**MARR** **14%**

| N | (F/P, i, N) | (P/F, i, N) | (F/A, i, N) | (A/F, i, N) | (P/A, i, N) | (A/P, i, N) |
|---|---|---|---|---|---|---|
| **1** | 1.1400 | 0.8772 | 1.0000 | 1.0000 | 0.8772 | 1.1400 |
| **2** | 1.2996 | 0.7695 | 2.1400 | 0.4673 | 1.6467 | 0.6073 |
| **3** | 1.4815 | 0.6750 | 3.4396 | 0.2907 | 2.3216 | 0.4307 |
| **4** | 1.6890 | 0.5921 | 4.9211 | 0.2032 | 2.9137 | 0.3432 |
| **5** | 1.9254 | 0.5194 | 6.6101 | 0.1513 | 3.4331 | 0.2913 |
| **6** | 2.1950 | 0.4556 | 8.5355 | 0.1172 | 3.8887 | 0.2572 |
| **7** | 2.5023 | 0.3996 | 10.7305 | 0.0932 | 4.2883 | 0.2332 |
| **8** | 2.8526 | 0.3506 | 13.2328 | 0.0756 | 4.6389 | 0.2156 |
| **9** | 3.2519 | 0.3075 | 16.0853 | 0.0622 | 4.9464 | 0.2022 |
| **10** | 3.7072 | 0.2697 | 19.3373 | 0.0517 | 5.2161 | 0.1917 |
| **11** | 4.2262 | 0.2366 | 23.0445 | 0.0434 | 5.4527 | 0.1834 |
| **12** | 4.8179 | 0.2076 | 27.2707 | 0.0367 | 5.6603 | 0.1767 |
| **13** | 5.4924 | 0.1821 | 32.0887 | 0.0312 | 5.8424 | 0.1712 |
| **14** | 6.2613 | 0.1597 | 37.5811 | 0.0266 | 6.0021 | 0.1666 |
| **15** | 7.1379 | 0.1401 | 43.8424 | 0.0228 | 6.1422 | 0.1628 |
| **16** | 8.1372 | 0.1229 | 50.9804 | 0.0196 | 6.2651 | 0.1596 |
| **17** | 9.2765 | 0.1078 | 59.1176 | 0.0169 | 6.3729 | 0.1569 |
| **18** | 10.5752 | 0.0946 | 68.3941 | 0.0146 | 6.4674 | 0.1546 |
| **19** | 12.0557 | 0.0829 | 78.9692 | 0.0127 | 6.5504 | 0.1527 |
| **20** | 13.7435 | 0.0728 | 91.0249 | 0.0110 | 6.6231 | 0.1510 |
| **21** | 15.6676 | 0.0638 | 104.7684 | 0.0095 | 6.6870 | 0.1495 |
| **22** | 17.8610 | 0.0560 | 120.4360 | 0.0083 | 6.7429 | 0.1483 |

| **N** | **1** | **2** | **3** | **4** | **5** | **6** |
|---|---|---|---|---|---|---|
| **(F/P, i, N)** | 1.1400 | 1.2996 | 1.4815 | 1.6890 | 1.9254 | 2.1950 |
| **(P/F, i, N)** | 0.8772 | 0.7695 | 0.6750 | 0.5921 | 0.5194 | 0.4556 |
| **(F/A, i, N)** | 1.0000 | 2.1400 | 3.4396 | 4.9211 | 6.6101 | 8.5355 |
| **(A/F, i, N)** | 1.0000 | 0.4673 | 0.2907 | 0.2032 | 0.1513 | 0.1172 |
| **(P/A, i, N)** | 0.8772 | 1.6467 | 2.3216 | 2.9137 | 3.4331 | 3.8887 |
| **(A/P, i, N)** | 1.1400 | 0.6073 | 0.4307 | 0.3432 | 0.2913 | 0.2572 |

