate are the same. Therefore, PW = face value = $50,000. 5.50 I = (50,000)(0.04)/4 = $500 every 3 months PW = 500(P/A,2%,60) + 50,000(P/F,2%,60) = 500(34.7609) + 50,000(0.3048) = $32,620 5.51 There are 17 years or 34 semiannual periods remaining in the life of the bond. I = 5000(0.08)/2 = $200 every 6 months PW = 200(P/A,5%,34) + 5000(P/F,5%,34) = 200(16.1929) + 5000(0.1904) = $4190.58 5.52 I = (V)(0.07)/2 201,000,000 = I(P/A,4%,60) + V(P/F,4%,60) Try V = 226,000,000: 201,000,000 > 200,444,485 Try V = 227,000,000: 201,000,000 < 201,331,408 By interpolation, V = $226,626,340Chapter 5 9

5.53 (a) I = (50,000)(0.12)/4 = $1500 Five years from now there will be 15(4) = 60 payments left. PW5 then is: PW5 = 1500(P/A,2%,60) + 50,000(P/F,2%,60) = 1500(34.7609) + 50,000(0.3048) = $67,381 (b) Total = 1500(F/A,3%,20) + 67,381 = 1500(26.8704) + 67,381 = $107,687 [PW in year 5 from (a)]

FE Review Solutions 5.54 Answer is (b) 5.55 PW = 50,000 + 10,000(P/A,10%,15) + [20,000/0.10](P/F,10%,15) = $173,941 Answer is (c) 5.56 CC = [40,000/0.10](P/F,10%,4) = $273,200 Answer is (c) 5.57 CC = [50,000/0.10](P/F,10%,20)(A/F,10%,10) = $4662.33 Answer is (b) 5.58 PWX = -66,000 10,000(P/A,10%,6) + 10,000(P/F,10%,6) = -66,000 10,000(4.3553) + 10,000(0.5645) = $-103,908 Answer is (c) 5.59 PWY = -46,000 15,000(P/A,10%,6) - 22,000(P/F,10%,3) + 24,000(P/F,10%,6) = -46,000 15,000(4.3553) - 22,000(0.7513) + 24,000(0.5645) = $-114,310 Answer is (d) 5.60 CCX = [-66,000(A/P,10%,6) 10,000 + 10,000(A/F,10%,6)]/0.10 = [-66,000(0.22961) 10,000 + 10,000(0.12961)]/0.10 = $-238,582 Answer is (d)Chapter 5 10

5.61 CC = -10,000(A/P,10%,5)/0.10 = -10,000(0.26380)/0.10 = $-26,380 Answer is (b) 5.62 Answer is (c) 5.63 Answer is (b) 5.64 Answer is (a) 5.65 Answer is (b)

Extended Exercise SolutionMicrosoft Excel

Questions 1, 3 and 4:

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Chapter 8

4. Composite rate of return approach Plan A (a) MARR = 15% and c = 15%

F0 = 1900; F1 = 1900(1.15) -500 = 1685; F2 = 1685(1.15) -8000 = -6062.25; F3 = -6062.25(1+ i') +6500 = 437.75 6062.25i' F4 = 0 = F3(1+ i') +400 So i' = 13.06% < MARR = 15%. Reject Plan A. (b) MARR = 15% and c = 45% F0 = 1900; F1=1900(1.45) -500 = 2255; F2 = 2255(1.45) -8000 = -4730.25; F3 = -4730.25(1+ i') +6500 = 1769.75 4730.25i' F4 = 0 = F3(1+ i') +400. So i' = 43.31% > MARR= 15%. Accept Plan A. (c) MARR = 50% and c = 50% F0 = 1900; F1 = 1900(1.50) -500 = 2350; F2 = 2350(1.50) -8000 = -4475; F3 = -4475(1+i') +6500 = -4475i' + 2025 F4 = 0 = F3(1+ i') +400. So i ' = 51.16% > MARR = 50%. Accept Plan A. Plan B (a) MARR = 15% and c = 15%

F0 = -1900; F1 = -1900(1+ i') +500; F2 = -1900(1+ i')2 +500(1+ i') +8000; F3 = (1.15)F2 6500 F4 = 0 = F3(1.15) -400. So i' = 17.74% > MARR = 15%. Accept Plan B. (b) MARR = 15% and c = 45% F0 = -1900; F1 = -1900(1+i') +500; F2 = -1900(1+ i')2 +500(1+ i') +8000; F3 = -1900(1.45) (1+ i')2 +500(1.45)(1+ i') +8000(1.45) 6500 F4 = 0 = F3(1.45) - 400. So i' = 46.14% > MARR = 15%. Accept Plan B (c) MARR = 50% and c = 50% F0 = -1900; F1 = -1900(1+ i') +500; F2 = -1900(1+ i')2 +500(1+ i') +8000; F3 = -1900(1. 5)(1+ i')2 +500(1.5) (1+ i') +8000(1.5) 6500 F4 = 0 = F3(1.5) - 400. So i' = 49.30% < MARR = 50%. Reject Plan B. d) Discussion: Plan B is superior to Plan A for c values below i*2, i.e., Bs composite rate of return is higher. However, for c values above i*2, plan A gives a higher (composite) rate of return. Conclusion: The composite rate of return evaluation yields unambiguous results when a reinvestment rate is specified.Chapter 8 15

Chapter 9 Benefit/Cost Analysis and Public Sector EconomicsSolutions to Problems 9.1 (a) Public sector projects usually require large initial investments while many private sector investments may be medium to small. (b) Public sector projects usually have long lives (30-50 years) while private sector projects are usually in the 2-25 year range. (c) Public sector projects are usually funded from taxes, government bonds, or user fees. Private sector projects are usually funded by stocks, corporate bonds, or bank loans. (d) Public sector projects use the term discount rate, not MARR. The discount rate is usually in the 4 10% range, thus it is lower than most private sector MARR values. 9.2 (a) Private (f) Private (a) Benefit (b) Private (c) Public (d) Public (e) Public

9.3 9.4

(b) Cost

(c) Cost

(d) Disbenefit (e) Benefit (f) Disbenefit

Some different dimensions are: 1. Contractor is involved in design of highway; contractor is not provided with the final plans before building the highway. 2. Obtaining project financing may be a partial responsibility in conjunction with the government unit. 3. Corporation will probably operate the highway (tolls, maintenance, management) for some years after construction. 4. Corporation will legally own the highway right of way and improvements until contracted time is over and title transfer occurs. 5. Profit (return on investment) will be stated in the contract. (a) Amount of financing for construction is too low, and usage rate is too low to cover cost of operation and agreed-to profit. (b) Special government-guaranteed loans and subsidies may be arranged at original contract time in case these types of financial problems arise later. (a) B/C = 600,000 100,000 = 1.11 450,000 (b) B-C = 600,000 100,000 450,000 = $+50,0001

9.5

9.6

Chapter 9

9.7 (a) Use Excel and assume an infinite life. Calculate the capitalized costs for all annual amount estimates.File Edit Vie . Insert Formet lools Dete Window Help-

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Note: Since no life is stated, assume it is very long, so the PW value is the capitalized cost of AW/i.

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Engineering Economy 6th Edition Hardcover - Lelend Blank, Anthony Tarquin

This student-friendly text on the current economic issues particular to engineering covers the topics needed to analyze engineering alternatives. Students use both hand-worked and spreadsheet solutions of examples, problems and case studies. In this edition the options have been increased, with an expanded spreadsheet analysis component, twice the number of case studies, and virtually all new end-of-chapter problems. The chapters on factor derivation and usage, cost estimation, replacement studies, and after-tax evaluation have been heavily revised. New material is included on public sector projects and cost estimation. A reordering of chapters puts the fundamental topics up front in the text. Many chapters include a special set of problems that prepare the students for the Fundamentals of Engineering (FE) exam. This college-level text provides students and practicing professionals with a solid preparation in the financial understanding of engineering problems and projects, as well as the techniques needed for evaluating and making sound economic decisions. Distinguishing characteristics include learning objectives for each chapter, an easy-to-read writing style, many solved examples, integrated spreadsheets, and case studies throughout the text. Graphical cross-referencing between topics and quick-solve spreadsheet solutions are indicated in the margins throughout the text. While the chapters are progressive, over three-quarters can stand alone, allowing instructors flexibility for meeting course needs. A complete online learning center (OLC) offers supplemental practice problems, spreadsheet exercises, and review questions for the Fundamentals of Engineering (FE) exam.

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3. F = [{[9000(1.08) 300] (1.08)} 500] (1.08) + (2000 1000) = $11,227.33 Change is 2.02%. Largest maintenance charge is in the last year and, therefore, no compound interest is accumulated by it. 4. The fastest method is to use the spreadsheet function: FV(12.32%,3,500,9000) + 2000 It displays the answer: F = $12,445.43

Chapter 1

7

Case Study Solution There is no definitive answer to the case study exercises. The following are examples only. 1. The first four steps are: Define objective, information collection, alternative definition and estimates, and criteria for decision-making. Objective: Select the most economic alternative that also meets requirements such as production rate, quality specifications, manufacturability for design specifications, etc. Information: Each alternative must have estimates for life (likely 10 years), AOC and other costs (e.g., training), first cost, any salvage value, and the MARR. The debt versus equity capital question must be addressed, especially if more than $5 million is needed. Alternatives: For both A and B, some of the required data to perform an analysis are: P and S must be estimated. AOC equal to about 8% of P must be verified. Training and other cost estimates (annual, periodic, one-time) must be finalized. Confirm n = 10 years for life of A and B. MARR will probably be in the 15% to 18% per year range. Criteria: Can use either present worth or annual worth to select between A and B. 2. Consider these and others like them: Debt capital availability and cost Competition and size of market share required Employee safety of plastics used in processing 3. With the addition of C, this is now a make/buy decision. Economic estimates needed are: Cost of lease arrangement or unit cost, whatever is quoted. Amount and length of time the arrangement is available. Some non-economic factors may be: Guarantee of available time as needed. Compatibility with current equipment and designs. Readiness of the company to enter the market now versus later.

Chapter 1

8

Chapter 2 Factors: How Time and Interest Affect MoneySolutions to Problems 2.1 1. (F/P,8%25) = 6.8485; 2. (P/A,3%,8) = 7.0197; 3. (P/G,9%,20) = 61.7770; 4. (F/A,15%,18) = 75.8364; 5. (A/P,30%,15) = 0.30598 P = 140,000(F/P,7%,4) =140,000(1.3108) = $183,512 F = 200,000(F/P,10%,3) = 200,000(1.3310) = $266,200 P = 600,000(P/F,12%,4) = 600,000(0.6355) = $381,300 (a) A =

225,000(A/P,15%,4) = 225,000(0.35027) = $78,811 (b) Recall amount = 78,811/0.10 = $788,110 per year 2.6 F = 150,000(F/P,18%,7) = 150,000(3.1855) = $477,825 P = 75(P/F,18%,2) = 75(0.7182) = $53.865 million P = 100,000((P/F,12%,2) = 100,000(0.7972) = $79,720 F = 1,700,000(F/P,18%,1) = 1,700,000(1.18) = $2,006,0001

2.2

2.3

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2.7

2.8

2.9

Chapter 2

2.10 P = 162,000(P/F,12%,6) = 162,000(0.5066) = $82,069 2.11 P = 125,000(P/F,14%,5) = 125,000(0.5149) = $ 64,925 2.12 P = 9000(P/F,10%,2) + 8000(P/F,10%,3) + 5000(P/F,10%,5) = 9000(0.8264) + 8000(0.7513) + 5000(0.6209) = $16,553 2.13 P = 1,250,000(0.10)(P/F,8%,2) + 500,000(0.10)(P/F,8%,5) = 125,000(0.8573) + 50,000(0.6806) = $141,193 2.14 F = 65,000(F/P,4%,5) = 65,000(1.2167) = $79,086 2.15 P = 75,000(P/A,20%,3) = 75,000(2.1065) = $157,988 2.16 A = 1.8(A/P,12%,6) = 1.8(0.24323) = $437,814 2.17 A = 3.4(A/P,20%,8) = 3.4(0.26061) = $886,074 2.18 P = (280,000-90,000)(P/A,10%,5) = 190,000(3.7908) = $720,252 2.19 P = 75,000(P/A,15%,5) = 75,000(3.3522) = $251,415 2.20 F = (458-360)(20,000)(0.90)(F/A,8%,5) = 1,764,000(5.8666) = $10,348,682

Chapter 2

2

2.21 P = 200,000((P/A,10%,5) = 200,000(3.7908) = $758,160 2.22 P = 2000(P/A,8%,35) = 2000(11.6546) = $23,309 2.23 A = 250,000(A/F,9%,3) = 250,000(0.30505) = $76,263 2.24 F = (100,000 + 125,000)(F/A,15%,3) = 225,000(3.4725) = $781,313 2.25 (a) 1. Interpolate between n = 32 and n = 34: 1/2 = x/0.0014 x = 0.0007 (P/F,18%,33) = 0.0050 0.0007 = 0.0043 2. Interpolate between n = 50 and n = 55: 4/5 = x/0.0654 x = 0.05232 (A/G,12%,54) = 8.1597 + 0.05232 = 8.2120 (b) 1. (P/F,18%,33) = 1/(1+0.18)33 = 0.0042 2. (A/G,12%,54) = {(1/0.12) 54/[(1+0.12)54 1} = 8.2143 2.26 (a) 1. Interpolate between i = 18% and i = 20% at n = 20: 1/2 = x/40.06 x = 20.03 (F/A,19%,20) = 146.6280 + 20.03 =166.658 2. Interpolate between i = 25% and i = 30% at n = 15: 1/5 = x/0.5911 x = 0.11822 (P/A,26%,15) = 3.8593 0.11822 = 3.74113

Chapter 2

(b)

1. (F/A,19%,20) = [(1 + 0.19)20 0.19]/0.19 = 169.6811 2. (P/A,26%,15) = [(1 + 0.26)15 1]/[0.26(1 + 0.26)15] = 3.7261

2.27 (a) G = $200 (b) CF8 = $1600

(c) n = 10

2.28 (a) G = $5 million (b) CF6 = $6030 million (c) n = 12 2.29 (a) G = $100 (b) CF5 = 900 100(5) = $400 2.30 300,000 = A + 10,000(A/G,10%,5) 300,000 = A + 10,000(1.8101) A = $281,899 2.31 (a) CF3 = 280,000 2(50,000) = $180,000 (b) A = 280,000 50,000(A/G,12%,5) = 280,000 50,000(1.7746) = $191,270 2.32 (a) CF3 = 4000 + 2(1000) = $6000 (b) P = 4000(P/A,10%,5) + 1000(P/G,10%,5) = 4000(3.7908) + 1000(6.8618) = $22,025 2.33 P = 150,000(P/A,15%,8) + 10,000(P/G,15%,8) = 150,000(4.4873) + 10,000(12.4807) = $797,902 2.34 A = 14,000 + 1500(A/G,12%,5) = 14,000 + 1500(1.7746) = $16,662 2.35 (a) Cost = 2000/0.2 = $10,000 (b) A = 2000 + 250(A/G,18%,5) = 2000 + 250(1.6728) = $2418

Chapter 2

4

2.36 Convert future to present and then solve for G using P/G factor: 6000(P/F,15%,4) = 2000(P/A,15%,4) G(P/G,15%,4) 6000(0.5718) = 2000(2.8550) G(3.7864) G = $601.94 2.37 50 = 6(P/A,12%,6) + G(P/G,12%,6) 50 = 6(4.1114) + G(8.9302) G = $2,836,622 2.38 A = [4 + 0.5(A/G,16%,5)] [1 0.1(A/G,16%,5) = [4 + 0.5(1.7060)] [1 0.1(1.7060)] = $4,023,600 2.39 For n = 1: {1 [(1+0.04)1/(1+0.10)1}]/(0.10 0.04) = 0.9091 For n = 2: {1 [(1+0.04)2/(1+0.10)2}]}/(0.10 0.04) = 1.7686 For n = 3: {1 [(1+0.04)3/(1+0.10)3}]}/(0.10 0.04) = 2.5812 2.40 For g = i, P = 60,000(0.1)[15/(1 + 0.04)] = $86,538 2.41 P = 25,000{1 [(1+0.06)3/(1+0.15)3}]}/(0.15 0.06) = $60,247 2.42 Find P and then convert to A. P = 5,000,000(0.01){1 [(1+0.20)5/(1+0.10)5}]}/(0.10 0.20) = 50,000{5.4505} = $272,525 A = 272,525(A/P,10%,5) = 272,525(0.26380) = $71,892 2.43 Find P and then convert to F. P = 2000{1 [(1+0.10)7/(1+0.15)7}]}/(0.15 0.10) = 2000(5.3481) = $10,696 F = 10,696(F/P,15%,7) = 10,696(2.6600) = $28,452 2.44 First convert future worth to P, then use Pg equation to find A. P =

80,000(P/F,15%,10) = 80,000(0.2472) = $19,776

Chapter 2

5

19,776 = A{1 [(1+0.09)10/(1+0.15)10}]/(0.15 0.09) 19,776 = A{6.9137} A = $2860 2.45 Find A in year 1 and then find next value. 900,000 = A{1 [(1+0.05)5/(1+0.15)5}]/(0.15 0.05) 900,000 = A{3.6546) A = $246,263 in year 1 Cost in year 2 = 246,263(1.05) = $258,576 2.46 g = i: P = 1000[20/(1 + 0.10)] = 1000[18.1818] = $18,182 2.47 Find P and then convert to F. P = 3000{1 [(1+0.05)4/(1+0.08)4}]/(0.08 0.05) = 3000{3.5522} = $10,657 F = 10,657(F/P,8%,4) = 10,657(1.3605) = $14,498 2.48 Decrease deposit in year 4 by 5% per year for three years to get back to year 1. First deposit = 1250/(1 + 0.05)3 = $1079.80

2.49 Simple: Total interest = (0.12)(15) = 180% Compound: 1.8 = (1 + i)15 i = 4.0% 2.50 Profit/year = 6(3000)/0.05 = $360,000 1,200,000 = 360,000(P/A,i,10) (P/A,i,10) = 3.3333 i = 27.3% (Excel) 2.51 2,400,000 = 760,000(P/A,i,5) (P/A,i,5) = 3.15789 i = 17.6% (Excel) 2.52 1,000,000 = 600,000(F/P,i,5) (F/P,i,5) = 1.6667 i = 10.8% (Excel)Chapter 2 6

