**IENG323 Tutorial B/C Analysis**

1. Calculate the B/C ratio for the following cash flow estimates at a discount rate of 10% per year. Is the project justified?

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| **Item** | **Estimate** |
| PW of benefits | $ 3,800,000 |
| AW of disbenefits $/year | 45,000 |
| First cost | $ 1,200,000 |
| M&O costs, $/year | 300,000 |
| Life, years | 20 |

**Step 1) all cash flows in same units of $/year**

AW of benefits = 3,800,000(A/P,10%,20) = 3,800,000(0.11746) = $446,348

AW of first cost = 1,200,000(A/P,10%,20) = 1,200,000(0.11746) = $140,952

Then we have ${\left(B-D\right)}/{C}$

The decision guideline is simple:

If **B/C ≥ 1.0**, accept the project as economically justified for the estimates and discount rate

applied.

If **B/C < 1.0**, the project is not economically acceptable.

(B - D)/C = (446,348 – 45,000)/(140,952 + 300,000) = 0.91

Project not justified

1. The following estimates (in $1000 units) have been developed for a security system upgrade at Chicago’s O’Hare Airport. (*a*) Calculate the conventional B/C ratio at a discount rate of 10% per year. Is the project justified? (*b*) Determine the minimum first cost that is possible to render the project just economically *unjustified*.

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| **Item** | **Estimate** |
| First cost | $ 13,000 |
| AW of benefits $/year | $ 3,800 |
| FW of disbenefits, year 20, | $ 13,000 |
| M&O costs, $/year | $ 400 |
| Life, years | 20 |

1. **In $1000 units**

AW of C = 13,000(A/P,10%,20) + 400 = 13,000(0.11746) + 400 = $1927

AW of B – D = 3800 – 6750(A/F,10%,20) = 3800 – 6750(0.01746) = $3682

B/C = 3682/1927 = 1.91 Well justified, since 1.91 > 1.0

**(b) Let P = minimum first cost allowed**

AW of C = P(A/P,10%,20) + 400

AW of B – D = 3682 from part (a)

1.00 = 3682/[P(A/P,10%,20) + 400]

0.11746P = 3682 - 400

P = $27,941

The first cost must > $27,941,000 to force B/C < 1.0

1. There are two potential locations to construct an urgent care walk-in clinic to serve rural residents. Use B/C analysis to determine which location, if any, is better at an interest rate of 8% per year.

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| **Location** | **1** | **2** |
| Initial cost, $ | 1,200,000 | 2,000,000 |
| Annual M&O cost, $/year | 80,000 | 75,000 |
| Annual benefits, $/year | 520,000 | 580,000 |
| Annual disbenefits, $/year | 90,000 | 140,000 |
| Site suitability, years | 10 | 20 |

**Location 1 vs DN:**

B = $520,000

D = $90,000

C = 1,200,000(A/P,8%,10) + 80,000 = 1,200,000(0.14903) + 80,000 = $258,836

B/C = (520,000 – 90,000)/258,836 = 1.66

**eliminate DN**

**Location 2 vs 1:** ΔB = 580,000 - 520,000 = $60,000

ΔD = 140,000 - 90,000 = $50,000

ΔC = [2,000,000(A/P,8%,20) + 75,000] – 258,836 = [2,000,000(0.10185) +75,000] - 258,836 = $19,864

ΔB/C = (60,000 –50,000)/19,864 = 0.50 eliminate 2

**Select Site 1**

1. One of two alternatives will be selected to reduce flood damage in a rural community in central Arizona. The estimates associated with each alternative are available. Use B/C analysis at a discount rate of 8% per year over a 20-year study period to determine which alternative should be selected. For analysis purposes only, assume the flood damage would be prevented in years 3, 9, and 18 of the study periods.

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|  | **Retention Pond** | **Channel** |
| Initial cost, $ | 880,000 | 2,900,000 |
| Annual maintenance, $/year | 92,000 | 30,000 |
| Reduced flood damage, $ | 200,000 | 600,000 |

PW of cost of Retention = 880,000 + 92,000(P/A,8%,20) = 880,000 + 92,000(9.8181) = $1,783,265

PW of cost of Channel = 2,900,000 + 30,000(P/A,8%,20) = 2,900,000 + 30,000(9.8181) = $3,194,543

**Channel has higher equivalent total cost**

PW of ΔC = 3,194,543 - 1,783,265 = $1,411,278

PW of ΔB = (600,000 - 200,000) [(P/F,8%,3) + (P/F,8%,9) + (P/F,8%,18)] = 400,000[0.7938 + 0.5002 + 0.2502] = $ 617,680

ΔB/C = 617,680/1,411,278 = 0.44

Build Retention Pond; Channel is not justified since ΔB/C < 1.0