| 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|
| 2.5023 | 2.8526 | 3.2519 | 3.7072 | 4.2262 | 4.8179 | 5.4924 |
| 0.3996 | 0.3506 | 0.3075 | 0.2697 | 0.2366 | 0.2076 | 0.1821 |
| 10.7305 | 13.2328 | 16.0853 | 19.3373 | 23.0445 | 27.2707 | 32.0887 |
| 0.0932 | 0.0756 | 0.0622 | 0.0517 | 0.0434 | 0.0367 | 0.0312 |
| 4.2883 | 4.6389 | 4.9464 | 5.2161 | 5.4527 | 5.6603 | 5.8424 |
| 0.2332 | 0.2156 | 0.2022 | 0.1917 | 0.1834 | 0.1767 | 0.1712 |

| **14** | **15** | **16** | **17** | **18** | **19** | **20** |
|---|---|---|---|---|---|---|
| 6.2613 | 7.1379 | 8.1372 | 9.2765 | 10.5752 | 12.0557 | 13.7435 |
| 0.1597 | 0.1401 | 0.1229 | 0.1078 | 0.0946 | 0.0829 | 0.0728 |
| 37.5811 | 43.8424 | 50.9804 | 59.1176 | 68.3941 | 78.9692 | 91.0249 |
| 0.0266 | 0.0228 | 0.0196 | 0.0169 | 0.0146 | 0.0127 | 0.0110 |
| 6.0021 | 6.1422 | 6.2651 | 6.3729 | 6.4674 | 6.5504 | 6.6231 |
| 0.1666 | 0.1628 | 0.1596 | 0.1569 | 0.1546 | 0.1527 | 0.1510 |

**LECTURE 4**
**CHAPTER 7**

**Consider the following financial data for 2 mutually exclusive projects:**

| N | Project X | Project Y |
|---|---|---|
| 0 | ($10,000) | ($14,000) |
| 1 | $7,000 | $10,000 |
| 2 | $8,000 | $11,000 |
| 3 | $9,000 | $12,000 |

**With a MARR of 12% calculate the following:**

**a. Calculate the NPV for each project. [2 + 2 points]**
**DO NOT CALCULATE USING THE PV FINANCIAL FUNCTION IN EXCEL.**
**b. Calculate the IRR for each project.**
**i. Use linear interpolation [3 points]**
**ii. Use the graphical method shown in class [3 points]**
**iii. Use the Excel IRR function [3 points]**
**iiii. Submit your Excel spreadsheet for credit. [1 points]**
**c. Using incremental IRR analysis, which project should be selected? Why? [5 + 1 points]**

**MARR 12%**

**PART a [2 + 2 points]**
**a. Calculate the NPV for each project. [2 + 2 points]**

**PROJECT X**

PW = -P + $\Sigma F_n$ x (P/F,i,n)

PW = -$10,000 + $7,000 x (P/F,12%,1) + $8,000 x (P/F,12%,2) + $9,000 x (P/F,12%,3)

PW = -$10,000 + $7,000 x 0.8929 + $8,000 x 0.7972 + $9,000 x 0.7118

**PW = $9,034**

**PROJECT Y**

PW = -P + $\Sigma F_n$ x (P/F,i,n)

PW = -$14,000 + $10,000 x (P/F,12%,1) + $11,000 x (P/F,12%,2) + $12,000 x (P/F,12%,3)

PW = -$14,000 + $10,000 x 0.8929 + $11,000 x 0.7972 + $12,000 x 0.7118

**PW = $12,239**

**PART b [10 points]**
**b. Calculate the IRR for each project.**

**i. Use linear interpolation [3 + 3 points]**

**PROJECT X**

| | | | |
|---|---|---|---|
| **Guess 1** | **IRR** | **50%** | **52%** |
| | PW | **$889** | **$631** |
| **Guess 2** | **IRR** | **59%** | **56%** |
| | PW | **-$194** | **$145** |