2.53 125,000 = (520,000 470,000)(P/A,i,4) (P/A,i,4) = 2.5000 i = 21.9% (Excel) 2.54 400,000 = 320,000 + 50,000(A/G,i,5) (A/G,i,5) = 1.6000 Interpolate between i = 22% and i = 24% i = 22.6% 2.55 85,000 = 30,000(P/A,i,5) + 8,000(P/G,i,5) Solve for i by trial and error or spreadsheet: i = 38.9% (Excel) 2.56 500,000 = 75,000(P/A,10%,n) (P/A,10%,n) = 6.6667 From 10% table, n is between 11 and 12 years; therefore, n = 11 years 2.57 160,000 = 30,000(P/A,12%,n) (P/A,12%,n) = 5.3333 From 12% table, n is between 9 and 10 years; therefore, n = 10 years 2.58 2,000,000 = 100,000(P/A,4%,n) (P/A,4%,n) = 20.000 From 4% table, n is between 40 and 45 years; by spreadsheet, 42 > n > 41 Therefore, n = 41 years 2.59 1,500,000 = 3,000,000(P/F,20%,n) (P/F,20%,n) = 0.5000 From 20% table, n is between 3 and 4 years; therefore, n = 4 years 2.60 100,000 = 1,600,000(P/F,18%,n) (P/F,18%,n) = 0.0625 From 18% table, n is between 16 and 17 years; therefore, n = 17 years 2.61 10A = A(F/A,10%,n) (F/A,10%,n) = 10.000 From 10% table, n is between 7 and 8 years; therefore, n = 8 years

Chapter 2

7

2.62

1,000,000 = 10,000{1 [(1+0.10)n/(1+0.07)n}]/(0.07 0.10) By trial and error, n = is between 50 and 51; therefore, n = 51 years 12,000 = 3000 + 2000(A/G,10%,n) (A/G,10%,n) = 4.5000 From 10% table, n is between 12 and 13 years; therefore, n = 13 years

2.63

FE Review Solutions 2.64 P = 61,000(P/F,6%,4) = 61,000(0.7921) = $48,318 Answer is (c) 2.65 160 = 235(P/F,i,5) (P/F,i,5) =0.6809 From tables, i = 8% Answer is (c) 2.66 23,632 = 3000{1- [(1+0.04)n/(1+0.06)n]}/(0.06-0.04) [(23,632*0.02)/3000]-1 = (0.98113)n log 0.84245 = nlog 0.98113 n=9 Answer is (b)

2.67 109.355 = 7(P/A,i,25) (P/A,i,25) = 15.6221 From tables, i = 4% Answer is (a) 2.68 A = 2,800,000(A/F,6%,10) = $212,436 Answer is (d) 2.69 A = 10,000,000((A/P,15%,7) = $2,403,600 Answer is (a) 2.70 P = 8000(P/A,10%,10) + 500(P/G,10%,10) = 8000(6.1446) + 500(22.8913) = $60,602.45 Answer is (a)Chapter 2 8

2.71 F = 50,000(F/P,18%,7) = 50,000(3.1855) = $159,275 Answer is (b) 2.72 P = 10,000(P/F,10%,20) = 10,000(0.1486) = $1486 Answer is (d) 2.73 F = 100,000(F/A,18%,5) = 100,000(7.1542) = $715,420 Answer is (c) 2.74 P = 100,000(P/A,10%,5) - 5000(P/G,10%,5) = 100,000(3.7908) - 5000(6.8618) = $344,771 Answer is (a) 2.75 F = 20,000(F/P,12%,10) = 20,000(3.1058) = $62,116 Answer is (a) 2.76 A = 100,000(A/P,12%,5) = 100,000(0.27741) = $27,741 Answer is (b)

2.77 A = 100,000(A/F,12%,3) = 100,000(0.29635) = $29,635 Answer is (c) 2.78 A = 10,000(F/A,12%,25) = 10,000(133.3339) = $1,333,339 Answer is (d) 2.79 F = 10,000(F/P,12%,5) + 10,000(F/P,12%,3) + 10,000 = 10,000(1.7623) + 10,000(1.4049) + 10,000 = $41,672 Answer is (c)Chapter 2 9

2.80

P = 8,000(P/A,10%,5) + 900(P/G,10%,5) = 8,000(3.7908) + 900(6.8618) = $36,502 Answer is (d)

2.81 100,000 = 20,000(P/A,i,10) (P/A,i,10) = 5.000 i is between 15 and 16% Answer is (a)

2.82

60,000 = 15,000(P/A,18%,n) (P/A,18%,n) = 4.000 n is between 7 and 8 Answer is (b)

Case Study Solution I. Manhattan Island Simple interest n = 375 years from 1626 2001 P + I = P + nPi = 375(24)(.06) + 24 = P(1 + ni) = 24(1 + 375(.06)) = $564 Compound interest F = P(F/P,6%,375) = 24(3,088,157,729.0) = $74,115,785,490, which is $74+ billion

II. Stock-option plan F=? after 5 years 1. Years 0 1 5

F=? after 35 years

35

AgeChapter 2

$50/mth = 60 deposits 22 2710

57

2.

Value when leaving the company F = A(F/A,1.25%,60) = 50(88.5745) = $4428.73

3.

Value at age 57 (n = 30 years) F = P(F/P,15%,30) = 4428.73(66.2118) = $293,234

4.

Amount for 7 years to accumulate F = $293,234 A = F(A/F,15%,7) = 293,234(.09036) = $26,497 per year

5.

Amount in 20s: 5(12)50 = $3000 Amount in 50s: 7(26,497) = $185,479

Chapter 2

11

Chapter 3 Combining FactorsSolutions to Problems 3.1 P = 100,000(260)(P/A,10%,8)(P/F,10%,2) = 26,000,000(5.3349)(0.8264) = $114.628 million 3.2 P = 50,000(56)(P/A,8%,4)(P/F,8%,1) = 2,800,000(3.3121)(0.9259) = $8.587 million 3.3 P = 80(2000)(P/A,18%,3) + 100(2500)(P/A,18%,5)(P/F,18%,3) = 160,000(2.1743) + 250,000(3.1272)(0.6086) = $823,691 3.4 P = 100,000(P/A,15%,3) + 200,000(P/A,15%,2)(P/F,15%,3) = 100,000(2.2832) + 200,000(1.6257)(0.6575) = $442,100 3.5 P = 150,000 + 150,000(P/A,10%,5) = 150,000 + 150,000(3.7908) = $718,620 3.6 P = 3500(P/A,10%,3) + 5000(P/A,10%,7)(P/F,10%,3) = 3500(2.4869) + 5000(4.8684)(0.7513) = $26,992 3.7 A = [0.701(5.4)(P/A,20%,2) + 0.701(6.1)(P/A,20%,2)((P/F,20%,2)](A/P,20%,4) = [3.7854(1.5278) + 4.2761(1.5278)(0.6944)](0.38629) = $3.986 billion 3.8 A = 4000 + 1000(F/A,10%,4)(A/F,10%,7) = 4000 + 1000(4.6410)(0.10541) = $4489.21 3.9 A = 20,000(P/A,8%,4)(A/F,8%,14) = 20,000(3.3121)(0.04130) = $2735.79 3.10 A = 8000(A/P,10%,10) + 600 = 8000(0.16275) + 600 = $1902Chapter 3 1

3.11 A = 20,000(F/P,8%,1)(A/P,8%,8) = 20,000(1.08)(0.17401) = $3758.62 3.12 A = 10,000(F/A,8%,26)(A/P,8%,30) = 10,000(79.9544)(0.08883) = $71,023 3.13 A = 15,000(F/A,8%,9)(A/F,8%,10) = 15,000(12.4876)(0.06903) = $12,930 3.14 A = 80,000(A/P,10%,5) + 80,000 = 80,000(0.26380) + 80,000 = $101,104 3.15 A = 5000(A/P,6%,5) + 1,000,000(0.15)(0.75) = 5000(0.2374) + 112,500 = $113,687 3.16 A = [20,000(F/A,8%,11) + 8000(F/A,8%,7)](A/F,8%,10) = [20,000(16.6455) + 8000(8.9228)]{0.06903) = $27,908 3.17 A = 600(A/P,12%,5) + 4000(P/A,12%,4)(A/P,12%,5) = 600(0.27741) + 4000(3.0373)(0.27741) = $3536.76 3.18 F = 10,000(F/A,15%,21) = 10,000(118.8101) = $1,188,101 3.19 100,000 = A(F/A,7%,5)(F/P,7%,10) 100,000 = A(5.7507)(1.9672) A = $8839.56 3.20 F = 9000(F/P,8%,11) + 600(F/A,8%,11) + 100(F/A,8%,5) = 9000(2.3316) + 600(16.6455) + 100(5.8666) = $31,558 3.21 Worth in year 5 = -9000(F/P,12%,5) + 3000(P/A,12%,9) = -9000(1.7623) + 3000(5.3282) = $123.90Chapter 3 2

3.22 Amt, year 5 = 1000(F/A,12%,4)(F/P,12%,2) + 2000(P/A,12%,7)(P/F,12%,1) = 1000(4.7793)(1.2544) + 2000(4.5638)(0.8929) = $14,145 3.23 A = [10,000(F/P,12%,3) + 25,000](A/P,12%,7) = [10,000(1.4049) + 25,000](0.21912) = $8556.42 3.24 Cost of the ranch is P = 500(3000) = $1,500,000. 1,500,000 = x + 2x(P/F,8%,3) 1,500,000 = x + 2x(0.7938) x = $579,688 3.25 Move unknown deposits to year 1, amortize using A/P, and set equal to $10,000. x(F/A,10%,2)(F/P,10%,19)(A/P,10%,15) = 10,000 x(2.1000)(6.1159)(0.13147) = 10,000 x = $5922.34 3.26 350,000(P/F,15%,3) = 20,000(F/A,15%,5) + x 350,000(0.6575) = 20,000(6.7424) + x x = $95,277 3.27 Move all cash flows to year 9. 0 = -800(F/A,14%,2)(F/P,14%,8) + 700(F/P,14%,7) + 700(F/P,14%,4) 950(F/A,14%,2)(F/P,14%,1) + x 800(P/A,14%,3) 0 = -800(2.14)2.8526) + 700(2.5023) + 700(1.6890) 950(2.14)(1.14) + x 800(2.3216) x = $6124.64 3.28 Find P at t = 0 and then convert to A. P = 5000 + 5000(P/A,12%,3) + 3000(P/A,12%,3)(P/F,12%,3) + 1000(P/A,12%,2)(P/F,12%,6) = 5000 + 5000(2.4018) + 3000(2.4018)(0.7118) + 1000(1.6901)(0.5066) = $22,994 A = 22,994(A/P,12%,8) = 22,994(0.20130) = $4628.69 3.29 F = 2500(F/A,12%,8)(F/P,12%,1) 1000(F/A,12%,3)(F/P,12%,2) = 2500(12.2997)(1.12) 1000(3.3744)(1.2544) = $30,206Chapter 3 3

3.30 15,000 = 2000 + 2000(P/A,15%,3) + 1000(P/A,15%,3)(P/F,15%,3) + x(P/F,15%,7) 15,000 = 2000 + 2000(2.2832) + 1000(2.2832)(0.6575) + x(0.3759) x = $18,442 3.31 Amt, year 3 = 900(F/A,16%,4) + 3000(P/A,16%,2) 1500(P/F,16%,3) + 500(P/A,16%,2)(P/F,16%,3) = 900(5.0665) + 3000(1.6052) 1500(0.6407) + 500(1.6052)(0.6407) = $8928.63 3.32 A = 5000(A/P,12%,7) + 3500 + 1500(F/A,12%,4)(A/F,12%,7) = 5000(0.21912) + 3500 + 1500(4.7793)(0.09912) = $5306.19 3.33 20,000 = 2000(F/A,15%,2)(F/P,15%,7) + x(F/A,15%,7) + 1000(P/A,15%,3) 20,000 = 2000(2.1500)(2.6600) + x(11.0668) + 1000(2.2832) x = $567.35 3.34 P = [4,100,000(P/A,6%,22) 50,000(P/G,6%,22)](P/F,6%,3) + 4,100,000(P/A,6%,3) = [4,100,000(12.0416) 50,000(98.9412](0.8396) + 4,100,000(2.6730) = $48,257,271 3.35 P = [2,800,000(P/A,12%,7) + 100,000(P/G,12%,7) + 2,800,000](P/F,12%,1) = [2,800,000(4.5638) + 100,000(11.6443) + 2,800,000](0.8929) = $14,949,887 3.36 P for maintenance = [11,500(F/A,10%,2) + 11,500(P/A,10%,8) + 1000(P/G,10%,8)](P/F,10%,2) = [11,500(2.10) + 11,500(5.3349) + 1000(16.0287)](0.8264) = $83,904 P for accidents = 250,000(P/A,10%,10) = 250,000(6.1446) = $1,536,150 Total savings = 83,904 + 1,536,150 = $1,620,054 Build overpass 3.37 Find P at t = 0, then convert to A. P = [22,000(P/A,12%,4)

+ 1000(P/G,12%,4) + 22,000](P/F,12%,1) = [22,000(3.0373) + 1000(4.1273) + 22,000](0.8929) = $82,993

Chapter 3

4

A = 82,993(A/P,12%,5) = 82,993(0.27741) = $23,023 3.38 First find P and then convert to F. P = -10,000 + [4000 + 3000(P/A,10%,6) + 1000(P/G,10%,6) 7000(P/F,10%,4)](P/F,10%,1) = -10,000 + [4000 + 3000(4.3553) + 1000(9.6842) 7000(0.6830)](0.9091) = $9972 F = 9972(F/P,10%,7) = 9972(1.9487) = $19,432 3.39 Find P in year 0 and then convert to A. P = 4000 + 4000(P/A,15%,3) 1000(P/G,15%,3) + [(6000(P/A,15%,4) +2000(P/G,15%,4)](P/F,15%,3) = 4000 + 4000(2.2832) 1000(2.0712) + [(6000(2.8550) +2000(3.7864)](0.6575) = $27,303.69 A = 27,303.69(A/P,15%,7) = 27,303.69(0.24036) = $6563 3.40 40,000 = x(P/A,10%,2) + (x + 2000)(P/A,10%,3)(P/F,10%,2) 40,000 = x(1.7355) + (x + 2000)(2.4869)(0.8264) 3.79067x = 35,889.65 x = $9467.89 (size of first two payments) 3.41 11,000 = 200 + 300(P/A,12%,9) + 100(P/G,12%,9) 500(P/F,12%,3) + x(P/F,12%,3) 11,000 = 200 + 300(5.3282) + 100(17.3563) 500(0.7118) + x(0.7118) x = $10,989 3.42 (a) In billions P in yr 1 = -13(2.73) + 5.3{[1 (1 + 0.09)10/ (1 + 0.15)10]/(0.15 0.09)} = -35.49 + 5.3(6.914) = $1.1542 billion P in yr 0 = 1.1542(P/F,15%,1) = 1.1542(0.8696) = $1.004 billion

Chapter 3

5

3.43 Find P in year 1; then find A in years 0-5. Pg in yr 2 = (5)(4000){[1 - (1 + 0.08)18/(1 + 0.10)18]/(0.10 - 0.08)} = 20,000(14.0640) = $281,280 P in yr 1 = 281,280(P/F,10%,3) + 20,000(P/A,10%,3) = 281,280(0.7513) + 20,000(2.4869) = $261,064 A = 261,064(A/P,10%,6) = 261,064(0.22961) = $59,943 3.44 Find P in year 1 and then move forward 1 year P-1= 20,000{[1 (1 + 0.05)11/(1 + 0.14)11]/(0.14 0.05)}. = 20,000(6.6145) = $132,290 P = 132,290(F/P,14%,1) = 132,290(1.14) = $150,811 3.45 P = 29,000 + 13,000(P/A,10%,3) + 13,000[7/(1 + 0.10)](P/F,10%,3) = 29,000 + 13,000(2.4869) + 82,727(0.7513) = $123,483 3.46 Find P in year 1 and then move to year 0. P (yr 1) = 15,000{[1 (1 + 0.10)5/(1 + 0.16)5]/(0.16 0.10)} = 15,000(3.8869) = $58,304 P = 58,304(F/P,16%,1) = 58,304(1.16) = $67,632 3.47 Find P in year 1 and then move to year 5. P (yr 1) = 210,000[6/(1 + 0.08)] = 210,000(0.92593) = $1,166,667 F = 1,166,667(F/P,8%,6) = 1,166,667(1.5869) = $1,851,383

Chapter 3

6

3.48 P = [2000(P/A,12%,6) 200(P/G,12%,6)](F/P,12%,1) = [2000(4.1114) 200(8.9302](1.12) = $7209.17 3.49 P = 5000 + 1000(P/A,12%,4) + [1000(P/A,12%,7) 100(P/G,12%,7)](P/F,12%,4) = 5000 + 1000(3.0373) + [1000(4.5638) 100(11.6443)](0.6355) = $10,198 3.50 Find P in year 0 and then convert to A. P = 2000 + 2000(P/A,10%,4) + [2500(P/A,10%,6) 100(P/G,10%,6)](P/F,10%,4) = 2000 + 2000(3.1699) + [2500(4.3553) 100(9.6842)](0.6830) = $15,115 A = 15,115(A/P,10%,10) = 15,115(0.16275) = $2459.97 3.51 20,000 = 5000 + 4500(P/A,8%,n) 500(P/G,8%,n) Solve for n by trial and error: Try n = 5: $15,000 > $14,281 Try n = 6: $15,000 < $15,541 By interpolation, n = 5.6 years 3.52 P = 2000 + 1800(P/A,15%,5) 200(P/G,15%,5) = 2000 + 1800(3.3522) 200(5.7751) = $6878.94 3.53 F = [5000(P/A,10%,6) 200(P/G,10%,6)](F/P,10%,6) = [5000(4.3553) 200(9.6842)](1.7716) = $35,148

FE Review Solutions 3.54 x = 4000(P/A,10%,5)(P/F,10%,1) = 4000(3.7908)(0.9091) = $13,785 Answer is (d) P = 7 + 7(P/A,4%,25) = $116.3547 million Answer is (c) Answer is (d)7

3.55

3.56

Chapter 3

3.57

Size of first deposit = 1250/(1 + 0.05)3 = $1079.80 Answer is (d) Balance = 10,000(F/P,10%,2) 3000(F/A,10%,2) = 10,000(1.21) 3000(2.10) = $5800 Answer is (b)

3.58

3.59 1000 = A(F/A,10%,5)(A/P,10%,20) 1000 = A(6.1051)(0.11746) A = $1394.50 Answer is (a) 3.60 First find P and then convert to A. P = 1000(P/A,10%,5) + 2000(P/A,10%,5)(P/F,10%,5) = 1000(3.7908) + 2000(3.7908)(0.6209) = $8498.22 A = 8498.22(A/P,10%,10) = 8498.22(0.16275) = $1383.08 Answer is (c) 3.61 100,000 = A(F/A,10%,4)(F/P,10%,1) 100,000 = A(4.6410)(1.10) A = $19,588 Answer is (a) 3.62 F = [1000 + 1500(P/A,10%,10) + 500(P/G,10%,10](F/P,10%,10) = [1000 + 1500(6.1446) + 500(22.8913](2.5937) = $56,186 Answer is (d) 3.63 F = 5000(F/P,10%,10) + 7000(F/P,10%,8) + 2000(F/A,10%,5) = 5000(2.5937) + 7000(2.1438) + 2000(6.1051) = $40,185 Answer is (b)

Chapter 3

8

Extended Exercise Solution Solution by Hand Cash flows for purchases at g = 25% start in year 0 at $4 million. Cash flows for parks development

at G = $100,000 start in year 4 at $550,000. All cash flow signs in the solution are +. Cash flow_____ Year Land Parks 0 1 2 3 4 5 6 $4,000,000 3,000,000 2,250,000 1,678,000 1,265.625 949,219

$550,000 650,000 750,000

1. Find P for all project funds (in $ million) P = 4 + 3(P/F,7%,1) + + 0.750(P/F,7%,6) = 13.1716 ($13,171,600) Amount to raise in years 1 and 2: A = (13.1716 3.0)(A/P,7%,2) = (10.1716)(0.55309) = 5.6258 2.

