ISEN 667 Project 1

Michael Bass

**Initial Estimate**

In our initial approach we estimated that the project would cost $500,000 and would take 1 year to complete. The project will result in an annual savings of 125,000. 10 years after the project is started, it will be terminated with a salvage value of 50,000. For our company the MARR is 10%.

In our analysis we have structured it such that the costs of the project will occur at the beginning of a year, and the savings will be realized at the end of the year. In the figure below, the cost of the project is shown in red in year 0, and there is no cash flow occurring at the end of year 1. This is because the project would have taken the full first year to complete, and would result in savings at the end of the second year.

Figure 1.

The initial project cost is shown in red, occurring at year 0. The annual savings is shown in blue, and the salvage value at year 10 is shown in green.

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| Cumulative Present Worth |
| $173,711.68 |

Table 1.

Cumulative present worth of the initial project estimates.

Under these estimates, the cumulative present worth of the project is $173,711.68, shown in Table 1.

**Altered Estimations**

Under further analysis, it has been determined that there is some uncertainty in our initial project estimates. There is uncertainty concerning the number of years required for project completion, the project cost, the annual savings, and salvage at the end of the product. I have analyzed the impact of each of these parameters individually, and then combined them for a full project analysis.

1. Years Required for Project Completion

The first parameter to consider is the number of years required for project completion. There is a 60% chance that the project will finish within 1 year, 30% within 2 years, and 10% within 3 years. The project cost will be evenly spread out between the number of years till completion. With these estimates, the cash flows for a 2 year project would resemble the cash flows in Figure 1.1, and the cash flows for a 3 year project would resemble the cash flows in Figure 1.2.

The 1, 2, and 3 year projects will result in different present worth values. The project present worths for these are summarized in Table 1.1, and visualized in Figure 1.3. Additionally Figure 1.4 shows the number of iterations from a Monte Carlo simulation that resulted in 1, 2, and 3 year projects. As expected, approximately 60% of the iterations required a 1 year project, approximately 30% required a 2 year project, and approximately 10% required a 3 year project.

Each of the given scenarios still has a positive present worth. As seen in Figure 1.3, the project present worth is sensitive to the number of years the project requires, and is barely positive when the project requires 3 years. Nevertheless, the project would still be recommended. The average project present worth would be $134,223.83.

Figure 1.1

Cash flows for a project taking 2 years to finish.

Figure 1.2

Cash flows for a project taking 3 years to finish.

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| **Years for Project Completion** | **Project Present Worth** |
| 1 Year | $173,711.68 |
| 2 Years | $93,133.17 |
| 3 Years | $20,568.68 |

Table 1.1

Project present worth for projects requiring 1, 2, and 3 years.

Figure 1.3

Visual representation of project present worth for projects requiring 1, 2, and 3 years.

Figure 1.4

Monte Carlo simulation showing number of iterations resulting in 1, 2, and 3 years.

2. Project Cost

The second parameter to consider is the project cost. The project cost is exponentially distributed with a mean of $500,000. An example cash flow is shown in Figure 2.1. To test the sensitivity of this parameter, 500 Monte Carlo simulations were performed, and the project cost and resulting project present worths were recorded. Figure 2.2 shows a histogram of the generated project costs. The costs were left as negative values, so that as the cost increases, becomes less negative, the project present worth will also increase. This is shown in Figure 2.3 where the resulting project present worths are graphed with their respective project costs.

It is apparent from Figure 2.3 that the project present worth is very sensitive to the project cost. The project present worth was positive 73.2% of the time, and was negative 26.8% of the time. The average project cost was $160,806.8, and the average project cost was -$512,905. When only changing the project cost, the project present worth is monotonically increasing with the project cost. Therefore, all projects costing less than -$673,454.15 had positive project present worths.

Figure 2.1

Example cash flow with the project cost being exponentially distributed.

Figure 2.2

Histogram of project costs using an exponential distribution. The costs are displayed using negative values.

Figure 2.3

Project present values graphed as the dependent variable, with the project cost acting as the independent variables.

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| **Positive Iterations** | 73.2 % |
| **Negative Iterations** | 26.8 % |
| **Average Project Present Worth** | $160,806.8 |
| **Average Project Cost** | -$512,905 |

Table 2.1

3. Annual Savings

The next parameter to consider is the annual savings. The annual savings were varied using a uniform distribution between $50,000 and $200,000. An example cash flow is shown in Figure 3.1, where the annual savings in years 2 through 10 are each generated from a uniform distribution.

Figure 3.1

Figure 3.3

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