**Interpolate**

| | | | |
|---|---|---|---|
| **x1** | PW guess 1 | $889 | $631 |
| **y1** | IRR guess 1 | 50% | 52% |
| **x2** | PW guess 2 | -$194 | $145 |
| **y2** | IRR guess 2 | 59% | 56% |
| **X** | target PW | $0 | $0 |
| **Y** | **IRR** | **57.39%** | **57.20%** |

**NOTE - Choosing a narrow range and guessing between 10% and 12% instead of 8% and 12% yields a more accurate IRR value**

**PROJECT Y**

| | | | |
|---|---|---|---|
| **Guess 1** | **IRR** | **50%** | **55%** |
| | PW | **$1,111** | **$253** |
| **Guess 2** | **IRR** | **60%** | **57%** |
| | PW | **-$523** | **-$67** |

**Interpolate**

| | | | |
|---|---|---|---|
| **x1** | PW guess 1 | $1,111 | $253 |
| **y1** | IRR guess 1 | 50% | 55% |
| **x2** | PW guess 2 | -$523 | -$67 |
| **y2** | IRR guess 2 | 60% | 57% |
| **X** | target PW | $0 | $0 |
| **Y** | **IRR** | **56.80%** | **56.58%** |

**NOTE - Choosing a narrow range and guessing between 11% and 13% instead of 10% and 15% yields a more accurate IRR value**

**ii. Use the Excel IRR function [ 2 + 2 points]**

| **N** | **Project X** | |
|---|---|---|
| 0 | ($10,000) | |
| 1 | $7,000 | |
| 2 | $8,000 | |
| 3 | $9,000 | |
| **IRR** | **57.26%** | =IRR(B56:B59) |

| **N** | **Project Y** | |
|---|---|---|
| 0 | ($14,000) | |
| 1 | $10,000 | |
| 2 | $11,000 | |
| 3 | $12,000 | |
| **IRR** | **56.57%** | =IRR(B56:B59) |

**PART c [6 points]**
**c. Using incremental IRR analysis, which project should be selected? Why? [5+ 1 points]**

| **N** | **Project X** | **Project Y** | **Project Y-X** |
|---|---|---|---|
| 0 | ($10,000) | ($14,000) | ($4,000) |
| 1 | $7,000 | $10,000 | $3,000 |
| 2 | $8,000 | $11,000 | $3,000 |
| 3 | $9,000 | $12,000 | $3,000 |
| | | **IRR Y-X** | 55% |
| | | **MARR** | 10% |

**IRR Y-X yields an incremental IRR of 55%. This is greater than the MARR of 10%.**
**Therefore, Project Y should be selected over project X.**

**LECTURE 5**
**CHAPTER 16**

**You are being comissioned by your company to implement a new data managem for this insurance company. You are given the following cost data for two potential program options:**

**Program 1:**
**A plan calculates that the program will cost $1.1 million and that it will cost $250,000 per year to maintain. The analysis of operating revenue determines that the program will provide the company with a savings of $600,000 per year starting in the second year.**

**Program 2:**
**An engineering plan calculates that the program will cost $2.2 million and that it will cost $320,000 per year to maintain. The analysis of operating revenue determines that the program will provide the company with savings of $700,000 per year starting in the second year.**

**At a MARR of 14% and a program life of 20 years, calculate the following:**

**a. Calculate the BCR for each program option. [3 + 3 points]**
**NOTE: USE PRESENT WORTH ANALYSIS**
**b. Using incremental benefit cost analysis, which program should be selected? W**

| **GIVEN:** | **Program 1** | **Program 2** | |
|---|---|---|---|
| **i** | 14% | 14% | |
| **N** | 20 | 20 | |
| **Investment** | $1,100,000 | $2,200,000 | |
| **O&M** | $250,000 | $320,000 | EOY 1 |
| **Revenue** | $600,000 | $700,000 | EOY 2 |