($5,625,800 per year)

Find remaining project fund needs in year 3, then find the A for the next 3 years (years 4, 5, and 6): F3 = (13.1716 3.0)(F/P,7%,3) = (10.1716)(1.2250) = 12.46019 A = 12.46019(A/P,7%,3) = 12.46019(0.38105) = 4.748

($4,748,000 per year)

Chapter 3

9

Extended Exercise Solution Solution by computerE Microsoft ExcelFile Edit View Insert Format lools Data Window Help QI MacrosB I,

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A .

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Chapter 3 - extended exercise solution.

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Chapter 5

11

Question 2:E3 Microsoft Excel

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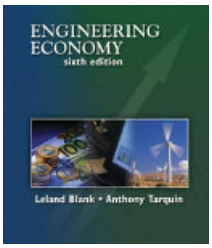

******Recently Published!****** Engineering Economy, 6th edition, provides undergraduate students and practicing professionals with a solid preparation in the financial understanding of engineering problems and projects, as well as the techniques needed for evaluating and making sound economic decisions. Information on cost estimation, depreciation, and taxes has been updated to conform to new tax laws. Eighty percent of the end-of-chapter problems are revised or new to this edition. Distinguishing pedagogical characteristics of this market-leading text include its easy-to-read writing style, chapter objectives, worked examples, integrated spreadsheets, case studies, Fundamentals of Engineering (FE) exam questions, and numerous new end-of-chapter problems. Graphical cross-referencing is indicated so users are able to locate additional material on any one subject in the text. Quick-solve (Q-Solv) and Excel-solve (E-Solve) icons found in the text indicate the difficulty of a problem, example, or spreadsheet. While the chapters are progressive, over three-quarters can stand alone, allowing instructors flexibility for meeting course needs. A complete Online Learning Center (OLC) located at http: //www.mhhe.com/blank6e offers supplemental quizzing, spreadsheet exercises, review questions, lecture outlines, and more!

Источник: https://books.google.com/books/about/Engineering_Economy.html?id=a1gQhgPjXZcC
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Chapter 3

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Chapter 4 Nominal and Effective Interest RatesSolutions to Problems 4.1 (a) monthly (b) quarterly (c) semiannually 4.2 (a) quarterly (b) monthly (c) weekly 4.3 (a) 12 (b) 4 (c) 2 4.4 (a) 1 (b) 4 (c) 12 4.5 (a) r/semi = 0.5*2 = 1% (b) 2% (c) 4% 4.6 (a) i = 0.12/6 = 2% per two months; r/4 months = 0.02*2 = 4% (b) r/6 months = 0.02*3 = 6% (c) r/2 yrs = 0.02*12 = 24% 4.7 (a) 5% (b) 20% 4.8 (a) effective (b) effective (c) nominal (d) effective (e) nominal 4.9 i/6months = 0.14/2 = 7% 4.10 i = (1 + 0.04)4 1 = 16.99% 4.11 0.16 = (1 + r/2)2 1 r = 15.41% 4.12 Interest rate is stated as effective. Therefore, i = 18% 4.13 0.1881 = (1 + 0.18/m)m 1 Solve for m by trial and gives m = 2 4.14 i = (1 + 0.01)2 1 i = 2.01%

Chapter 4

1

4.15 i = 0.12/12 = 1% per month Nominal per 6 months = 0.01(6) = 6% Effective per 6 months = (1 + 0.06/6)6 1 = 6.15% 4.16 (a) i/week = 0.068/26 = 0.262% (b) effective 4.17 PP = weekly; CP = quarterly 4.18 PP = daily; CP = quarterly 4.19 From 2% table at n =12, F/P = 1.2682 4.20 Interest rate is effective From 6% table at n = 5, P/G = 7.9345 4.21 P = 85(P/F,2%,12) = 85(0.7885) = $67.02 million 4.22 F = 2.7(F/P,3%,60) = 2.7(5.8916) = $15.91 billion 4.23 P = 5000(P/F,4%,16) = 5000(0.5339) = $2669.50 4.24 P = 1.2(P/F,5%,1) = 1.2(0.9524) = $1,142,880 (in $million)

4.25 P = 1.3(P/A,1%,28)(P/F,1%,2) = 1.3(24.3164)(0.9803) = $30,988,577 4.26 F = 3.9(F/P,0.5%,120) = 3.9(1.8194) = $7,095,660,000

(in $million)

(in $billion)

4.27 P = 3000(250 150)(P/A,4%,8) = 3000(100)(6.7327) = $2,019,810Chapter 4

(in $million)

2

4.28 F = 50(20,000,000)(F/P,1.5%,9) = 1,000,000,000(1.1434) = $1.1434 billion 4.29 A = 3.5(A/P,5%,12) = 3.5(0.11283) = $394,905 (in $million)

4.30 F = 10,000(F/P,4%,4) + 25,000(F/P,4%,2) + 30,000(F/P,4%,1) = 10,000(1.1699) + 25,000(1.0816) + 30,000(1.04) = $69,939 4.31 i/wk = 0.25% P = 2.99(P/A,0.25%,40) = 2.99(38.0199) = $113.68 4.32 i/6 mths = (1 + 0.03)2 1 A = 20,000(A/P,6.09%,4) = 20,000 {[0.0609(1 + 0.0609)4]/[(1 + 0.0609)4-1]} = 20,000(0.28919) = $5784 4.33 F = 100,000(F/A,0.25%,8)(F/P,0.25%,3) = 100,000(8.0704)(1.0075) = $813,093 Subsidy = 813,093 800,000 = $13,093 4.34 P = (14.99 6.99)(P/A,1%,24) = 8(21.2434) = $169.95 4.35 First find P, then convert to A P = 150,000{1 [(1+0.20)10/(1+0.07)10}]/(0.07 0.20) = 150,000(16.5197) = $2,477,955 A = 2,477,955(A/P,7%,10) = 2,477,955(0.14238) = $352,811Chapter 4 3

4.36 P = 80(P/A,3%,12) + 2(P/G,3%,12) P = 80(9.9540) + 2(51.2482) = $898.82 4.37 2,000,000 = A(P/A,3%,8) + 50,000(P/G,3%,8) 2,000,000 = A(7.0197) + 50,000(23.4806) A = $117,665 4.38 P = 1000 + 2000(P/A,1.5%,12) + 3000(P/A,1.5%,16)(P/F,1.5%,12) = 1000 + 2000(10.9075) + 3000(14.1313)(0.8364) = $58,273 4.39 First find P in quarter 1 and then use A/P to get A in quarters 0-8. P-1 = 1000(P/F,4%,2) + 2000(P/A,4%,2)(P/F,4%,2) + 3000(P/A,4%,4)(P/F,4%,5) = 1000(0.9246) + 2000(1.8861)(0.9246) + 3000(3.6299)(0.8219) = $13,363 A = 13,363(A/P,4%,9) = 13,363(0.13449) = $1797.19 4.40 Move deposits to end of compounding periods and then find F. F = 1800(F/A,3%,30) = 1800(47.5754) = $85,636 4.41 Move withdrawals to beginning of periods and then find F. F = (10,000 1000)(F/P,4%,6) 1000(F/P,4%,5) 1000(F/P,4%,3) = 9000(1.2653) 1000(1.2167) 1000(1.1249) = $9046 4.42 Move withdrawals to beginning of periods and deposits to end; then find F. F = 1600(F/P,4%,5) +1400(F/P,4%,4) 2600(F/P,4%,3) + 1000(F/P,4%,2) -1000(F/P,4%,1) = 1600(1.2167) + 1400(1.1699) 2600(1.1249) + 1000(1.0816) 1000(1.04) = $701.44 4.43 Move monthly costs to end of quarter and then find

F. Monthly costs = 495(6)(2) = $5940 End of quarter costs = 5940(3) = $17,820 F = 17,820(F/A,1.5%,4) = 17,820(4.0909) = $72,900Chapter 4 4

4.44 i = e0.13 1 = 13.88% 4.45 i = e0.12 1 = 12.75% 4.46 0.127 = er 1 r/yr = 11.96% r /quarter = 2.99%

4.47 15% per year = 15/12 = 1.25% per month i = e0.0125 1 = 1.26% per month F = 100,000(F/A,1.26%,24) = 100,000{[1 + 0.0126)24 1]/0.0126} = 100,000(27.8213) = $2,782,130 4.48 18% per year = 18/12 = 1.50% per month i = e0.015 1 = 1.51% per month P = 6000(P/A,1.51%,60) = 6000{[(1 + 0.0151)60 1]/[0.0151(1 + 0.0151)60]} = 6000(39.2792) = $235,675 4.49 i = e0.02 1 = 2.02% per month A = 50(A/P,2.02%,36) = 50{[0.0202(1 + 0.0202)36]/[(1 + 0.0202)36 1]} = 50(0.03936) = $1,968,000

4.50 i = e0.06 1 = 6.18% per year P = 85,000(P/F,6.18%,4) = 85,000[1/(1 + 0.0618)4 = 85,000(0.78674) = $66,873 4.51 i = e0.015 1 = 1.51% per month 2P = P(1 + 0.0151)n 2.000 = (1.0151) n Take log of both sides and solve for n n = 46.2 monthsChapter 4 5

4.52 Set up F/P equation in months. 3P = P(1 + i)60 3.000 = (1 + i)60 1.01848 = 1 + i i = 1.85% per month (effective) 4.53 P = 150,000(P/F,12%,2)(P/F,10%,3) = 150,000(0.7972)(0.7513) = $89,840 4.54 F = 50,000(F/P,10%,4)(F/P,1%,48) = 50,000(1.4641)(1.6122) = $118,021

4.55 (a) First move cash flow in years 0-4 to year 4 at i = 12%. F = 5000(F/P,12%,4) + 6000(F/A,12%,4) = 5000(1.5735) + 6000(4.7793) = $36,543 Now move the total to year 5 at i = 20%. F = 36,543(F/P,20%,1) + 9000 = 36,543(1.20) + 9000 = $52,852 (b) Substitute A values for annual cash flows, including year 5 with the factor (F/P,20%,0) = 1.00 52,852 = A{[(F/P,12%,4) + (F/A,12%,4)](F/P,20%,1) + (F/P,20%,0)} = A{[(1.5735) + (4.7793)](1.20) + 1.00} = A(8.62336) A = $6129 per year for years 0 through 5 (a total of 6 A values). 4.56 First find P. P = 5000(P/A,10%,3) + 7000(P/A,12%,2)(P/F,10%3) = 5000(2.4869) + 7000(1.6901)(0.7513) = 12,434.50 + 8888.40 = $21,323Chapter 4 6

Now substitute A values for cash flows. 21,323 = A(P/A,10%,3) + A(P/A,12%,2)(P/F,10%3) = A(2.4869) + A(1.6901)(0.7513) = A(3.7567) A = $5676

FE Review Solutions 4.57 Answer is (b) 4.58 Answer is (d) 4.59 i/yr = (1 + 0.01)12 1 = 0.1268 = 12.68% Answer is (d) 4.60 i/quarter = e0.045 1 = 0.0460 = 4.60% Answer is (c) 4.61 Answer is (d) 4.62 Answer is (a) 4.63 Find annual rate per year for each condition. i/yr = 22% simple i/yr = (1 + 0.21/4)4 1 = 0.2271 = 22.7 % i/yr = (1 + 0.21/12)12 1 = 0.2314 = 23.14 % i/yr = (1 + 0.22/2)2 1 = 0.2321 = 23.21 % Answer is (a) 4.64 i/semi-annual = e0.02 1 = 0.0202 = 2.02% Answer is (b) 4.65 Answer is (c) 4.66 P = 30(P/A,0.5%,60) = $1552 Answer is (b)

Chapter 4

7

4.67 P = 7 + 7(P/A,4%,25) = $116.3547 million Answer is (c) 4.68 Answer is (a) 4.69 Answer is (d) 4.70 PP>CP; must use i over PP of 1 year. Therefore, n = 7 Answer is (a) 4.71 P = 1,000,000 + 1,050,000{[1- [(1 + 0.05)12/(1 + 0.01)12]}/(0.01-0.05) = $16,585,447 Answer is (b) 4.72 Answer is (d) 4.73 Deposit in year 1 = 1250/(1 + 0.05)3 = $1079.80 Answer is (d)

4.74 A = 40,000(A/F,5%,8) = 40,000(0.10472) = $4188.80 Answer is (c) 4.75 A = 800,000(A/P,3%,12) = 800,000(0.10046) = $80,368 Answer is (c)

Case Study Solution 1. Plan C:15-Year Rate - The calculations for this plan are the same as those for plan A, except that i = 9 % per year and n = 180 periods instead of 360. However, for a 5% down payment, the P&I is now $1488.04 which will yield a total payment of $1788.04. This is greater than the $1600 maximum payment available. Therefore, the down payment will have to be increased to $25,500, making the loan amount $124,500. This will make the P&I amount $1300.06 for a total monthly payment of $1600.06.Chapter 4 8

The amount of money required up front is now $28,245 (the origination fee has also changed). The plan C values for F1C, F2C, and F3C are shown below. F1C = (40,000 28,245)(F/P,0.25%,120) = $15,861.65 F2C = 0 F3C = 170,000 [124,500(F/P,9.5%/12,120) 1300.06(F/A,9.5%/12,120) = $108,097.93 FC = F1C + F2C + F3C = $123,959.58 The future worth of Plan C is considerably higher than either Plan A ($87,233) or Plan B ($91,674). Therefore, Plan C with a 15-year fixed rate is the preferred financing method. 2. Plan A Loan amount = $142,500 Balance after 10 years = $129,582.48 Equity = 142,500 129,582.48 = $12,917.52 Total payment made = 1250.56(120) = $150,067.20 Interest paid = 150,067.20 12,917.52 = $137,149.68 3. Amount paid through first 3 yrs = 1146.58 (36) = $41,276.88 Principal reduction through first 3 yrs = 142,500 139,297.08 = $3,202.92 Interest paid first 3 yrs = 41,276.88 3202.92 = $38,073.96 Amount paid year 4 = 1195.67(12) = 14,348.04 Principal reduction year 4 = 139,297.08 138,132.42 = 1164.66 Interest paid year 4 = 14,348.04 1164.66 = 13,183.38 Total interest paid in 4 years = 38,073.96 + 13,183.38 = $51,257.34 4. Let DP = down payment Fixed fees = 300 + 200 + 200 + 350 + 150 + 300 = $1500 Available for DP = 40,000 1500 (loan amount)(0.01) where loan amount = 150,000 DPChapter 4 9

DP = 40,000 1500 - (150,000 DP)(0.01) = 40,000 1500 1500 + 0.01DP 0.99DP = 37,000 DP = $37,373.73 check: origination fee = (150,000 37,373.73)(0.01) = 1126.26 available DP = 40,000 1500 1126.26 = $37,373.73 5. Amount financed = $142,500 Monthly P&I @ 10% = $1,250.56 Monthly P&I @ 11% = 142,500(A/P,11%/12, 60) A = (142,500) (0.009167)(1 + 0.009167)360 = $1357.06 (1 + 0.009167)360 1 Monthly P&I @ 12% = $1465.77 Monthly P&I @ 13% = $1576.33 Monthly P&I @ 14% = $1688.44 Increase varies: 10% to 11% = $106.50 11% to 12% = 108.71 12% to 13% = 110.56 13% to 14% = 112.11 Increase from one interest rate to the other ----106.50

108.71 110.56 112.11

6. In buying down interest, you must give lender money now instead of money later. Therefore, to go from 10% to 9%, lender must recover the additional 1% now. 103.95/month P&I @ 10% = 1250.54 P&I @ 9% = 1146.59 Difference = $103.95/month P = 103.95(P/A,10%/12,360) = 103.95(113.9508) = $11,845.19 P 1 2 3 . . . . . 360 month

