**MECH 5760 Chapter 5 Assignment #4**

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5.3f) Breakeven Analysis

Automatic machine 🡪 Cost = $800,000, 10 cents/cell cost

Semi-automatic machine 🡪 Cost = $500,000, 40 cents/cell cost

Selling cost = $1/unit

Profit of automatic machine = $1 - $0.1 = $0.9/part

Profit of semi-automatic machine = $1 - $0.4 = $0.6/part

Assume NO salvage value, interest rate = 5%, 5-year life

AV1 = -800000(A/P, 5%, n = 5) + 0.9N = -800000(0.231) + 0.9N = -184800 + 0.9N

AV2 = -500000(A/P, 5%, n = 5) + 0.6N = -500000(0.231) + 0.6N = -115500 + 0.6N

Breakeven is when AV1 = AV2 and solve for N pieces

**N = 231,000 pieces**

To demonstrate the breakeven analysis graphically, please generate a graph (Figure 1) based on a range of x values (N parts sold) versus Y values from both machines (AV1 and AV2)

Chart

Description automatically generated

5.3g) Probabilistic Analysis

Semi-automatic machine 🡪 Cost = $500,000, Interest rate = 5%, 5-year life, NO salvage value, NO Taxes, 120,000 cells/year

P (B = $0.8) = 0.8

P (B = $1) = 0.2

P (n = 4) = 0.6

P (n = 5) = 0.4

Given B = $0.8/cell, the benefit would be 120000 \* 0.8 = $96,000

PV level 1 = -500000 + 96000\*3.546 = $(159,584)

PV Compound level 1 = $(159,584) \* 0.48 = $ (76,600)

Given B = $0.8/cell, the benefit would be 120000 \* 0.8 = $96,000

PV level 2 = -500000 + 96000\*4.329 = $(84,416)

PV Compound level 2 = $(84,416) \* 0.32 = $ (27,013)

Given B = $1/cell, the benefit would be 120000 \* 1 = $120,000

PV level 3 = -500000 + 120000 \* (P/A, 5%, n = 4) 🡪 -500000 + 120000 \* (3.546) = $(74,480)

PV Compound level 3 = $ (74,480) \* 0.12 = $ (8937.6)

Given B = $1/cell, the benefit would be 120000 \* 1 = $120,000

PV level 4 = -500000 + 120000 \* (P/A, 5%, n = 5) 🡪 -500000 + 120000 \* (4.329) = $19,480

PV Compound level 4 = $ (19,480) \* 0.08 = $1558.4

Please complete the Table 2 for Levels 2 and 4.

Table 1: Probabilistic Analysis Calculations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Benefits/ Cell | Probability (Benefits) | Actual Profits/Y | Years (n) | Probability (Years) | Probability (B\*n) | P (A,5%, n) | PV Each Level | PV Compound |
| $0.80 | 0.8 | $96,000 | 4 | 0.6 | 0.48 | 3.546 | $(159,584) | $ (76,600) |
| $0.80 | 0.8 | $96,000 | 5 | 0.4 | 0.32 | 4.329 | $(159,584) | $(27,013) |
| $1.00 | 0.2 | $120,000 | 4 | 0.6 | 0.12 | 3.546 | $(74,480) | $ (8,937.6) |
| $1.00 | 0.2 | $120,000 | 5 | 0.4 | 0.08 | 4.329 | $19,480 | $1,558.4 |
| Total | 2 |  |  | 2 | 1 |  |  | $(110,992) |

5.3h) Sensitivity Analysis

Semi-automatic machine 🡪 Interest rate = 5%, cost = $500,000, 120,000 cells/year @ $1 profit/cell, 5-year life

Current Machine cost = $500,000

Current profit = 120,000 \* 1 = $120,000/year, current Useful Life = 5 Years

PV = -500000 + (B = 96000, 120000, 144000) \* (P/A, 5%, n = 4, 5, 6)

PV1 = -500000 + 96000 \* (P/A, 5%, n = 4) = -500000 + 96000 \* 3.546 = **$ (159,584)**

PV2 = -500000 + 96000 \* (P/A, 5%, n = 5) = -500000 + 96000 \* 4.329 = **$ (84,416)**

PV3 = -500000 + 96000 \* (P/A, 5%, n = 6) = -500000 + 96000 \* 5.076 = **$ (12,704)**

PV4 = -500000 + 120000 \* (P/A, 5%, n = 4) = -500000 + 120000 \* 3.546 = **$ (74,480)**

PV5 = -$500,000 + $120000 \* (P/A, 5%, n = 5) = -500000 + 120000 \* 4.329 = **$19,480**

PV6 = -$500,000 + $120000 \* (P/A, 5%, n = 5) = -500000 + 120000 \* 5.076 = **$109,120**

PV7 = -500000 + 144000 \* (P/A, 5%, n = 4) = -500000 + 144000 \* 3.546 = **$10,624**

PV8 = -500000 + 144000 \* (P/A, 5%, n = 4) = -500000 + 144000 \* 4.329 = **$123,376**

PV9 = -500000 + 144000 \* (P/A, 5%, n = 4) = -500000 + 144000 \* 5.076 = **$230,944**

Please fill out the rest of Table 2 below.

Table 2: Sensitivity Analysis Calculations

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| % Change Benefits | Resulting Benefits | % Change Years | Life (years) | PV | Row Number |
| -20 | $96,000 | -20 | 4 | -$(159,584) | PV 1 |
| -20 | $96,000 | 0 | 5 | -$(84,416) | PV 2 |
| -20 | $96,000 | 20 | 6 | -$(12,704) | PV 3 |
| 0 | $120,000 | -20 | 4 | -$ (74,480) | PV 4 |
| 0 | $120,000 | 0 | 5 | $19,480 | PV 5 |
| 0 | $120,000 | 20 | 6 | $109120 | PV 6 |
| 20 | $144,000 | -20 | 4 | $10,624 | PV 7 |
| 20 | $144,000 | 0 | 5 | $123,376 | PV 8 |
| 20 | $144,000 | 20 | 6 | $230,944 | PV 9 |

As seen from Table 2, the nominal value (0% change for both benefits and life) = $19,480.

Taking the averages,

For -20% Benefit, Average = (AV 1 + AV 2 + AV3) / 3 = (-159594 – 84416 – 12704) / 3 = $ (85,568)

For Current Benefit, Average = (AV 4 + AV 5 + AV6) / 3 = (-74480 + 19480 + 109120) / 3 = $18,040

For +20% Benefit, Average = (AV 7 + AV 8 + AV9) / 3 = (10624 + 123376 + 230944) / 3 = $121,648

For -20% Useful Life, Average = (AV 1 + AV 4 + AV7) / 3 = (-159594 – 74408 + 10624) / 3 = $ (74,480)

For Current Useful Life, Average = (AV 2 + AV 5 + AV8) / 3 = (-84416 + 19480 + 123376) / 3 = $19,480

For +20% Useful Life, Average = (AV 3 + AV 6 + AV9) / 3 = (-12704 + 109120 + 230944) / 3 = $109,120

Please present these in a graph with three levels of Benefits and three levels of Life.

To Plot Figure 2 like graph in the textbook, in Excel, assign the three levels of Benefits then years in one column of 6 rows for x, and two successive columns of three rows each for Benefits and life.

Figure 2: Sensitivity Analysis Graph

Chart, line chart

Description automatically generated

Chart, line chart

Description automatically generated