| | **PROGRAM 1** | | | | |
|---|---|---|---|---|---|
| **N** | **Investment** | **A (O&M)** | **A (rev)** | **S** | **Investment** |
| **0** | $1,100,000 | $0 | $0 | | $2,200,000 |
| **1** | | $250,000 | $0 | | |
| **2** | | $250,000 | $600,000 | | |
| **3** | | $250,000 | $600,000 | | |
| **4** | | $250,000 | $600,000 | | |
| **5** | | $250,000 | $600,000 | | |
| **6** | | $250,000 | $600,000 | | |
| **7** | | $250,000 | $600,000 | | |
| **8** | | $250,000 | $600,000 | | |
| **9** | | $250,000 | $600,000 | | |
| **10** | | $250,000 | $600,000 | | |
| **11** | | $250,000 | $600,000 | | |
| **12** | | $250,000 | $600,000 | | |
| **13** | | $250,000 | $600,000 | | |

| | | | | | |
|---|---|---|---|---|---|
| **14** | | $250,000 | $600,000 | | |
| **15** | | $250,000 | $600,000 | | |
| **16** | | $250,000 | $600,000 | | |
| **17** | | $250,000 | $600,000 | | |
| **18** | | $250,000 | $600,000 | | |
| **19** | | $250,000 | $600,000 | | |
| **20** | | $250,000 | $600,000 | $0 | |

**PART a** **[3 + 3 points]**

| | **Program 1** | **Program 2** |
|---|---|---|
| **I** | $1,100,000 | $2,200,000 |
| **C'** | ######## | $2,119,402 |
| **B** | ######## | $4,022,156.30 |
| **BCR (i)** | 1.44 | 0.93 |
| **TARGET** | 1 | 1 |
| **STATUS** | accept | reject |

$$BCR(i) = \frac{B}{C} = \frac{B}{I + C'}$$

where,

$I + C' > 0$

B = usersbenefits

I = initial cost of invest

C = sponsorscosts

C' = equivalent annual

**PART b** **[3 + 1 points]**

| | **Program 1** | **Program 2** | |
|---|---|---|---|
| **I** | $1,100,000 | $2,200,000 | |
| **C'** | $1,655,783 | $2,119,402 | |
| **I+C'** | $2,755,783 | $4,319,402 | (Option 2 greater than Option 1, therefor |
| **B** | $3,973,878 | $4,022,156 | |
| **$BCR_{2-1}$** | 0.03 | < | 1 |

**Therefore, select Program 1.**

**management system**

You are being comissioned by your comp

A plan calculates that the program will cc

**savings of**

An engineering plan calculates that the p

**selected? Why? [3 + 1 points]**

| PROGRAM 2 | | |
|---|---|---|
| **A (O&M)** | **A (rev)** | **S** |
| $0 | $0 | |
| $320,000 | $0 | |
| $320,000 | $700,000 | |
| $320,000 | $700,000 | |
| $320,000 | $700,000 | |
| $320,000 | $700,000 | |
| $320,000 | $700,000 | |
| $320,000 | $700,000 | |
| $320,000 | $700,000 | |
| $320,000 | $700,000 | |
| $320,000 | $700,000 | |
| $320,000 | $700,000 | |
| $320,000 | $700,000 | |
| $320,000 | $700,000 | |

| | | |
|---|---|---|
| $320,000 | $700,000 | |
| $320,000 | $700,000 | |
| $320,000 | $700,000 | |
| $320,000 | $700,000 | |
| $320,000 | $700,000 | |
| $320,000 | $700,000 | |
| $320,000 | $700,000 | $0 |

Benefit **A(P/A, i, 19)(P/F, i, 1)**

:ment

operating

e find $BCR_{2-1}$)

your company to implement a new data management systemfor this insurance company. You are given the following cos

gram will cost $1.1 million and thatit will cost $250,000 per year to maintain. The analysis of operatingrevenue determine

s that the program will cost $2.2 million and thatit will cost $320,000 per year to maintain. The analysis of operatingrever

ny. You are given the following cost data for two potential program options:

sis of operatingrevenue determines that the program will provide the company with a savings of$600,000 per year starti

ain. The analysis of operatingrevenue determines that the program will provide the company with savings of$700,000 per

vings of$600,000 per year starting in the second year.

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