Chapter 4

10

Chapter 5 Present Worth AnalysisSolutions to Problems 5.1 A service alternative is one that has only costs (no revenues). 5.2 (a) For independent projects, select all that have PW 0; (b) For mutually exclusive projects, select the one that has the highest numerical value. 5.3 (a) Service; (b) Revenue; (c) Revenue; (d) Service; (e) Revenue; (f) Service 5.4 (a) Total possible = 25 = 32 (b) Because of restrictions, cannot have any combinations of 3,4, or 5. Only 12 are acceptable: DN, 1, 2, 3, 4, 5, 1&3, 1&4, 1&5, 2&3, 2&4, and 2&5. 5.5 Equal service means that the alternatives end at the same time. 5.6 Equal service can be satisfied by using a specified planning period or by using the least common multiple of the lives of the alternatives. 5.7 Capitalized cost represents the present worth of service for an infinite time. Real world examples that might be analyzed using CC would be Yellowstone National Park, Golden Gate Bridge, Hoover Dam, etc. 5.8 PWold = -1200(3.50)(P/A,15%,5) = -4200(3.3522) = $-14,079 PWnew = -14,000 1200(1.20)(P/A,15%,5) = -14,000 1440(3.3522) = $-18,827 Keep old brackets 5.9 PWA = -80,000 30,000(P/A,12%,3) + 15,000(P/F,12%,3) = -80,000 30,000(2.4018) + 15,000(0.7118) = $-141,377

Chapter 5

1

PWB = -120,000 8,000(P/A,12%,3) + 40,000(P/F,12%,3) = -120,000 8,000(2.4018) + 40,000(0.7118) = $-110,742 Select Method B 5.10 Bottled water: Cost/mo = -(2)(0.40)(30) = $24.00 PW = -24.00(P/A,0.5%,12) = -24.00(11.6189) = $-278.85 Municipal water: Cost/mo = -5(30)(2.10)/1000 = $0.315 PW = -0.315(P/A,0.5%,12) = -0.315(11.6189) = $-3.66 5.11 PWsingle = -4000 - 4000(P/A,12%,4) = -4000 - 4000(3.0373) = $-16,149 PWsite = $-15,000 Buy the site license 5.12 PWvariable = -250,000 231,000(P/A,15%,6) 140,000(P/F,15%,4) + 50,000(P/F,15%,6) = -250,000 231,000(3.7845) 140,000(0.5718) + 50,000(0.4323) = $-1,182,656 PWdual = -224,000 235,000(P/A,15%,6) 26,000(P/F,15%,3) + 10,000(P/F,15%,6) = -224,000 235,000(3.7845) 26,000(0.6575) + 10,000(0.4323) = $-1,126,130 Select dual speed machine 5.13 PWJX = -205,000 29,000(P/A,10%,4) 203,000(P/F,10%,2) + 2000(P/F,10%,4) = -205,000 29,000(3.1699) 203,000(0.8264) + 2000(0.6830) = $-463,320 PWKZ = -235,000 27,000(P/A,10%,4) + 20,000(P/F,10%,4) = -235,000 27,000(3.1699) + 20,000(0.6830) = $-306,927 Select material KZChapter 5 2

5.14

PWK = -160,000 7000(P/A,2%,16) 120,000(P/F,2%,8) + 40,000(P/F,2%,16) = -160,000 7000(13.5777) 120,000(0.8535) + 40,000(0.7284) = $-328,328 PWL = -210,000 5000(P/A,2%,16) + 26,000(P/F,2%,16) = -210,000 5000(13.5777) + 26,000(0.7284) = $-258,950 Select process L

5.15

PWplastic = -75,000 - 27,000(P/A,10%,6) - 75,000(P/F,10%,2) - 75,000(P/F,10%,4) = -75,000 - 27,000(4.3553) - 75,000(0.8264) - 75,000(0.6830) = $-305,798 PWaluminum = -125,000 12,000(P/A,10%,6) 95,000(P/F,10%,3) + 30,000(P/F,10%,6) = -125,000 12,000(4.3553) 95,000(0.7513) + 30,000(0.5645) = $-231,702 Use aluminum case

5.16

i/year = (1 + 0.03)2 1 = 6.09% PWA = -1,000,000 - 1,000,000(P/A,6.09%,5) = -1,000,000 - 1,000,000(4.2021) (by equation) = $-5,202,100 PWB = -600,000 600,000(P/A,3%,11) = -600,000 600,000(9.2526) = $-6,151,560 PWC = -1,500,000 500,000(P/F,3%,4) 1,500,000(P/F,3%,6) - 500,000(P/F,3%,10) = -1,500,000 500,000(0.8885) 1,500,000(0.8375) 500,000(0.7441) = $-3,572,550 Select plan C

5.17

FWsolar = -12,600(F/P,10%,4) 1400(F/A,10%,4) = -12,600(1.4641) 1400(4.6410) = $-24,945 FWline = -11,000(F/P,10%,4) 800(F/P,10%,4) = -11,000(1.4641) 800(4.6410) = $-19,818 Install power line

Chapter 5

3

5.18

FW20% = -100(F/P,10%,15) 80(F/A,10%,15) = -100(4.1772) 80(31.7725) = $-2959.52 FW35% = -240(F/P,10%,15) 65(F/A,10%,15) = -240(4.1772) 65(31.7725) = $-3067.74 20% standard is slightly more economical

5.19

FWpurchase = -150,000(F/P,15%,6) + 12,000(F/A,15%,6) + 65,000 = -150,000(2.3131) + 12,000(8.7537) + 65,000 = $-176,921 FWlease = -30,000(F/A,15%,6)(F/P,15%,1) = - 30,000(8.7537)(1.15) = $-302,003 Purchase the clamshell

5.20

FWHSS = -3500(F/P,1%,6) 2000(F/A,1%,6) 3500(F/P,1%,3) = -3500(1.0615) 2000(6.1520) 3500(1.0303) = $-19,625 FWgold = -6500(F/P,1%,6) 1500(F/A,1%,6) = -6500(1.0615) 1500(6.1520) = $-16,128 FWtitanium = -7000(F/P,1%,6) 1200(F/A,1%,6) = -7000(1.0615) 1200(6.1520) = $-14,813 Use titanium nitride bits

5.21

FWA = -300,000(F/P,12%,10) 900,000(F/A,12%,10) = -300,000(3.1058) 900,000(17.5487) = $-16,725,570 FWB = -1,200,000(F/P,12%,10) 200,000(F/A,12%,10) 150,000(F/A,12%,10) = -1,200,000(3.1058) 200,000(17.5487) 150,000(17.5487) = $-9,869,005 Select Plan B

Chapter 5

4

5.22

CC = -400,000 400,000(A/F,6%,2)/0.06 = -400,000 400,000(0.48544)/0.06 =$-3,636,267 CC = -1,700,000 350,000(A/F,6%,3)/0.06 = -1,700,000 350,000(0.31411)/0.06 = $-3,532,308 CC = -200,000 25,000(P/A,12%,4)(P/F,12%,1) [40,000/0.12])P/F,12%,5) = -200,000 25,000(3.0373)(0.8929) [40,000/0.12])(0.5674) = $-456,933 CC = -250,000,000 800,000/0.08 [950,000(A/F,8%,10)]/0.08 -75,000(A/F,8%,5)/0.08 = -250,000,000 800,000/0.08 [950,000(0.06903)]/0.08 -75,000(0.17046)/0.08 = $-251,979,538 Find AW and then divide by i. AW = [-82,000(A/P,12%,4) 9000 +15,000(A/F,12%,4)] = [-82,000(0.32923) 9000 +15,000(0.20923)]/0.12 = $-32,858.41 CC = -32,858.41/0.12 = $-273,820

5.23

5.24

5.25

5.26

5.27

(a) P29 = 80,000/0.08 = $1,000,000 (b) P0 = 1,000,000(P/F,8%,29) = 1,000,000(0.1073) = $107,300

5.28

Find AW of each plan, then take difference, and divide by i. AWA = -50,000(A/F,10%,5) = -50,000(0.16380) = $-8190 AWB = -100,000(A/F,10%,10) = -100,000(0.06275) = $-6275 CC of difference = (8190 - 6275)/0.10 = $19,150

Chapter 5

5

5.29

CC = -3,000,000 50,000(P/A,1%,12) 100,000(P/A,1%,13)(P/F,1%,12) - [50,000/0.01](P/F,1%,25) = -3,000,000 50,000(11.2551) 100,000(12.1337)(0.8874) - [50,000/0.01](0.7798) = $-8,538,500 CCpetroleum = [-250,000(A/P,10%,6) 130,000 + 400,000 + 50,000(A/F,10%,6)]/0.10 = [-250,000(0.22961) 130,000 + 400,000 + 50,000(0.12961)]/0.10 = $2,190,780 CCinorganic = [-110,000(A/P,10%,4) 65,000 + 270,000 + 20,000(A/F,10%,4)]/0.10 = [-110,000(0.31547) 65,000 + 270,000 + 20,000(0.21547)]/0.10 = $1,746,077 Petroleum-based alternative has a larger profit.

5.30

5.31

CC = 100,000 + 100,000/0.08 = $1,350,000 CCpipe = -225,000,000 10,000,000/0.10 [50,000,000(A/F,10%,40)]/0.10 = -225,000,000 10,000,000/0.10 [50,000,000(0.00226)]/0.10 = $-326,130,000 CCcanal = -350,000,000 500,000/0.10 = $-355,000,000 Build the pipeline

5.32

5.33 CCE = [-200,000(A/P,3%,8) + 30,000 + 50,000(A/F,3%,8)]/0.03 = [-200,000(0.14246) + 30,000 + 50,000(0.11246)]/0.03 = $237,700 CCF = [-300,000(A/P,3%,16) + 10,000 + 70,000(A/F,3%,16)]/0.03 = [-300,000(0.07961) + 10,000 + 70,000(0.04961)]/0.03 = $-347,010 CCG = -900,000 + 40,000/0.03 = $433,333 Select alternative G.Chapter 5 6

5.34 No-return payback refers to the time required to recover an investment at i = 0%. 5.35 The alternatives that have large cash flows beyond the date where other alternatives recover their investment might actually be more attractive over the entire lives of the alternatives (based on PW, AW, or other evaluation methods). 5.36 0 = - 40,000 + 6000(P/A,8%,n) + 8000(P/F,8%,n) Try n = 9: 0 +1483 Try n = 8: 0 -1198 n is between

8 and 9 years 5.37 0 = -22,000 + (3500 2000)(P/A,4%,n) (P/A,4%,n) = 14.6667 n is between 22 and 23 quarters or 5.75 years 5.38 0 = -70,000 + (14,000 1850)(P/A,10%,n) (P/A,10%,n) = 5.76132 n is between 9 and 10; therefore, it would take 10 years. 5.39 (a) n = 35,000/(22,000 17,000) = 7 years (b) 0 = -35,000 + (22,000 17,000)(P/A,10%,n) (P/A,10%,n) = 7.0000 n is between 12 and 13; therefore, n = 13 years. 5.40 250,000 500n + 250,000(1 + 0.02)n = 100,000 Try n = 18: 98,062 < 100,000 Try n = 19: 104,703 > 100,000 n is 18.3 months or 1.6 years. 5.41 Payback: Alt A: 0 = -300,000 + 60,000(P/A,8%,n) (P/A,8%,n) = 5.0000 n is between 6 and 7 years Alt B: 0 = -300,000 + 10,000(P/A,8%,n) + 15,000(P/G,8%,n) Try n = 7: 0 > -37,573 Try n = 8: 0 < +24,558 n is between 7 and 8 years Select AChapter 5 7

PW for 10 yrs: Alt A: PW = -300,000 + 60,000(P/A,8%,10) = - 300,000 + 60,000(6.7101) = $102,606 Alt B: PW = -300,000 + 10,000(P/A,8%,10) + 15,000(P/G,8%,10) = -300,000 + 10,000(6.7101) + 15,000(25.9768) = $156,753 Select B Income for Alt B increases rapidly in later years, which is not accounted for in payback analysis. 5.42 LCC = -6.6 3.5(P/F,7%,1) 2.5(P/F,7%,2) 9.1(P/F,7%,3) 18.6(P/F,7%,4) - 21.6(P/F,7%,5) - 17(P/A,7%,5)(P/F,7%,5) 14.2(P/A,7%,10)(P/F,7%,10) - 2.7(P/A,7%,3)(P/F,7%,17) = -6.6 3.5(0.9346) 2.5(0.8734) 9.1(0.8163) 18.6(0.7629) - 21.6(0.7130) - 17(4.1002)(0.7130) 14.2(7.0236)(0.5083) - 2.7(2.6243)(0.3166) = $-151,710,860 5.43 LCC = 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 5.44 LCCA = -750,000 (6000 + 2000)(P/A,0.5%,240) 150,000[(P/F,0.5%,60) + (P/F,0.5%,120) + (P/F,0.5%,180)] = -750,000 (8000)(139.5808) 150,000[(0.7414) + (0.5496) + (0.4075)] = $-2,121,421 LCCB = -1.1 (3000 + 1000)(P/A,0.5%,240) = -1.1 (4000) (139.5808) = $-1,658,323 Select proposal B. 5.45 LCCA = -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) = $-1,309,517Chapter 5 8

LCCB = -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 LCCC = -175,000(P/A,8%,10) = -175,000(6.7101) = $-1,174,268 Select alternative B. 5.46 I = 10,000(0.06)/4 = $150 every 3 months 5.47 800 = (V)(0.04)/2 V = $40,000 5.48 1500 = (20,000)(b)/2 b = 15% 5.49 Bond interest rate and market interest rate are the same. Therefore, PW = face value = $50,000. 5.50 I = (50,000)(0.04)/4 = $500 every 3 months PW = 500(P/A,2%,60) + 50,000(P/F,2%,60) = 500(34.7609) + 50,000(0.3048) = $32,620 5.51 There are 17 years or 34 semiannual periods remaining in the life of the bond. I = 5000(0.08)/2 = $200 every 6 months PW = 200(P/A,5%,34) + 5000(P/F,5%,34) = 200(16.1929) + 5000(0.1904) = $4190.58 5.52 I = (V)(0.07)/2 201,000,000 = I(P/A,4%,60) + V(P/F,4%,60) Try V = 226,000,000: 201,000,000 > 200,444,485 Try V = 227,000,000: 201,000,000 < 201,331,408 By interpolation, V = $226,626,340Chapter 5 9

5.53 (a) I = (50,000)(0.12)/4 = $1500 Five years from now there will be 15(4) = 60 payments left. PW5 then is: PW5 = 1500(P/A,2%,60) + 50,000(P/F,2%,60) = 1500(34.7609) + 50,000(0.3048) = $67,381 (b) Total = 1500(F/A,3%,20) + 67,381 = 1500(26.8704) + 67,381 = $107,687 [PW in year 5 from (a)]

FE Review Solutions 5.54 Answer is (b) 5.55 PW = 50,000 + 10,000(P/A,10%,15) + [20,000/0.10](P/F,10%,15) = $173,941 Answer is (c) 5.56 CC = [40,000/0.10](P/F,10%,4) = $273,200 Answer is (c) 5.57 CC = [50,000/0.10](P/F,10%,20)(A/F,10%,10) = $4662.33 Answer is (b) 5.58 PWX = -66,000 10,000(P/A,10%,6) + 10,000(P/F,10%,6) = -66,000 10,000(4.3553) + 10,000(0.5645) = $-103,908 Answer is (c) 5.59 PWY = -46,000 15,000(P/A,10%,6) - 22,000(P/F,10%,3) + 24,000(P/F,10%,6) = -46,000 15,000(4.3553) - 22,000(0.7513) + 24,000(0.5645) = $-114,310 Answer is (d) 5.60 CCX = [-66,000(A/P,10%,6) 10,000 + 10,000(A/F,10%,6)]/0.10 = [-66,000(0.22961) 10,000 + 10,000(0.12961)]/0.10 = $-238,582 Answer is (d)Chapter 5 10

5.61 CC = -10,000(A/P,10%,5)/0.10 = -10,000(0.26380)/0.10 = $-26,380 Answer is (b) 5.62 Answer is (c) 5.63 Answer is (b) 5.64 Answer is (a) 5.65 Answer is (b)

Extended Exercise SolutionMicrosoft Excel

Questions 1, 3 and 4:

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Chapter 5

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Question 2:E3 Microsoft Excel

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Chapter 9

5

9.15

1.7 = 150,000 M&O costs_ 1,000,000(A/P,6%,30) 1.7 = 150,000 M&O costs 1,000,000(0.07265) M&O costs = $26,495 per year

9.16 Convert all estimates to PW values. PW disbenefits = 45,000(P/A,6%,15) = 45,000(9.7122) = $437,049 PW M&O Cost = 300,000(P/A,6%,15) = 300,000(9.7122) = $2,913,660 B/C = 3,800,000 437,049__ 2,200,000 + 2,913,660 = 3,362,951/5,113,660 = 0.66

9.17 (a) AW of Cost = 30,000,000(0.08) + 100,000 = $2,500,000 per year B/C = 2,800,000 2,500,000 Construct the dam. (b) Calculate the CC of the initial cost to obtain AW for denominator. = 1.12

B/C =

1.12

B/C = (2,800,000)/(100,000+30,000,000*(0.08))

Chapter 9

6

9.18 AW = C = 2,200,000(0.12) + 10,000 + 65,000(A/F,12%,15) = 264,000 + 10,000 + 65,000(0.02682) = $275,743 Annual Benefit = B = 90,000 10,000 = $80,000 B/C = 80,000/ 275,743 = 0.29 Since B/C < 1.0, the dam should not be constructed. 9.19 Calculate the AW of initial

cost, then the 3 B/C measures of worth. The roadway should not be built.Microsoft Excel - Prob 9.19

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\ Q i**! = 28.71 %. The table in Section 7.5 of Blank and Tarquin suggests that the composite rate i' should be greaterthan 28.71 %. However the effect from 1*2 = 48.25% may 43 cause the composite rate to be > 35%. Use the procedure in the case study to find a composite 44 rate without having to solve a polynomial equation. 45 Step 1: It was performed above in finding the two 1* roots., ,

46

Step 2; Make an initial guess of the composite rate; for example a value less than 35% or greaterthan 35% may be tried. Guess the composite rate of 33% and follow the project 49 net investment procedure fromt= 1 to t= 10. If F10 < 0 then the guessed value is too large. 5U Another value is then tried and the procedure is repeated till F10 > 0. Now Interpolate to find the rate 51 that makes F10 close to zero. This trial and error scheme is done conveniently on the spreadsheet.48, ,

47

l i'2;123 But, if i* k-1 < c < i* k and m > 2, then i' can be < or > c and i* k-1 < I' < r k.

