10-31

At decision node D2 we must decide between PickA1 and PickA2 based on PW:

PW(C3) = 0.4($12,000) + 0.6($8,100) = $9,660

Or $10,000

Select PickA2 with greater PW of $10,000

At decision node D1 we must decide between PickA and PickB based on PW:

PW(C1) = 0.4($10,000) + 0.6($4,000) = $6,400

PW(C2) = 0.4($9,000) + 0.6($5,000) = $6,600

PW is greatest if we PickB

10-32

**Leave the Valve as it is**

Expected PW of Cost = 0.60 ($10,000) + 0.50 ($20,000) + 0.40 ($30,000)

= $28,000

**Repair the Valve**

Expected PW of Cost = $10,000 repair + 0.40 ($10,000) + 0.30 ($20,000) + 0.20 ($30,000)

= $26,000

**Replace the Valve**

Expected PW of Cost = $20,000 replacement + 0.30 ($10,000) + 0.20 ($20,000) + 0.10 ($30,000)

= $30,000

To minimize Expected PW of Cost, repair the valve.

10-46

First cost = $25,000

*i* = 7%

Project life = Minimum = 7 years

Maximum = 10 years

Mean = $4,400

Standard deviation = $1,000

Using the RAND function, the following are the 25 simulated iterations:

|  |  |  |  |
| --- | --- | --- | --- |
| **Iteration** | **Life (in years)** | **Benefit** | **PV, Present Worth** |
| 1 | 7 | $4,312.11 | −$6,861.70 |
| 2 | 10 | $3,771.30 | $15,078.30 |
| 3 | 8 | $3,663.36 | $1,861.80 |
| 4 | 9 | $5,593.07 | $3,369.10 |
| 5 | 7 | $3,640.22 | $2,093.00 |
| 6 | 9 | $3,214.61 | $1,391.70 |
| 7 | 7 | $3,192.83 | −$3,266.50 |
| 8 | 8 | $6,205.05 | $3,761.90 |
| 9 | 10 | $5,307.80 | −$3,583.60 |
| 10 | 9 | $3,491.57 | $2,384.10 |
| 11 | 7 | $5,589.71 | −$5,200.20 |
| 12 | 8 | $3,949.91 | −$8,391.40 |
| 13 | 10 | $2,182.74 | $4,271.30 |
| 14 | 8 | $4,540.77 | −$3,141.10 |
| 15 | 7 | $4,763.85 | $1,368.20 |
| 16 | 10 | $4,434.67 | $4,364.20 |
| 17 | 8 | $4,443.16 | $4,130.30 |
| 18 | 9 | $3,790.58 | −$11,355.80 |
| 19 | 7 | $3,214.48 | −$10,760.30 |
| 20 | 10 | $4,383.76 | $10,233.10 |
| 21 | 9 | $4,443.02 | −$4,705.80 |
| 22 | 7 | $6,041.64 | −$1,032.70 |
| 23 | 10 | $4,650.47 | −$1,419.40 |
| 24 | 8 | $3,265.61 | $4,229.50 |
| 25 | 9 | $2,141.80 | $940.90 |
|  | | | |
| **Standard Deviation** | | | **$6,109.82** |

10-47

The present worth of the project is PW = –P –10,000(*P*/*A*, 8%,*N*)

Where P is normally distributed with a mean of $150,000 and an s.d. of $50,000, while *N* is uniformly and discretely distributed over the values 3,4,5,6 and 7.

This Excel spreadsheet uses the RAND function to evaluate 25 trial cases; the average value of present worth is $192,628, and the standard deviation is $35,136. However, before putting too much trust in these numbers, it is instructive to repeat the spreadsheet calculation using larger numbers of trial cases, and see how much the average value changes when you re-calculate the spreadsheet using a fresh set of random numbers.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **N** | ***i*** | **P** | ***P*/*A*, 0.08, N** | | **PW** | **EA** | |
| 4 | 0.08 | $139,110 | 3.3121 | | $172,231 | $52,000 | |
| 6 |  | $134,698 | 4.6229 | | $180,927 | $39,137 | |
| 7 |  | $139,156 | 5.2064 | | $191,220 | $36,728 | |
| 3 |  | $193,033 | 2.5771 | | $218,804 | $84,903 | |
| 4 |  | $177,211 | 3.3121 | | $210,332 | $63,504 | |
| 7 |  | $232,216 | 5.2064 | | $284,280 | $54,602 | |
| 6 |  | $161,126 | 4.6229 | | $207,355 | $44,854 | |
| 4 |  | $171,432 | 3.3121 | | $204,553 | $61,759 | |
| 3 |  | $180,391 | 2.5771 | | $206,162 | $79,998 | |
| 3 |  | $98,413 | 2.5771 | | $124,184 | $48,187 | |
| 7 |  | $131,965 | 5.2064 | | $184,029 | $35,347 | |
| 6 |  | $93,896 | 4.6229 | | $140,125 | $30,311 | |
| 7 |  | $129,564 | 5.2064 | | $181,627 | $34,886 | |
| 3 |  | $142,306 | 2.5771 | | $168,077 | $65,220 | |
| 5 |  | $170,362 | 3.9927 | | $210,290 | $52,668 | |
| 4 |  | $132,440 | 3.3121 | | $165,561 | $49,986 | |
| 4 |  | $149,128 | 3.3121 | | $182,249 | $55,025 | |
| 6 |  | $146,032 | 4.6229 | | $192,261 | $41,589 | |
| 7 |  | $201,891 | 5.2064 | | $253,954 | $48,778 | |
| 6 |  | $133,757 | 4.6229 | | $179,986 | $38,934 | |
| 6 |  | $122,714 | 4.6229 | | $168,943 | $36,545 | |
| 7 |  | $81,621 | 5.2064 | | $133,685 | $25,677 | |
| 6 |  | $192,766 | 4.6229 | | $238,995 | $51,698 | |
| 6 |  | $151,301 | 4.6229 | | $197,529 | $42,729 | |
| 7 |  | $145,893 | 5.2064 | | $197,956 | $38,022 | |
|  | | | | | | | |
| Averages of PW & EW | | | | **$192,628** | | | $48,379 |
| SD of PW & EW | | | | **$35,136** | | | $14,408 |

We also, in the right-hand column, calculate the equivalent annual cost of the power plant, to facilitate comparison with the annual cost of the current power bill, $55,000 per year. We see that in most cases, the equivalent annual cost of building the power plant would be less than the current power bill, so building the power plant is a reasonable choice.

10-51

(a) PW(A) = –250,000 + 20,000 (*P*/*A*, 6%, 30) = –250,000 + (20,000) (13.765) = $25,300

PW(B) = –250,000 + 15,000 (13.765) = –$43,525

PW(C) = –250,000 + 8,000 (13.765) = –$139,880

(b) Mean Annual Savings =  = $14,667

PW(MAS) = –250,000 + 14,667 (13.765) = –$48,109

(c) No, because the pessimistic estimate was $2,000 further below the most likely than the most optimistic was above the most likely.