Please **do not** attempt if you do not know what crystal ball is. Please answer 8 questions and showing all work in excel sheet were required.. **Attach screenshots of crystal Ball Assumptions/simulations were required.**

In addition to posting this answer sheet, be sure to post an **Excel file** that shows your calculations. You **Must** post the file that includes your crystal ball assumptions, forecast and the results of your simulations. Post any MS Project file you used to answer a question. **DO NOT** just insert MS Project, Excel or CB derived answers in your answer sheet.

1. Two investments (A and B, below) have been proposed to the Capital Investment committee of your organization;
	1. The required rate of return for your company is 15%. What is the NPV for each investment? Assume the initial investments ($150k and $50k) occur at the beginning of the year and all other costs and benefits occur at the end of the year indicated. Ignore inflation.
	2. What is the payback period for each investment?
	3. Which investment would you recommend and why?
	4. Why might you recommend the other investment?

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Investment A | Year 1 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
| Costs: | $150,000 | $5,000 | $5,000 | $5,000 | $5,000 | $5,000 |
| Benefits: | - | $75,000 | $55,000 | $35,000 | $20,000 | $65,000 |
|  |  |  |  |  |  |  |
| Investment B | Year 1 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
| Costs: | $50,000 |  |  |  |  |  |
| Benefits: |  | $30,000 | $15,000 | $10,000 | $10,000 | $15,000 |

1. Unfortunately, the Capital Investment Committee refused to approve your recommendation (Problem 1) since you did not consider the uncertainty inherent in these types of investments. You pull out your very dog-eared notes and repeat your analysis, this time using Crystal Ball and the following information:

Investment A:

* + 1. Year 0 Investment cost: Triangular distribution (optimistic: $125,000; most likely: $150,000; pessimistic: $200,000)
		2. Year 1-5 operating cost: Normal distribution (mean of $5,000, standard deviation of $500)
		3. Year 1 Benefits: Normal distribution (mean of $75,000, standard deviation of $20,000)
		4. Year 2 Benefits: Normal distribution (mean of $55,000, standard deviation of $15,000)
		5. Year 3 Benefits: Normal distribution (mean of $35,000, standard deviation of $10,000)
		6. Year 4 Benefits: Normal distribution (mean of $20,000, standard deviation of $5000)
		7. Year 5 Benefits: Uniform distribution (Minimum: $60,000; Maximum: $120,000)

Investment B:

* + 1. Year 0 Investment cost: Uniform distribution (Minimum: $40,000; Maximum: $60,000)
		2. Year 1 Benefits: Normal distribution (mean of $30,000, standard deviation of $3,000)
		3. Year 2 Benefits: Normal distribution (mean of $15,000, standard deviation of $5,000)
		4. Year 3 Benefits: Normal distribution (mean of $10,000, standard deviation of $3,000)
		5. Year 4 Benefits: Normal distribution (mean of $10,000, standard deviation of $3,000)
		6. Year 5 Benefits: Normal Distribution (mean of $15,000, standard deviation of $5000).
1. If the IRR is still 15%, use Crystal Ball to calculate the median NPV for each investment. Would you still prefer the same investment you recommended in question 1.c?
2. What is the probability that Investment B will be better than Investment A (financially)?

Be sure to show all work.

1. Using the forward and backward pass method, identify the Critical Path and total duration for the following network. Show all work.

|  |  |  |
| --- | --- | --- |
| Task | Duration | Predecessor |
| a | 5 |  |
| b | 10 | a |
| c | 10 | a |
| d | 5 | b |
| e | 3 | c |
| f | 10 | d, e |

1. For the network below:
	1. Assume that each activity has a Beta distribution. Calculate T-E and Variance for each activity. Assume the durations have 95% certainty (i.e. the range from optimistic to pessimistic durations covers 95% of all possible durations).
	2. Calculate the expected duration of the network. Do not use Crystal Ball.
	3. What is the probability the network will take no more than 23 days? Use the Z-table or Excel’s NORM.DIST formula, not Crystal Ball. Be sure to show all work.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Activity | Optimistic Duration | Most Likely duration | Pessimistic Duration | T-E | Var | Pred |
| A | 8 | 10 | 14 |  |  |  |
| B | 4 | 5 | 7 |  |  | A |
| C | 8 | 8 | 9 |  |  | A |
| D | 3 | 3 | 3 |  |  | B, C |

1. You are still trying to get your engineering cost estimate for the Kuraiz-Reconda Fiber Optic Cable (KRFOC) project approved by your sponsor (remember IA-5?). In opening your morning mail, however, you see a proposal from *Engineers ‘R Us* to do all the KRFOC engineering for a fixed price of $60,000. Comparing that with your estimate of doing the work yourself (See the IA-5 question 2b School Solution):
2. What is the probability that the price for completing the work yourself will be less than the *Engineers ‘R Us* offer? Show all work.
3. Would you recommend the work be done in-house or accept the fixed price offer from *Engineers ‘R Us? Why or why not?*

Be sure to provide all calculations.

1. Which of the following are activities and which are work packages?
	1. Project Plan
	2. Prepare the purchase order for a router
	3. System Design Package
	4. Install the foundation
2. Larry, Moe and Curly decide to make a movie. Being graduates of the university, and having aced PMAN 635, they decide to build a project plan using MS Project. The attached file (Question 7- Fall 2019.doc) lists the activities and costs they think it will take to complete their movie. Note that there are two tables in this file. Using MS Project, what is the total duration and cost for their project? Include your MSP project file with your submission.
3. Please answer each of the following:
	1. What is the expected time to complete a task with an optimistic (a), most likely (m), and pessimistic (b) times of 2, 4 and 7 days respectively?
	2. What is the standard deviation of the same task, assuming that 99.7% of the outcomes fall between a and b?
	3. What is the standard deviation of the same task, assuming that 90% of the outcomes fall between a and b?