121 [Step 2. From the given c and the two rvalues closest to the c (arbitrarily called 1' k-1 and i* k. k= 5, 3

m),

124 Step 3. Guess a starting value for i' according to the situation. Try to find two values of i'such that Fn < 0 and Fn 0. 125 Step 4. Interpolate or tweak the Fn until it is approximately zero. The corresponding i' is the solution.126

127 4) Use the same procedure as in part (1) with c = 35% then with c = 45%. Then place the Ftvalue in the appropriate year 128 as the cashflow. Use the IRR function to determine i* (which will be i) for the remaining cashflows. 129 For c = 35%, determine F1 through F4:,

130 131132 133 134135

F1= 200; F2 = 200(1.35) + 1 00 = 370; F3 = 370(1.35) + 50 = 549.50 F4= 549.50(1.35)- 1800 =-1058.18; now enterthis value as the cash flow in year 4.Year0 1

Cashflow-

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33.45%

Same as above.

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Chapter 7

17

Chapter 8 Rate of Return Analysis: Multiple AlternativesSolutions to Problems 8.1 (a) The rate of return on the increment has to be larger than 18%. (b) The rate of return on the increment has to be smaller than 10%. 8.2 Overall ROR: 30,000(0.20) + 70,000(0.14) = 100,000(x) x = 15.8% 8.3 There is no income associated with service alternatives. Therefore, the only way to obtain a rate of return is on the increment of investment. 8.4 The rate of return on the increment of investment is less than 0. 8.5 By switching the position of the two cash flows, the interpretation changes completely. The situation would be similar to receiving a loan in the amount of the difference between the two alternatives if the lower cost alternative is selected. The rate of return would represent the interest paid on the loan. Since it is higher than what the company would consider attractive (i.e., 15% or less), the loan should not be accepted. Therefore, select the alternative with the higher initial investment, A. 8.6 (a) Both processors should be selected because the rate of return on both exceeds the companys MARR. (b) The microwave model should be selected because the rate of return on increment of investment between the two is greater than 23%. 8.7 (a) Incremental investment analysis is not required. Alternative X should be selected because the rate of return on the increment is known to be lower than 20% (b) Incremental investment analysis is not required because only Alt Y has ROR greater than the MARR (c) Incremental investment analysis is not required. Neither alternative should be selected because neither one has a ROR greater than the MARR. (d) The ROR on the increment is less than 26%, but an incremental investment analysis is required to determine if the rate of return on the increment equals or exceeds the MARR of 20% (e) Incremental investment analysis is not required because it is known that the ROR on the increment is greater than 22%.

Chapter 8

1

8.8 Overall ROR: 100,000(i) = 30,000(0.30) + 20,000(0.25) + 50,000(0.20) i = 24% 8.9 (a) Size of investment in Y = 50,000 20,000 = $30,000 (b) 30,000(i) + 20,000(0.15) = 50,000(0.40) i = 56.7% 8.10 Year 0 1 2 3 4 5 6 8.11 Machine A -15,000 -1,600 -1600 -15,000 1600 + 3000 -1600 -1600 +3000 1600 Machine B -25,000 -400 -400 -400 -400 -400 +6000 400 BA -10,000 +1200 +1200 +13,200 +1200 +1200 +4200

The incremental cash flow equation is 0 = -65,000 + x(P/A,25%,4), where x is the difference in the operating costs of the processes. x = 65,000/2.3616 = $27,524 Operating cost of process B = 60,000 27,524 = $32,476

8.12

The one with the higher initial investment should be selected because it yields a rate of return that is acceptable, that is, the MARR. (a) Find rate of return on incremental cash flow. 0 = -3000 200(P/A,i,3) + 4700(P/F,i,3) i = 10.4% (Excel) (b) Incremental ROR is less than MARR; select Ford.

8.13

8.14

(a) 0 = -200,000 + 50,000(P/A,i,5) + 130,000(P/F,i,5) Solve for i by trial and error or Excel i = 20.3% (Excel) (b) i > MARR; select process Y.

Chapter 8

2

8.15 0 = -25,000 + 4000(P/A,i,6) + 26,000(P/F,i,3) 39,000(P/F,i,4) + 40,000(P/F,i,6) Solve for i by trial and error or Excel i = 17.4% (Excel) i > MARR; select machine requiring extra investment: variable speed 8.16 0 = -10,000 + 1200(P/A,i,4) + 12,000(P/F,i,2) + 1000(P/F,i,4) Solve for i by trial and error or Excel i = 30.3% (Excel) Select machine B. 8.17 0 = -17,000 + 400(P/A,i,6) + 17,000(P/F,i,3) + 1700(P/F,i,6) Solve for i by trial and error or Excel i = 6.8% (Excel) Select alternative P. 8.18 0 = -90,000 + 10,000(P/A,i,3) + 20,000(P/A,i,6) (P/F,i,3) + 5000(P/F,i,10) Solve for i by trial and error or Excel i = 10.5% (Excel) i < MARR; select alternative J. 8.19 Find P to yield exactly 50% and the take difference. 0 = -P + 400,000(P/F,i,1) + 600,000(P/F,i,2) + 850,000(P/F,i,3) P = 400,000(0.6667) + 600,000(0.4444) + 850,000(0.2963) = $785,175 Difference = 900,000 785,175 = $114,825 8.20 Let x = M & O costs. Perform an incremental cash flow analysis. 0 = -75,000 + (-x + 50,000)(P/A,20%,5) + 20,000(P/F,20%,5) 0 = -75,000 + (-x + 50,000)(2.9906) + 20,000(0.4019) x = $27,609 M & O cost for S = $-27,609

Chapter 8

3

8.21 0 = -22,000(A/P,i,9) + 4000 + (12,000 4000)(A/F,i,9) Solve for i by trial and error or Excel i = 14.3% (Excel) i > MARR; select alternative N 8.22 Find ROR for incremental cash flow over LCM of 4 years 0 = -50,000(A/P,i,4) + 5000 + (40,000 5000)(P/F, i,2)(A/P, i,4) + 2000(A/F,i,4) Solve for i by trial and error or Excel i = 6.1% (Excel) i < MARR; select semiautomatic machine 8.23 0 = -62,000(A/P,i,24) + 4000 + (10,000 4000)(A/F,i,24) Solve for i by trial and error or Excel i = 4.2% per month is > MARR = 2% per month Select alternative Y 8.24 0 = -40,000(A/P,i,10) + 8500 500(A/G,i,10) Solve for i by trial and error or Excel i = 10.5% is < MARR = 17% (Excel) Select Z1 8.25 Find ROR on increment of investment. 0 = -500,000(A/P,i,10) + 60,000 i = 3.5% < MARR Select design 1A 8.26 Develop a cash flow tabulation. Year 0 1 2 3 Lease, $ -108,000 -108,000 -108,000 0 Build, $ -50,000 270,000 0 0 +55,000 + 60,000 B L, $ -212,000 +108,000 +108,000 +115,000

(Excel)

0 = -212,000(A/P,i,3) + 108,000 + (115,000 - 108,000) (A/F,i,3)Chapter 8 4

Solve for i by trial and error or Excel i = 25.8% < MARR Lease space 8.27 Select the one with the lowest initial investment cost because none of the increments were justified. 8.28 (a) A vs DN: 0 = -30,000(A/P,i,8) + 4000 + 1000(A/F,i,8) Solve for i by trial and error or Excel i = 2.1% (Excel) Method A is not acceptable B vs DN: 0 = - 36,000(A/P,i,8) + 5000 + 2000(A/F,i,8) Solve for i by trial and error or Excel i = 3.4% (Excel) Method B is not acceptable C vs DN: 0 = - 41,000(A/P,i,8) + 8000 + 500(A/F,i,8) Solve for i by trial and error or Excel i = 11.3% (Excel) Method C is acceptable D vs DN: 0 = - 53,000(A/P,i,8) + 10,500 - 2000(A/F,i,8) Solve for i by trial and error or Excel i = 11.1% (Excel) Method D is acceptable (b) A vs DN: 0 = -30,000(A/P,i,8) + 4000 + 1000(A/F,i,8) Solve for i by trial and error or Excel i = 2.1% (Excel) Eliminate A B vs DN: 0 = - 36,000(A/P,i,8) + 5000 + 2000(A/F,i,8) Solve for i by trial and error or Excel i = 3.4% (Excel) Eliminate B C vs DN: 0 = - 41,000(A/P,i,8) + 8000 + 500(A/F,i,8) Solve for i by trial and error or Excel i = 11.3% (Excel) Eliminate DN (Excel)

Chapter 8

5

C vs D: 0 = - 12,000(A/P,i,8) + 2,500 - 2500(A/F,i,8) Solve for i by trial and error or Excel i = 10.4% (Excel) Eliminate D Select method C 8.29 Rank alternatives according to increasing initial cost: 2,1,3,5,4 1 vs 2: 0 = -3000(A/P,i,5) + 1500 (A/P,i,5) = 0.5000 i = 41.0% (Excel) Eliminate 2 3 vs1: 0 = -3500(A/P,i,5) + 1000 (A/P,i,5) = 0.2857 i = 13.2% (Excel) Eliminate 3 5 vs 1: 0 = -10,000(A/P,i,5) + 2500 (A/P,i,5) = 0.2500 i = 7.9% (Excel) Eliminate 5 4 vs1: 0 = -17,000(A/P,i,5) + 6000 (A/P,i,5) = 0.3529 i = 22.5% (Excel) Eliminate 1 Select machine 4 8.30 Alternatives are revenue alternatives. Therefore, add DN (a) DN vs 8: 0 = -30,000(A/P,i,5) + (26,500 14,000) + 2000(A/F,i,5) Solve for i by trial and error or Excel i = 31.7% (Excel) Eliminate DN 8 vs 10: 0 = -4000(A/P,i,5) + (14,500 12,500) + 500(A/F,i,5) Solve for i by trial and

error or Excel i = 42.4% (Excel) Eliminate 8 10 vs 15: 0 = -4000(A/P,i,5) + (15,500 14,500) + 500(A/F,i,5) Solve for i by trial and error or ExcelChapter 8 6

i = 10.9% (Excel) Eliminate 15 10 vs 20: 0 = -14,000(A/P,i,5) + (19,500 14,500) + 1000(A/F,i,5) Solve for i by trial and error or Excel i = 24.2% (Excel) Eliminate 10 20 vs 25: 0 = -9000(A/P,i,5) + (23,000 19,500) + 1100(A/F,i,5) Solve for i by trial and error or Excel i = 29.0% (Excel) Eliminate 20 Purchase 25 m3 truck (b) For second truck, purchase truck that was eliminated next to last: 20 m3 8.31 (a) Select all projects whose ROR > MARR of 15%. Select A, B, and C (b) Eliminate alternatives with ROR < MARR; compare others incrementally: Eliminate D and E Rank survivors according to increasing first cost: B, C, A B vs C: i = 800/5000 = 16% > MARR C vs A: i = 200/5000 = 4% < MARR Select project C 8.32 (a) All machines have ROR > MARR of 12% and all increments of investment have ROR > MARR. Therefore, select machine 4. (b) Machines 2, 3, and 4 have ROR greater than 20%. Increment between 2 and 3 is justified, but not increment between 3 and 4. Therefore, select machine 3. 8.33 (a) Select A and C. (b) Proposal A is justified. A vs B yields 1%, eliminate B; A vs C yields 7%, eliminate C; A vs D yields 10%, eliminate A. Therefore, select proposal D (c) Proposal A is justified. A vs B yields 1%, eliminate B; A vs C yields 7%, eliminate C; A vs D yields 10%, eliminate D. Therefore, select proposal A

Eliminate B

Eliminate A

Chapter 8

7

8.34 (a) Find ROR for each increment of investment: E vs F: 20,000(0.20) + 10,000(i) = 30,000(0.35) i = 65% E vs G: 20,000(0.20) + 30,000(i) = 50,000(0.25) i = 28.3% E vs H: 20,000(0.20) + 60,000(i) = 80,000(0.20) i = 20% F vs G: 30,000(0.35) + 20,000(i) = 50,000(0.25) i = 10% F vs H: 30,000(0.35) + 50,000(i) = 80,000(0.20) i = 11% G vs H: 50,000(0.25) + 30,000(i) = 80,000(0.20) i = 11.7% (b) Revenue = A = Pi E: A = 20,000(0.20) = $4000 F: A = 30,000(0.35) = $10,500 G: A = 50,000(0.25) = $12,500 H: A = 80,000(0.20) = $16,000 (c) Conduct incremental analysis using results from part (a): E vs DN: i = 20% > MARR eliminate DN E vs F: i = 65% > MARR eliminate E F vs G: i = 10% < MARR eliminate G F vs H: i = 11% < MARR eliminate H Therefore, select Alternative F (d) Conduct incremental analysis using results from part (a). E vs DN: i = 20% >MARR, eliminate DN E vs F: i = 65% > MARR, eliminate E F vs G: i = 10% < MARR, eliminate G F vs H: i = 11% = MARR, eliminate F Select alternative H (e) Conduct incremental analysis using results from part (a). E vs DN: i = 20% > MARR, eliminate DN E vs F: i = 65% > MARR, eliminate E F vs G: i = 10% < MARR, eliminate G F vs H: i = 11% < MARR, eliminate HChapter 8 8

Select F as first alternative; compare remaining alternatives incrementally. E vs DN: i = 20% > MARR, eliminate DN E vs G: i = 28.3% > MARR, eliminate E G vs H: i = 11.7% < MARR, eliminate H Therefore, select alternatives F and G 8.35 (a) ROR for F: 10,000(0.25) + 15,000(0.20) = 25,000(i) i = 22% ROR for G: 25,000(0.22) + 5000(0.04) = 30,000(i) i = 19% Increment between E and G: 10,000(0.25) + 20,000(i) = 30,000(0.19) i = 16% Increment between E and H: 10,000(0.25) + 50,000(i) = 60,000(0.30) i = 31%

Increment between F and H: 25,000(0.22) + 35,000(i) = 60,000(0.30) i = 35.7% Increment between G and H: 30,000(0.19) + 30,000(i) = 60,000(0.30) i = 41% (b) Select all alternatives with ROR MARR of 21%; select E, F, and H. (c) Conduct incremental analysis using results from table and part (a). E vs DN: i = 25% > MARR, eliminate DN E vs F: i = 20% < MARR, eliminate F E vs G: i = 16% < MARR, eliminate G E vs H: i = 31% > MARR, eliminate E Select alternative H. FE Review Solutions 8.36 8.37 8.38 8.39 8.40 Answer is (a) Answer is (c) Answer is (c) Answer is (b) Answer is (d)9

Chapter 8

8.41 8.42 8.43

Answer is (b) Answer is (b) Answer is (b)

Extended Exercise Solution 1. PW at 12% is shown in row 29. Select #2 (n = 8) with the largest PW value. 2. #1 (n = 3) is eliminated. It has i* < MARR = 12%. Perform an incremental analysis of #1 (n = 4) and #2 (n = 5). Column H shows i* = 19.49%. Now perform an incremental comparison of #2 for n = 5 and n = 8. This is not necessary. No extra investment is necessary to expand cash flow by three years. The i* is infinity. It is obvious: select #2 (n = 8). 3. PW at 2000% > $0.05. i* is infinity, as shown in cell K45, where an error for IRR(K4:K44) is indicated. This analysis is not necessary, but shows how Excel can be used over the LCM to find a rate of return.Microsoft Excel - C8 - ext exer soln

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1 (n = 3)Year 01 2 Cash flow

1 (n = 4)Cash flow

#2 (n = 5)Cash flow

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(100,000)35,000 35.000 35.000

$(200,000)$ $ 50.000 55.000

$(200,000)$50.000 55.000 80.000 86.000 70.000 70.000 70.000 70.000

20 yr. CP $ (100.000)$ 35.000

#2(6)-to-#l(4) tt2(n=5) Incremental 20 yr. CP cash flow $ (200.000) $ (100.000)$50.000 55.000 80.000

#2 (n= 5) 40 gr. CP $(200,000)$ $ 50.000 55.000

$s

#2 (n = 8) 40 yr. CP (200,000)50.000 55.000 80.000

2(8)-to-2(5) Incrementalcash flow

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Interest rate 10%

1) Charles: Payment each year = (2) Beginningunrecovered

$2,010.57

(3)=(0.1)(2) (4) = (2)+(3)

(5)

(6H4M5) Endingunrecoveredbalance

Unrscoi/eted balances, column (4)

Year0

balance

Interest

Total owed

Payment

1 21 j14 5

$(5,000.00) $(5,000.00) $ (500.00) $(5 500.00) $2 010.57 $(3,489.43) $ (348.94) $(3 838.37) $2,010.57 $ (1,827.79) $ (182.78) $ (2,010.57) $2,010.57 $6,031.72 $(1,031.72), , ,

$(5,000.00) $(3 489.43) $(1 827.79) $ (0.00), ,

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3. F = [{[9000(1.08) 300] (1.08)} 500] (1.08) + (2000 1000) = $11,227.33 Change is 2.02%. Largest maintenance charge is in the last year and, therefore, no compound interest is accumulated by it. 4. The fastest method is to use the spreadsheet function: FV(12.32%,3,500,9000) + 2000 It displays the answer: F = $12,445.43

Chapter 1

7

Case Study Solution There is no definitive answer to the case study exercises. The following are examples only. 1. The first four steps are: Define objective, information collection, alternative definition and estimates, and criteria for decision-making. Objective: Select the most economic alternative that also meets requirements such as production rate, quality specifications, manufacturability for design specifications, etc. Information: Each alternative must have estimates for life (likely 10 years), AOC and other costs (e.g., training), first cost, any salvage value, and the MARR. The debt versus equity capital question must be addressed, especially if more than $5 million is needed. Alternatives: For both A and B, some of the required data to perform an analysis are: P and S must be estimated. AOC equal to about 8% of P must be verified. Training and other cost estimates (annual, periodic, one-time) must be finalized. Confirm n = 10 years for life of A and B. MARR will probably be in the 15% to 18% per year range. Criteria: Can use either present worth or annual worth to select between A and B. 2. Consider these and others like them: Debt capital availability and cost Competition and size of market share required Employee safety of plastics used in processing 3. With the addition of C, this is now a make/buy decision. Economic estimates needed are: Cost of lease arrangement or unit cost, whatever is quoted. Amount and length of time the arrangement is available. Some non-economic factors may be: Guarantee of available time as needed. Compatibility with current equipment and designs. Readiness of the company to enter the market now versus later.

Chapter 1

8

Chapter 2 Factors: How Time and Interest Affect MoneySolutions to Problems 2.1 1. (F/P,8%25) = 6.8485; 2. (P/A,3%,8) = 7.0197; 3. (P/G,9%,20) = 61.7770; 4. (F/A,15%,18) = 75.8364; 5. (A/P,30%,15) = 0.30598 P = 140,000(F/P,7%,4) =140,000(1.3108) = $183,512 F = 200,000(F/P,10%,3) = 200,000(1.3310) = $266,200 P = 600,000(P/F,12%,4) = 600,000(0.6355) = $381,300 (a) A = 225,000(A/P,15%,4) = 225,000(0.35027) = $78,811 (b) Recall amount = 78,811/0.10 = $788,110 per year 2.6 F = 150,000(F/P,18%,7) = 150,000(3.1855) = $477,825 P = 75(P/F,18%,2) = 75(0.7182) = $53.865 million P = 100,000((P/F,12%,2) = 100,000(0.7972) = $79,720 F = 1,700,000(F/P,18%,1) = 1,700,000(1.18) = $2,006,0001

2.2

2.3

2.4

2.5

2.7

2.8

2.9

Chapter 2

2.10 P = 162,000(P/F,12%,6) = 162,000(0.5066) = $82,069 2.11 P = 125,000(P/F,14%,5) = 125,000(0.5149) = $ 64,925 2.12 P = 9000(P/F,10%,2) + 8000(P/F,10%,3) + 5000(P/F,10%,5) = 9000(0.8264) + 8000(0.7513) + 5000(0.6209) = $16,553 2.13 P = 1,250,000(0.10)(P/F,8%,2) + 500,000(0.10)(P/F,8%,5) = 125,000(0.8573) + 50,000(0.6806) = $141,193 2.14 F = 65,000(F/P,4%,5) = 65,000(1.2167) = $79,086 2.15 P = 75,000(P/A,20%,3) = 75,000(2.1065) = $157,988 2.16 A = 1.8(A/P,12%,6) = 1.8(0.24323) = $437,814 2.17 A = 3.4(A/P,20%,8) = 3.4(0.26061) = $886,074 2.18 P = (280,000-90,000)(P/A,10%,5) = 190,000(3.7908) = $720,252 2.19 P = 75,000(P/A,15%,5) = 75,000(3.3522) = $251,415 2.20 F = (458-360)(20,000)(0.90)(F/A,8%,5) = 1,764,000(5.8666) = $10,348,682

Chapter 2

2

2.21 P = 200,000((P/A,10%,5) = 200,000(3.7908) = $758,160 2.22 P = 2000(P/A,8%,35) = 2000(11.6546) = $23,309 2.23 A = 250,000(A/F,9%,3) = 250,000(0.30505) = $76,263 2.24 F = (100,000 + 125,000)(F/A,15%,3) = 225,000(3.4725) = $781,313 2.25 (a) 1. Interpolate between n = 32 and n = 34: 1/2 = x/0.0014 x = 0.0007 (P/F,18%,33) = 0.0050 0.0007 = 0.0043 2. Interpolate between n = 50 and

n = 55: 4/5 = x/0.0654 x = 0.05232 (A/G,12%,54) = 8.1597 + 0.05232 = 8.2120 (b) 1. (P/F,18%,33) = 1/(1+0.18)33 = 0.0042 2. (A/G,12%,54) = {(1/0.12) 54/[(1+0.12)54 1} = 8.2143 2.26 (a) 1. Interpolate between i = 18% and i = 20% at n = 20: 1/2 = x/40.06 x = 20.03 (F/A,19%,20) = 146.6280 + 20.03 =166.658 2. Interpolate between i = 25% and i = 30% at n = 15: 1/5 = x/0.5911 x = 0.11822 (P/A,26%,15) = 3.8593 0.11822 = 3.74113

Chapter 2

(b)

1. (F/A,19%,20) = [(1 + 0.19)20 0.19]/0.19 = 169.6811 2. (P/A,26%,15) = [(1 + 0.26)15 1]/[0.26(1 + 0.26)15] = 3.7261

2.27 (a) G = $200 (b) CF8 = $1600

(c) n = 10

2.28 (a) G = $5 million (b) CF6 = $6030 million (c) n = 12 2.29 (a) G = $100 (b) CF5 = 900 100(5) = $400 2.30 300,000 = A + 10,000(A/G,10%,5) 300,000 = A + 10,000(1.8101) A = $281,899 2.31 (a) CF3 = 280,000 2(50,000) = $180,000 (b) A = 280,000 50,000(A/G,12%,5) = 280,000 50,000(1.7746) = $191,270 2.32 (a) CF3 = 4000 + 2(1000) = $6000 (b) P = 4000(P/A,10%,5) + 1000(P/G,10%,5) = 4000(3.7908) + 1000(6.8618) = $22,025 2.33 P = 150,000(P/A,15%,8) + 10,000(P/G,15%,8) = 150,000(4.4873) + 10,000(12.4807) = $797,902 2.34 A = 14,000 + 1500(A/G,12%,5) = 14,000 + 1500(1.7746) = $16,662 2.35 (a) Cost = 2000/0.2 = $10,000 (b) A = 2000 + 250(A/G,18%,5) = 2000 + 250(1.6728) = $2418

Chapter 2

4

2.36 Convert future to present and then solve for G using P/G factor: 6000(P/F,15%,4) = 2000(P/A,15%,4) G(P/G,15%,4) 6000(0.5718) = 2000(2.8550) G(3.7864) G = $601.94 2.37 50 = 6(P/A,12%,6) + G(P/G,12%,6) 50 = 6(4.1114) + G(8.9302) G = $2,836,622 2.38 A = [4 + 0.5(A/G,16%,5)] [1 0.1(A/G,16%,5) = [4 + 0.5(1.7060)] [1 0.1(1.7060)] = $4,023,600 2.39 For n = 1: {1 [(1+0.04)1/(1+0.10)1}]}/(0.10 0.04) = 0.9091 For n = 2: {1 [(1+0.04)2/(1+0.10)2}]}/(0.10 0.04) = 1.7686 For n = 3: {1 [(1+0.04)3/(1+0.10)3}]}/(0.10 0.04) = 2.5812 2.40 For g = i, P = 60,000(0.1)[15/(1 + 0.04)] = $86,538 2.41 P = 25,000{1 [(1+0.06)3/(1+0.15)3}]}/(0.15 0.06) = $60,247 2.42 Find P and then convert to A. P = 5,000,000(0.01){1 [(1+0.20)5/(1+0.10)5}]}/(0.10 0.20) = 50,000{5.4505} = $272,525 A = 272,525(A/P,10%,5) = 272,525(0.26380) = $71,892 2.43 Find P and then convert to F. P = 2000{1 [(1+0.10)7/(1+0.15)7}]}/(0.15 0.10) = 2000(5.3481) = $10,696 F = 10,696(F/P,15%,7) = 10,696(2.6600) = $28,452 2.44 First convert future worth to P, then use Pg equation to find A. P = 80,000(P/F,15%,10) = 80,000(0.2472) = $19,776

Chapter 2

5

19,776 = A{1 [(1+0.09)10/(1+0.15)10}]}/(0.15 0.09) 19,776 = A{6.9137} A = $2860 2.45 Find A in year 1 and then find next value. 900,000 = A{1 [(1+0.05)5/(1+0.15)5}]}/(0.15 0.05) 900,000 = A{3.6546) A = $246,263 in year 1 Cost in year 2 = 246,263(1.05) = $258,576 2.46 g = i: P = 1000[20/(1 + 0.10)] = 1000[18.1818] = $18,182 2.47 Find P and then convert to F. P = 3000{1 [(1+0.05)4/(1+0.08)4}]}/(0.08 0.05) = 3000{3.5522} = $10,657 F = 10,657(F/P,8%,4) = 10,657(1.3605) = $14,498 2.48 Decrease deposit in year 4 by 5% per year for three years to get back to year 1. First deposit = 1250/(1 + 0.05)3 = $1079.80

2.49 Simple: Total interest = (0.12)(15) = 180% Compound: 1.8 = (1 + i)15 i = 4.0% 2.50 Profit/year = 6(3000)/0.05 = $360,000 1,200,000 = 360,000(P/A,i,10) (P/A,i,10) = 3.3333 i = 27.3% (Excel) 2.51 2,400,000 = 760,000(P/A,i,5) (P/A,i,5) = 3.15789 i = 17.6% (Excel) 2.52 1,000,000 = 600,000(F/P,i,5) (F/P,i,5) = 1.6667 i = 10.8% (Excel)Chapter 2 6

2.53 125,000 = (520,000 470,000)(P/A,i,4) (P/A,i,4) = 2.5000 i = 21.9% (Excel) 2.54 400,000 = 320,000 + 50,000(A/G,i,5) (A/G,i,5) = 1.6000 Interpolate between i = 22% and i = 24% i = 22.6% 2.55 85,000 = 30,000(P/A,i,5) + 8,000(P/G,i,5) Solve for i by trial and error or spreadsheet: i = 38.9% (Excel) 2.56 500,000 = 75,000(P/A,10%,n) (P/A,10%,n) = 6.6667 From 10% table, n is between 11 and 12 years; therefore, n = 11 years 2.57 160,000 = 30,000(P/A,12%,n) (P/A,12%,n) = 5.3333 From 12% table, n is between 9 and 10 years; therefore, n = 10 years 2.58 2,000,000 = 100,000(P/A,4%,n) (P/A,4%,n) = 20.000 From 4% table, n is between 40 and 45 years; by spreadsheet, 42 > n > 41 Therefore, n = 41 years 2.59 1,500,000 = 3,000,000(P/F,20%,n) (P/F,20%,n) = 0.5000 From 20% table, n is between 3 and 4 years; therefore, n = 4 years 2.60 100,000 = 1,600,000(P/F,18%,n) (P/F,18%,n) = 0.0625 From 18% table, n is between 16 and 17 years; therefore, n = 17 years 2.61 10A = A(F/A,10%,n) (F/A,10%,n) = 10.000 From 10% table, n is between 7 and 8 years; therefore, n = 8 years

Chapter 2

7

2.62

1,000,000 = 10,000{1 [(1+0.10)n/(1+0.07)n}]}/(0.07 0.10) By trial and error, n = is between 50 and 51; therefore, n = 51 years 12,000 = 3000 + 2000(A/G,10%,n) (A/G,10%,n) = 4.5000 From 10% table, n is between 12 and 13 years; therefore, n = 13 years

2.63

FE Review Solutions 2.64 P = 61,000(P/F,6%,4) = 61,000(0.7921) = $48,318 Answer is (c) 2.65 160 = 235(P/F,i,5) (P/F,i,5) =0.6809 From tables, i = 8% Answer is (c) 2.66 23,632 = 3000{1- [(1+0.04)n/(1+0.06)n]}/(0.06-0.04) [(23,632*0.02)/3000]-1 = (0.98113)n log 0.84245 = nlog 0.98113 n=9 Answer is (b)

2.67 109.355 = 7(P/A,i,25) (P/A,i,25) = 15.6221 From tables, i = 4% Answer is (a) 2.68 A = 2,800,000(A/F,6%,10) = $212,436 Answer is (d) 2.69 A = 10,000,000((A/P,15%,7) = $2,403,600 Answer is (a) 2.70 P = 8000(P/A,10%,10) + 500(P/G,10%,10) = 8000(6.1446) + 500(22.8913) = $60,602.45 Answer is (a)Chapter 2 8

2.71 F = 50,000(F/P,18%,7) = 50,000(3.1855) = $159,275 Answer is (b) 2.72 P = 10,000(P/F,10%,20) = 10,000(0.1486) = $1486 Answer is (d) 2.73 F = 100,000(F/A,18%,5) = 100,000(7.1542) = $715,420 Answer is (c) 2.74 P = 100,000(P/A,10%,5) - 5000(P/G,10%,5) = 100,000(3.7908) - 5000(6.8618) = $344,771 Answer is (a) 2.75 F = 20,000(F/P,12%,10) = 20,000(3.1058) = $62,116 Answer is (a) 2.76 A = 100,000(A/P,12%,5) = 100,000(0.27741) = $27,741 Answer is (b)

2.77 A = 100,000(A/F,12%,3) = 100,000(0.29635) = $29,635 Answer is (c) 2.78 A = 10,000(F/A,12%,25) = 10,000(133.3339) = $1,333,339 Answer is (d) 2.79 F = 10,000(F/P,12%,5) + 10,000(F/P,12%,3) + 10,000 = 10,000(1.7623) + 10,000(1.4049) + 10,000 = $41,672 Answer is (c)Chapter 2 9

2.80

P = 8,000(P/A,10%,5) + 900(P/G,10%,5) = 8,000(3.7908) + 900(6.8618) = $36,502 Answer is (d)

2.81 100,000 = 20,000(P/A,i,10) (P/A,i,10) = 5.000 i is between 15 and 16% Answer is (a)

2.82

60,000 = 15,000(P/A,18%,n) (P/A,18%,n) = 4.000 n is between 7 and 8 Answer is (b)

Case Study Solution I. Manhattan Island Simple interest n = 375 years from 1626 2001 P + I = P + nPi = 375(24)(.06) + 24 = P(1 + ni) = 24(1 + 375(.06)) = $564 Compound interest F = P(F/P,6%,375) = 24(3,088,157,729.0) = $74,115,785,490, which is $74+ billion

II. Stock-option plan F=? after 5 years 1. Years 0 1 5

F=? after 35 years

35

AgeChapter 2

$50/mth = 60 deposits 22 2710

57

2.

Value when leaving the company F = A(F/A,1.25%,60) = 50(88.5745) = $4428.73

3.

Value at age 57 (n = 30 years) F = P(F/P,15%,30) = 4428.73(66.2118) = $293,234

4.

Amount for 7 years to accumulate F = $293,234 A = F(A/F,15%,7) = 293,234(.09036) = $26,497 per year

5.

Amount in 20s: 5(12)50 = $3000 Amount in 50s: 7(26,497) = $185,479

Chapter 2

11

Chapter 3 Combining FactorsSolutions to Problems 3.1 P = 100,000(260)(P/A,10%,8)(P/F,10%,2) = 26,000,000(5.3349)(0.8264) = $114.628 million 3.2 P = 50,000(56)(P/A,8%,4)(P/F,8%,1) = 2,800,000(3.3121)(0.9259) = $8.587 million 3.3 P = 80(2000)(P/A,18%,3) + 100(2500)(P/A,18%,5)(P/F,18%,3) = 160,000(2.1743) + 250,000(3.1272)(0.6086) = $823,691 3.4 P = 100,000(P/A,15%,3) + 200,000(P/A,15%,2)(P/F,15%,3) = 100,000(2.2832) + 200,000(1.6257)(0.6575) = $442,100 3.5 P = 150,000 + 150,000(P/A,10%,5) = 150,000 + 150,000(3.7908) = $718,620 3.6 P = 3500(P/A,10%,3) + 5000(P/A,10%,7)(P/F,10%,3) = 3500(2.4869) + 5000(4.8684)(0.7513) = $26,992 3.7 A = [0.701(5.4)(P/A,20%,2) + 0.701(6.1)(P/A,20%,2)((P/F,20%,2)](A/P,20%,4) = [3.7854(1.5278) + 4.2761(1.5278)(0.6944)](0.38629) = $3.986 billion 3.8 A = 4000 + 1000(F/A,10%,4)(A/F,10%,7) = 4000 + 1000(4.6410)(0.10541) = $4489.21 3.9 A = 20,000(P/A,8%,4)(A/F,8%,14) = 20,000(3.3121)(0.04130) = $2735.79 3.10 A = 8000(A/P,10%,10) + 600 =

8000(0.16275) + 600 = $1902Chapter 3 1

3.11 A = 20,000(F/P,8%,1)(A/P,8%,8) = 20,000(1.08)(0.17401) = $3758.62 3.12 A = 10,000(F/A,8%,26)(A/P,8%,30) = 10,000(79.9544)(0.08883) = $71,023 3.13 A = 15,000(F/A,8%,9)(A/F,8%,10) = 15,000(12.4876)(0.06903) = $12,930 3.14 A = 80,000(A/P,10%,5) + 80,000 = 80,000(0.26380) + 80,000 = $101,104 3.15 A = 5000(A/P,6%,5) + 1,000,000(0.15)(0.75) = 5000(0.2374) + 112,500 = $113,687 3.16 A = [20,000(F/A,8%,11) + 8000(F/A,8%,7)](A/F,8%,10) = [20,000(16.6455) + 8000(8.9228)]{0.06903) = $27,908 3.17 A = 600(A/P,12%,5) + 4000(P/A,12%,4)(A/P,12%,5) = 600(0.27741) + 4000(3.0373)(0.27741) = $3536.76 3.18 F = 10,000(F/A,15%,21) = 10,000(118.8101) = $1,188,101 3.19 100,000 = A(F/A,7%,5)(F/P,7%,10) 100,000 = A(5.7507)(1.9672) A = $8839.56 3.20 F = 9000(F/P,8%,11) + 600(F/A,8%,11) + 100(F/A,8%,5) = 9000(2.3316) + 600(16.6455) + 100(5.8666) = $31,558 3.21 Worth in year 5 = -9000(F/P,12%,5) + 3000(P/A,12%,9) = -9000(1.7623) + 3000(5.3282) = $123.90Chapter 3 2

3.22 Amt, year 5 = 1000(F/A,12%,4)(F/P,12%,2) + 2000(P/A,12%,7)(P/F,12%,1) = 1000(4.7793)(1.2544) + 2000(4.5638)(0.8929) = $14,145 3.23 A = [10,000(F/P,12%,3) + 25,000](A/P,12%,7) = [10,000(1.4049) + 25,000](0.21912) = $8556.42 3.24 Cost of the ranch is P = 500(3000) = $1,500,000. 1,500,000 = x + 2x(P/F,8%,3) 1,500,000 = x + 2x(0.7938) x = $579,688 3.25 Move unknown deposits to year 1, amortize using A/P, and set equal to $10,000. x(F/A,10%,2)(F/P,10%,19)(A/P,10%,15) = 10,000 x(2.1000)(6.1159)(0.13147) = 10,000 x = $5922.34 3.26 350,000(P/F,15%,3) = 20,000(F/A,15%,5) + x 350,000(0.6575) = 20,000(6.7424) + x x = $95,277 3.27 Move all cash flows to year 9. 0 = -800(F/A,14%,2)(F/P,14%,8) + 700(F/P,14%,7) + 700(F/P,14%,4) 950(F/A,14%,2)(F/P,14%,1) + x 800(P/A,14%,3) 0 = -800(2.14)2.8526) + 700(2.5023) + 700(1.6890) 950(2.14)(1.14) + x 800(2.3216) x = $6124.64 3.28 Find P at t = 0 and then convert to A. P = 5000 + 5000(P/A,12%,3) + 3000(P/A,12%,3)(P/F,12%,3) + 1000(P/A,12%,2)(P/F,12%,6) = 5000 + 5000(2.4018) + 3000(2.4018)(0.7118) + 1000(1.6901)(0.5066) = $22,994 A = 22,994(A/P,12%,8) = 22,994(0.20130) = $4628.69 3.29 F = 2500(F/A,12%,8)(F/P,12%,1) 1000(F/A,12%,3)(F/P,12%,2) = 2500(12.2997)(1.12) 1000(3.3744)(1.2544) = $30,206Chapter 3 3

3.30 15,000 = 2000 + 2000(P/A,15%,3) + 1000(P/A,15%,3)(P/F,15%,3) + x(P/F,15%,7) 15,000 = 2000 + 2000(2.2832) + 1000(2.2832)(0.6575) + x(0.3759) x = $18,442 3.31 Amt, year 3 = 900(F/A,16%,4) + 3000(P/A,16%,2) 1500(P/F,16%,3) + 500(P/A,16%,2)(P/F,16%,3) = 900(5.0665) + 3000(1.6052) 1500(0.6407) + 500(1.6052)(0.6407) = $8928.63 3.32 A = 5000(A/P,12%,7) + 3500 + 1500(F/A,12%,4)(A/F,12%,7) = 5000(0.21912) + 3500 + 1500(4.7793)(0.09912) = $5306.19 3.33 20,000 = 2000(F/A,15%,2)(F/P,15%,7) + x(F/A,15%,7) + 1000(P/A,15%,3) 20,000 = 2000(2.1500)(2.6600) + x(11.0668) + 1000(2.2832) x = $567.35 3.34 P = [4,100,000(P/A,6%,22) 50,000(P/G,6%,22)](P/F,6%,3) + 4,100,000(P/A,6%,3) = [4,100,000(12.0416) 50,000(98.9412](0.8396) + 4,100,000(2.6730) = $48,257,271 3.35 P = [2,800,000(P/A,12%,7) + 100,000(P/G,12%,7) + 2,800,000](P/F,12%,1) = [2,800,000(4.5638) + 100,000(11.6443) + 2,800,000](0.8929) = $14,949,887 3.36 P for maintenance = [11,500(F/A,10%,2) + 11,500(P/A,10%,8) + 1000(P/G,10%,8)](P/F,10%,2) = [11,500(2.10) + 11,500(5.3349) + 1000(16.0287)](0.8264) = $83,904 P for accidents = 250,000(P/A,10%,10) = 250,000(6.1446) = $1,536,150 Total savings = 83,904 + 1,536,150 = $1,620,054 Build overpass 3.37 Find P at t = 0, then convert to A. P = [22,000(P/A,12%,4) + 1000(P/G,12%,4) + 22,000](P/F,12%,1) = [22,000(3.0373) + 1000(4.1273) + 22,000](0.8929) = $82,993

Chapter 3

4

A = 82,993(A/P,12%,5) = 82,993(0.27741) = $23,023 3.38 First find P and then convert to F. P = -10,000 + [4000 + 3000(P/A,10%,6) + 1000(P/G,10%,6) 7000(P/F,10%,4)](P/F,10%,1) = -10,000 + [4000 + 3000(4.3553) + 1000(9.6842) 7000(0.6830)](0.9091) = $9972 F = 9972(F/P,10%,7) = 9972(1.9487) = $19,432 3.39 Find P in year 0 and then convert to A. P = 4000 + 4000(P/A,15%,3) 1000(P/G,15%,3) + [(6000(P/A,15%,4) +2000(P/G,15%,4)](P/F,15%,3) = 4000 + 4000(2.2832) 1000(2.0712) + [(6000(2.8550) +2000(3.7864)](0.6575) = $27,303.69 A = 27,303.69(A/P,15%,7) = 27,303.69(0.24036) = $6563 3.40 40,000 = x(P/A,10%,2) + (x + 2000)(P/A,10%,3)(P/F,10%,2) 40,000 = x(1.7355) + (x + 2000)(2.4869)(0.8264) 3.79067x = 35,889.65 x = $9467.89 (size of first two payments) 3.41 11,000 = 200 + 300(P/A,12%,9) + 100(P/G,12%,9) 500(P/F,12%,3) + x(P/F,12%,3) 11,000 = 200 + 300(5.3282) + 100(17.3563) 500(0.7118) + x(0.7118) x = $10,989 3.42 (a) In billions P in yr 1 = -13(2.73) + 5.3{[1 (1 + 0.09)10/ (1 + 0.15)10]/(0.15 0.09)} = -35.49 + 5.3(6.914) = $1.1542 billion P in yr 0 = 1.1542(P/F,15%,1) = 1.1542(0.8696) = $1.004 billion

Chapter 3

5

3.43 Find P in year 1; then find A in years 0-5. Pg in yr 2 = (5)(4000){[1 - (1 + 0.08)18/(1 + 0.10)18]/(0.10 - 0.08)} = 20,000(14.0640) = $281,280 P in yr 1 = 281,280(P/F,10%,3) + 20,000(P/A,10%,3) = 281,280(0.7513) + 20,000(2.4869) = $261,064 A = 261,064(A/P,10%,6) = 261,064(0.22961) = $59,943 3.44 Find P in year 1 and then move forward 1 year P-1= 20,000{[1 (1 + 0.05)11/(1 + 0.14)11]/(0.14 0.05)}. = 20,000(6.6145) = $132,290 P = 132,290(F/P,14%,1) = 132,290(1.14) = $150,811 3.45 P = 29,000 + 13,000(P/A,10%,3) + 13,000[7/(1 + 0.10)](P/F,10%,3) = 29,000 + 13,000(2.4869) + 82,727(0.7513) = $123,483 3.46 Find P in year 1 and then move to year 0. P (yr 1) = 15,000{[1 (1 + 0.10)5/(1 + 0.16)5]/(0.16 0.10)} = 15,000(3.8869) = $58,304 P = 58,304(F/P,16%,1) = 58,304(1.16) = $67,632 3.47 Find P in year 1 and then move to year 5. P (yr 1) = 210,000[6/(1 + 0.08)] = 210,000(0.92593) = $1,166,667 F = 1,166,667(F/P,8%,6) = 1,166,667(1.5869) = $1,851,383

Chapter 3

6

3.48 P = [2000(P/A,12%,6) 200(P/G,12%,6)](F/P,12%,1) = [2000(4.1114) 200(8.9302](1.12) = $7209.17 3.49 P = 5000 + 1000(P/A,12%,4) + [1000(P/A,12%,7) 100(P/G,12%,7)](P/F,12%,4) = 5000 + 1000(3.0373) + [1000(4.5638) 100(11.6443)](0.6355) =

$10,198 3.50 Find P in year 0 and then convert to A. P = 2000 + 2000(P/A,10%,4) + [2500(P/A,10%,6) 100(P/G,10%,6)](P/F,10%,4) = 2000 + 2000(3.1699) + [2500(4.3553) 100(9.6842)](0.6830) = $15,115 A = 15,115(A/P,10%,10) = 15,115(0.16275) = $2459.97 3.51 20,000 = 5000 + 4500(P/A,8%,n) 500(P/G,8%,n) Solve for n by trial and error: Try n = 5: $15,000 > $14,281 Try n = 6: $15,000 < $15,541 By interpolation, n = 5.6 years 3.52 P = 2000 + 1800(P/A,15%,5) 200(P/G,15%,5) = 2000 + 1800(3.3522) 200(5.7751) = $6878.94 3.53 F = [5000(P/A,10%,6) 200(P/G,10%,6)](F/P,10%,6) = [5000(4.3553) 200(9.6842)](1.7716) = $35,148

FE Review Solutions 3.54 x = 4000(P/A,10%,5)(P/F,10%,1) = 4000(3.7908)(0.9091) = $13,785 Answer is (d) P = 7 + 7(P/A,4%,25) = $116.3547 million Answer is (c) Answer is (d)7

3.55

3.56

Chapter 3

3.57

Size of first deposit = 1250/(1 + 0.05)3 = $1079.80 Answer is (d) Balance = 10,000(F/P,10%,2) 3000(F/A,10%,2) = 10,000(1.21) 3000(2.10) = $5800 Answer is (b)

3.58

3.59 1000 = A(F/A,10%,5)(A/P,10%,20) 1000 = A(6.1051)(0.11746) A = $1394.50 Answer is (a) 3.60 First find P and then convert to A. P = 1000(P/A,10%,5) + 2000(P/A,10%,5)(P/F,10%,5) = 1000(3.7908) + 2000(3.7908)(0.6209) = $8498.22 A = 8498.22(A/P,10%,10) = 8498.22(0.16275) = $1383.08 Answer is (c) 3.61 100,000 = A(F/A,10%,4)(F/P,10%,1) 100,000 = A(4.6410)(1.10) A = $19,588 Answer is (a) 3.62 F = [1000 + 1500(P/A,10%,10) + 500(P/G,10%,10](F/P,10%,10) = [1000 + 1500(6.1446) + 500(22.8913](2.5937) = $56,186 Answer is (d) 3.63 F = 5000(F/P,10%,10) + 7000(F/P,10%,8) + 2000(F/A,10%,5) = 5000(2.5937) + 7000(2.1438) + 2000(6.1051) = $40,185 Answer is (b)

Chapter 3

8

Extended Exercise Solution Solution by Hand Cash flows for purchases at g = 25% start in year 0 at $4 million. Cash flows for parks development at G = $100,000 start in year 4 at $550,000. All cash flow signs in the solution are +. Cash flow_____ Year Land Parks 0 1 2 3 4 5 6 $4,000,000 3,000,000 2,250,000 1,678,000 1,265.625 949,219

$550,000 650,000 750,000

1. Find P for all project funds (in $ million) P = 4 + 3(P/F,7%,1) + + 0.750(P/F,7%,6) = 13.1716 ($13,171,600) Amount to raise in years 1 and 2: A = (13.1716 3.0)(A/P,7%,2) = (10.1716)(0.55309) = 5.6258 2.

($5,625,800 per year)

Find remaining project fund needs in year 3, then find the A for the next 3 years (years 4, 5, and 6): F3 = (13.1716 3.0)(F/P,7%,3) = (10.1716)(1.2250) = 12.46019 A = 12.46019(A/P,7%,3) = 12.46019(0.38105) = 4.748

($4,748,000 per year)

Chapter 3

9

Extended Exercise Solution Solution by computerE Microsoft ExcelFile Edit View Insert Format lools Data Window Help QI MacrosB I,

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Chapter 3 - extended exercise solution.

and purchase multiplier = 0,75 4

Engineering Economy, 6th edition, provides undergraduate students and practicing professionals with a solid preparation in the financial understanding of engineering problems and projects, as well as the techniques needed for evaluating and making sound economic decisions. Information on cost estimation, depreciation, and taxes has been updated to conform to new tax laws and a majority of the end-of-chapter problems are revised or new to this edition.

Distinguishing pedagogical characteristics of this market-leading text include its easy-to-read writing style, chapter objectives, worked examples, integrated spreadsheets, case studies, Fundamentals of Engineering (FE) exam questions, and numerous end-of-chapter problems. Graphical cross-referencing is indicated so users are able to locate additional material on any one subject in the text.

While the chapters are progressive, over three-quarters can stand alone, allowing instructors flexibility for meeting course needs. A complete Online Learning Center (OLC) offers supplemental practice problems, spreadsheet exercises, review questions for the Fundamentals of Engineering (FE) exam, and more!

"synopsis" may belong to another edition of this title.

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Engineering Economy, 6th Edition

รายละเอียดสินค้า Engineering Economy, 6th Edition

Blank and Tarquin moved to the number one book in May of 2004.

Approximately 80% of the end-of-chapter problems are either new or revised for the 6th edition.

Information on cost estimation, depreciation, and taxes has been updated for this edition.

International considerations have been updated and expanded upon.

The Online Learning Center (http://www.mhhe.com/blank6) includes resources for students and instructors. Resources will include: Glossary, Web links, FE Exam Problems and Quiz, Learning Objectives, Spreadsheet Exercises, Lecture Slides, Summaries, general textbook information, and more!

Table of Contents

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10/12/2560 13:51

คุณภาพสินค้าดีมาก

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Chapter 8

4. Composite rate of return approach Plan A (a) MARR = 15% and c = 15%

F0 = 1900; F1 = 1900(1.15) -500 = 1685; F2 = 1685(1.15) -8000 = -6062.25; F3 = -6062.25(1+ i') +6500 = 437.75 6062.25i' F4 = 0 = F3(1+ i') +400 So i' = 13.06% < MARR = 15%. Reject Plan A. (b) MARR = 15% and c = 45% F0 = 1900; F1=1900(1.45) -500 = 2255; F2 = 2255(1.45) -8000 = -4730.25; F3 = -4730.25(1+ i') +6500 = 1769.75 4730.25i' F4 = 0 = F3(1+ i') +400. So i' = 43.31% > MARR= 15%. Accept Plan A. (c) MARR = 50% and c = 50% F0 = 1900; F1 = 1900(1.50) -500 = 2350; F2 = 2350(1.50) -8000 = -4475; F3 = -4475(1+i') +6500 = -4475i' + 2025 F4 = 0 = F3(1+ i') +400. So i ' = 51.16% > MARR = 50%. Accept Plan A. Plan B (a) MARR = 15% and c = 15%

F0 = -1900; F1 = -1900(1+ i') +500; F2 = -1900(1+ i')2 +500(1+ i') +8000; F3 = (1.15)F2 6500 F4 = 0 = F3(1.15) -400. So i' = 17.74% > MARR = 15%. Accept Plan B. (b) MARR = 15% and c = 45% F0 = -1900; F1 = -1900(1+i') +500; F2 = -1900(1+ i')2 +500(1+ i') +8000; F3 = -1900(1.45) (1+ i')2 +500(1.45)(1+ i') +8000(1.45) 6500 F4 = 0 = F3(1.45) - 400. So i' = 46.14% > MARR = 15%. Accept Plan B (c) MARR = 50% and c = 50% F0 = -1900; F1 = -1900(1+ i') +500; F2 = -1900(1+ i')2 +500(1+ i') +8000; F3 = -1900(1. 5)(1+ i')2 +500(1.5) (1+ i') +8000(1.5) 6500 F4 = 0 = F3(1.5) - 400. So i' = 49.30% < MARR = 50%. Reject Plan B. d) Discussion: Plan B is superior to Plan A for c values below i*2, i.e., Bs composite rate of return is higher. However, for c values above i*2, plan A gives a higher (composite) rate of return. Conclusion: The composite rate of return evaluation yields unambiguous results when a reinvestment rate is specified.Chapter 8 15

Chapter 9 Benefit/Cost Analysis and Public Sector EconomicsSolutions to Problems 9.1 (a) Public sector projects usually require large initial investments while many private sector investments may be medium to small. (b) Public sector projects usually have long lives (30-50 years) while private sector projects are usually in the 2-25 year range. (c) Public sector projects are usually funded from taxes, government bonds, or user fees. Private sector projects are usually funded by stocks, corporate bonds, or bank loans. (d) Public sector projects use the term discount rate, not MARR. The discount rate is usually in the 4 10% range, thus it is lower than most private sector MARR values. 9.2 (a) Private (f) Private (a) Benefit (b) Private (c) Public (d) Public (e) Public

9.3 9.4

(b) Cost

(c) Cost

(d) Disbenefit (e) Benefit (f) Disbenefit

Some different dimensions are: 1. Contractor is involved in design of highway; contractor is not provided with the final plans before building the highway. 2. Obtaining project financing may be a partial responsibility in conjunction with the government unit. 3. Corporation will probably operate the highway (tolls, maintenance, management) for some years after construction. 4. Corporation will legally own the highway right of way and improvements until contracted time is over and title transfer occurs. 5. Profit (return on investment) will be stated in the contract. (a) Amount of financing for construction is too low, and usage rate is too low to cover cost of operation and agreed-to profit. (b) Special government-guaranteed loans and subsidies may be arranged at original contract time in case these types of financial problems arise later. (a) B/C = 600,000 100,000 = 1.11 450,000 (b) B-C = 600,000 100,000 450,000 = $+50,0001

9.5

9.6

Chapter 9

9.7 (a) Use Excel and assume an infinite life. Calculate the capitalized costs for all annual amount estimates.File Edit Vie . Insert Formet lools Dete Window Help-

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Estimates

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per year per year

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Note: Since no life is stated, assume it is very long, so the PW value is the capitalized cost of AW/i.

B/C ratio

(B-D)/C

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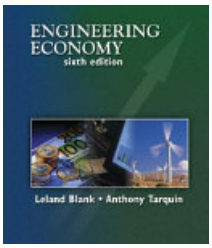
Engineering Economy



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Ingeniería Económica - Solutions Manual - Leland Blank & Anthony Tarquin 6th Edition

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CONOMY

Solucionario

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Letand Blank . Anthony TarquinBy Keyser Sze

UNTVERSIDAD AUTONOMA DEL ESTADO DE MORELOS (UAEM)

FACULTAD DE CIENCIAS QUlMICAS E INGENIERIA (FCQel)FORMULARIO DE INGENIERIA ECONOMICA

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ING. ALFREDO PEREZ PATlto

Chapter 1 Foundations of Engineering EconomySolutions to Problems 1.1 Time value of money means that there is a certain worth in having money and the worth changes as a function of time. Morale, goodwill, friendship, convenience, aesthetics, etc. (a) Evaluation criterion is the measure of value that is used to identify best. (b) The primary evaluation criterion used in economic analysis is cost. Nearest, tastiest, quickest, classiest, most scenic, etc If the alternative that is actually the best one is not even recognized as an alternative, it obviously will not be able to be selected using any economic analysis tools. In simple interest, the interest rate applies only to the principal, while compound interest generates interest on the principal and all accumulated interest. Minimum attractive rate of return is the lowest rate of return (interest rate) that a company or individual considers to be high enough to induce them to invest their money. Equity financing involves the use of the corporations or individuals own funds for making investments, while debt financing involves the use of borrowed funds. An example of equity financing is the use of a corporations cash or an individuals savings for making an investment. An example of debt financing is a loan (secured or unsecured) or a mortgage. Rate of return = (45/966)(100) = 4.65% Rate of increase = [(29 22)/22](100) = 31.8% Interest rate = (275,000/2,000,000)(100) = 13.75% Rate of return = (2.3/6)(100) = 38.3%1

1.2 1.3

1.4 1.5

1.6

1.7

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1.9

1.10

1.11

1.12

Chapter 1

1.13

Profit = 8(0.28) = $2,240,000 P + P(0.10) = 1,600,000 1.1P = 1,600,000 P = $1,454,545 Earnings = 50,000,000(0.35) = $17,500,000 (a) Equivalent future amount = 10,000 + 10,000(0.08) = 10,000(1 + 0.08) = $10,800 (b) Equivalent past amount: P + 0.08P = 10,000 1.08P = 10,000 P = $9259.26

1.14

1.15

1.16

1.17

Equivalent cost now: P + 0.1P = 16,000 1.1P = 16,000 P = $14,545.45 40,000 + 40,000(i) = 50,000 i = 25% 80,000 + 80,000(i) = 100,000 i = 25% F = 240,000 + 240,000(0.10)(3) = $312,000 Compound amount in 5 years = 1,000,000(1 + 0.07)5 = $1,402,552 Simple amount in 5 years = 1,000,000 + 1,000,000(0.075)(5) = $1,375,000 Compound interest is better by $27,552

1.18

1.19

1.20

1.21

1.22

Simple: 1,000,000 = 500,000 + 500,000(i)(5) i = 20% per year simple Compound: 1,000,000 = 500,000(1 + i)5 (1 + i)5 = 2.0000 (1 + i) =

(2.0000)0.2 i = 14.87%

Chapter 1

2

1.23

Simple: 2P = P + P(0.05)(n) P = P(0.05)(n) n = 20 years Compound: 2P = P(1 + 0.05)n (1 + 0.05)n = 2.0000 n = 14.2 years

1.24

(a) Simple: 1,300,000 = P + P(0.15)(10) 2.5P = 1,300,000 P = $520,000 (b) Compound: 1,300,000 = P(1 + 0.15)10 4.0456P = 1,300,000 P = $321,340

1.25

Plan 1: Interest paid each year = 400,000(0.10) = $40,000 Total paid = 40,000(3) + 400,000 = $520,000 Plan 2: Total due after 3 years = 400,000(1 + 0.10)3 = $532,400 Difference paid = 532,400 520,000 = $12,400

1.26

(a) Simple interest total amount = 1,750,000(0.075)(5) = $656,250 Compound interest total = total amount due after 4 years amount borrowed = 1,750,000(1 + 0.08)4 1,750,000 = 2,380856 1,750,000 = $630,856 (b) The company should borrow 1 year from now for a savings of $656,250 $630,856 = $25,394

1.27 1.28

The symbols are F = ?; P = $50,000; i = 15%; n = 3 (a) FV(i%,n,A,P) finds the future value, F (b) IRR(first_cell:last_cell) finds the compound interest rate, i (c) PMT(i%,n,P,F) finds the equal periodic payment, A (d) PV(i%,n,A,F) finds the present value, P3

Chapter 1

1.29

1.30 1.31

(a) F = ?; i = 7%; n = 10; A = $2000; P = $9000 (b) A = ?; i = 11%; n = 20; P = $14,000; F = 0 (c) P = ?; i = 8%; n = 15; A = $1000; F = $800 (a) PV = P (b) PMT = A (c) NPER = n (d) IRR = i

(e) FV = F

For built-in Excel functions, a parameter that does not apply can be left blank when it is not an interior one. For example, if there is no F involved when using the PMT function to solve a particular problem, it can be left blank because it is an end function. When the function involved is an interior one (like P in the PMT function), a comma must be put in its position. (a) Risky (b) Safe (c) Safe (d) Safe (e) Risky (a) Equity (b) Equity (c) Equity (d) Debt (e) Debt Highest to lowest rate of return is as follows: Credit card, bank loan to new business, corporate bond, government bond, interest on checking account Highest to lowest interest rate is as follows: rate of return on risky investment, minimum attractive rate of return, cost of capital, rate of return on safe investment, interest on savings account, interest on checking account. WACC = (0.25)(0.18) + (0.75)(0.10) = 12% Therefore, MARR = 12% Select the last three projects: 12.4%, 14%, and 19%

1.32

1.33

1.34

1.35

1.36

1.37

End of period convention means that the cash flows are assumed to have occurred at the end of the period in which they took place. The following items are inflows: salvage value, sales revenues, cost reductions The following items are outflows: income taxes, loan interest, rebates to dealers, accounting services

1.38

Chapter 1

4

F= ?

1.39

The cash flow diagram is:

i = 10% $9000 0 1 2 3 4 $3000 $10,000 5 6 7 8

1.40

The cash flow diagram is:

P=?i = 15%

0 1

2

3

4

5

$40,000

1.41

Time to double = 72/8 = 9 years Time to double = 72/9 = 8 years Time to quadruple = (8)(2) = 16 years

1.42

1.43

4 = 72/i i = 18% per year Account must double in value five times to go from $62,500 to $2,000,000 in 20 years. Therefore, account must double every 20/5 = 4 years. Required rate of return = 72/4 = 18% per year

1.44

FE Review Solutions 1.45 1.46 Answer is (c) 2P = P + P(0.05)(n) n = 20 Answer is (d)5

Chapter 1

1.47 Amount now = 10,000 + 10,000(0.10) = $11,000 Answer is (c) 1.48 i = 72/9 = 8 % Answer is (b) 1.49 Answer is (c) 1.50 Let i = compound rate of increase: 235 = 160(1 + i)5 (1 + i)5 = 235/160 (1 + i) = (1.469)0.2 (1 + i) = 1.07995 i = 7.995% = 8.0% Answer is (c) Extended Exercise Solution

F=? 1. 0 1 2 3 $2000 4

$500

$500

$500

$9000 F = [{[9000(1.08) 500] (1.08)} 500] (1.08) + (2000500) = $10,960.60 or F = 9000(F/P,8%,3) 500(F/A,8%,3) + 2000 2. A spreadsheet uses the FV function as shown in the formula bar. F = $10,960.61.

Chapter 1

6

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Case Study Solution 1. Set first cost of toilet equal to monthly savings and solve for n: (115.83 76.12) + 50(A/P,0.75%,n) = 2.1(0.76 + 0.62) 89.71(A/P,0.75%,n) = 2.898 (A/P,0.75%,n) = 0.03230 From 0.75% interest table, n is between 30 and 36 months By interpolation, n = 35 months or 2.9 years

Chapter 5

12

2. If the toilet life were to decrease by 50% to 2.5 years, then the homeowner would not breakeven at any interest rate (2.6 years is required at 0% and longer times would be required for i > 0%). If the interest rate were to increase by more than 50% (say from 9% to 15%), the payback period would increase from 2.9 years (per above solution) to a little less than 3.3 years (from 1.25% interest table). Therefore, the payback period is much more sensitive to the toilet life than to the interest rate. 3. cost/month = 76.12 (A/P,0.5%,60) = 76.12 (0.01933) = $1.47 CCF/month = 2.1 + 2.1 = 4.2 cost/CCF = 1.47/4.2 = $0.35/CCF or $0.47/1000 gallons (vs $0.40/1000 gallons at 0% interest) 4. (a) If 100% of the $115.83 cost of the toilet is rebated, the cost to the city at 0% interest is c= 115.83 (2.1 + 2.1) (12) (5)

= $0.46/CCF or $0.61/1000 gal (vs $0.40/1000 gal at 75% rebate) This is still far below the citys cost of $1.10/1000 gallons. Therefore, the success of the program is not sensitive to the percentage of cost rebated. (b) Use the same relation for cost/month as in question 3 above, except with varying interest rates, the values shown in the table below are obtained for n = 5 years.

Interest Rate, % $ / CCF $/1000 gal

4 6 0.33 0.35 0.45 0.47

8 0.37 0.49

10 0.39 0.51

12 0.40 0.54

15 0.43 0.58

The results indicate that even at an interest rate of 15% per year, the cost at $0.58/1000 gallons is significantly below the citys cost of $1.10/1000 gallons. Therefore, the programs success is not sensitive to interest rates.

Chapter 5

13

(c) Use the same equation as in question 3 above with i = 0.5% per month and varying life values. Life, years 2 3 $ / CCF 0.80 0.55 $/1000 gal 1.07 0.74 4 0.43 0.57 5 0.35 0.47 6 0.30 0.40 8 0.24 0.32 10 0.20 0.27 15 0.15 0.20 20 0.13 0.17

For a 2-year life and an interest rate of a nominal 6% per year, compounded monthly, the cost of the program is $1.07/1000 gallons, which is very close to the savings of $1.10/1000 gallons. But the cost decreases rapidly as life increases. If further sensitivity analysis is performed, the following results are obtained. At an interest rate of 8% per year, the costs and savings are equal. Above 8% per year, the program would not be cost effective for a 2-year toilet life at the 75% rebate level. When the rebate is increased to 100%, the cost of the program exceeds the savings at all interest rates above 4.5% per year for a toilet life of 3 years. These calculations reveal that at very short toilet lives (2-3 years), there are some conditions under which the program will not be financially successful. Therefore, it can be concluded that the programs success is mildly sensitive to toilet life.

Chapter 5

14

Chapter 6 Annual Worth AnalysisSolutions to Problems 6.1 The estimate obtained from the three-year AW would not be valid, because the AW calculated over one life cycle is valid only for the entire cycle, not part of the cycle. Here the asset would be used for only a part of its three-year life cycle. -10,000(A/P,10%,3) 7000 = -10,000(A/P,10%,2) 7000 + S(A/F,10%,2) -10,000(0.40211) 7000 = -10,000(0.57619) 7000 + S(0.47619) S = $3656 AWGM = -26,000(A/P,15%,3) 2000 + 12,000(A/F,15%,3) = -26,000(0.43798) 2000 + 12,000(0.28798) = $-9932 AWFord = -29,000(A/P,15%,3) 1200 + 15,000(A/F,15%,3) = -29,000(0.43798) 1200 + 15,000(0.28798) = $-9582 Purchase the Ford SUV. 6.4 AWcentrifuge = -250,000(A/P,10%,6) 31,000 + 40,000(A/F,10,6) = -250,000(0.22961) 31,000 + 40,000(0.12961) = $-83,218 AWbelt = -170,000(A/P,10%,4) 35,000 26,000(P/F,10%,2)(A/P,10%,4) + 10,000(A/F,10%,4) = -170,000(0.31547) 35,000 26,000(0.8624)(0.31547) + 10,000(0.21547) = $-93,549 Select centrifuge. 6.5 AWsmall = -1,700,000(A/P,1%,120) 12,000 + 170,000(A/F,1%,120) = -1,700,000(0.01435) 12,000 + 170,000(0.00435) = $-35,656 AWlarge = -2,100,000(A/P,1%,120) 8,000 + 210,000(A/F,1%,120) = -2,100,000(0.01435) 8,000 + 210,000(0.00435) = $-37,222 Select small pipeline.Chapter 6 1

6.2

6.3

6.6

AWA = -2,000,000(A/P,1%,36) 5000 +200,000(A/F,1%,36) = -2,000,000(0.03321) 5000 +200,000(0.02321) = $-66,778 AWB = -25,000(A/P,1%,36) 45,000(P/A,1%,8)(A/P,1%,36) - 10,000(P/A,1%,28)(P/F,1%,8)(A/P,1%,36) = -25,000(0.03321) 45,000(7.6517)(0.03321) - 10,000(24.3164)(0.9235)(0.03321) = $-19,723 Select plan B.

6.7

AWX = -85,000(A/P,12%,3) 30,000 + 40,000(A/F,12%,3) = -85,000(0.41635) 30,000 + 40,000(0.29635) = $-53,536 AWY = -97,000(A/P,12%,3) 27,000 + 48,000(A/F,12%,3) = -97,000(0.41635) 27,000 + 48,000(0.29635) = $-53,161 Select robot Y by a small margin.

6.8

AWA = -25,000(A/P,12%,2) 4000 = -25,000(0.59170) 4,000 = $-18,793 AWB = -88,000(A/P,12%,6) 1400 = -88,000(0.24323) 1400 = $-22,804 Select plan A.

6.9

AWX = -7650(A/P,12%,2) 1200 = -7650(0.59170) 1200 = $-5726.51 AWY = -12,900(A/P,12%,4) 900 + 2000(A/F,12%,4) = -12,900(0.32923) 900 + 2000(0.20923) = $-4728.61 Select plan Y.

Chapter 6

6.10

AWC = -40,000(A/P,15%,3) 10,000 + 12,000(A/F,15%,3) = -40,000(0.43798) 10,000 + 12,000(0.28798) = $-24,063 AWD = -65,000(A/P,15%,6) 12,000 + 25,000(A/F,15%,6) = -65,000(0.26424) 12,000 + 25,000(0.11424) = $-26,320 Select machine C.

6.11

AWK = -160,000(A/P,1%,24) 7000 + 40,000(A/F,1%,24) = -160,000(0.04707) 7000 + 40,000(0.03707) = $-13,048 AWL = -210,000(A/P,1%,48) 5000 + 26,000(A/F,1%,48) = -210,000(0.02633) 5000 + 26,000(0.01633) = $-10,105 Select process L.

6.12

AWQ = -42,000(A/P,10%,2) 6000 = -42,000(0.57619) 6000 = $-30,200 AWR = -80,000(A/P,10%,4) [7000 + 1000(A/G,10%,4)] + 4000(A/F,10%,4) = -80,000(0.31547) [7000 + 1000(1.3812)] + 4000(0.21547) = $-32,757 Select project Q.

6.13

AWland = -110,000(A/P,12%,3) 95,000 + 15,000(A/F,12%,3) = -110,000(0.41635) 95,000 + 15,000(0.29635) = $-136,353 AWincin = -800,000(A/P,12%,6) 60,000 + 250,000(A/F,12%,6) = -800,000(0.24323) 60,000 + 250,000(0.12323) = $-223,777 AWcontract = $-190,000 Use land application.

6.14

AWhot = -[(700)(300) + 24,000](A/P,8%,2) 5000 = -234,000(0.56077) 5000 = $-136,220 AWresurface = -850,000(A/P,8%,10) 2000(P/A,8%,8)(P/F,8%,2)(A/P,8%,10) = -850,000(0.14903) 2000(5.7466)(0.8573)(0.14903) = $-128,144 Resurface the road.

6.15

Find P in year 29, move back to year 9, and then use A/F for n = 10. A = [80,000/0.10](P/F,10%,20)(A/F,10%,10) = [80,000/0.10](0.1486)(0.06275) = $ 7459.72

6.16

AW100 = 100,000(A/P,10%,100) = 100,000(0.10001) = $10,001 AW = 100,000(0.10) = $10,000 Difference is $1.

6.17

First find the value of the account in year 11 and then multiply by i = 6%. F11 = 20,000(F/P,15%,11) + 40,000(F/P,15%,9) + 10,000(F/A,15%,8) = 20,000(4.6524) + 40,000(3.5179) + 10,000(13.7268) = $371,032 A = 371,032(0.06) = $22,262

6.18 6.19

AW = 50,000(0.10) + 50,000 = $55,000 AW = -100,000(0.08) 50,000(A/F,8%,5) = -100,000(0.08) 50,000(0.17046) = $-16,523 Perpetual AW is equal to AW over one life cycle AW = -[6000(P/A,8%,28) + 1000(P/G,8%,28)](P/F,8%,2)(A/P,8%,30) = -[6000(11.0511) + 1000(97.5687)](0.8573)(0.08883) = $-12,480

6.20

6.21

P-1 = 1,000,000(P/A,10%,11) + 100,000(P/G,10%,11) = 1,000,000(6.4951) + 100,000(26.3963) = $9,134,730 Amt in yr 10 = 9,134,730(F/P,10%,11) = 9,134,730(2.8531) = $26,062,298 AW = 26,062,298(0.10) = $2,606,230

6.22

Find P in year 1, move to year 9, and then multiply by i. Amounts are in $1000. P-1 = [100(P/A,12%,7) 10(P/G,12%,7)](F/P,12%,10) = [100(4.5638) 10(11.6443)](3.1058) = $1055.78 A = 1055.78(0.12) = $126.69

6.23 (a) AWin-house = -30(A/P,15%,10) 5 + 14 + 7(A/F,15%,10) = -30(0.19925) 5 + 14 + 7(0.04925) = $3.37 ($ millions) AWlicense = -2(0.15) 0.2 + 1.5 = $1.0 ($ millions) AWcontract = -2 + 2.5 = $0.5 ($ millions) Select in-house option. (b) All three options are acceptable. FE Review Solutions 6.24 6.25 Answer is (b) Find PW in year 0 and then multiply by i. PW0 = 50,000 + 10,000(P/A,10%,15) + (20,000/0.10)

(P/F,10%,15) = 50,000 + 10,000(7.6061) + (20,000/0.10)(0.2394) = $173,941Chapter 6 5

AW = 173,941(0.10) = $17,394 Answer is (c) 6.26 A = [40,000/0.08](P/F,8%,2)(A/F,8%,3) = [40,000/0.08](0.8573)(0.30803) = $132,037 Answer is (d) 6.27 A = [50,000/0.10](P/F,10%,20)(A/F,10%,10) = [50,000/0.10](0.1486)(0.06275) = $4662 Answer is (b) 6.28 Note: i = effective 10% per year. A = [100,000(F/P,10%,5) 10,000(F/A,10%,6)](0.10) = [100,000(1.6105) 10,000(7.7156)](0.10) = $8389 Answer is (b) 6.29 i/year = (1 + 0.10/2)2 1 = 10.25% Answer is (d) 6.30 i/year = (1 + 0.10/2)2 1 = 10.25% Answer is (d) 6.31 AW = -800,000(0.10) 10,000 = $-90,000 Answer is (c) Case Study Solution 1. Spreadsheet and chart are below. Revised costs and savings are in columns F-H.

Chapter 6

6

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