

**TIE4203 Decision Analysis in Industrial & Operations Management**  
**Assignment #2**

**Due: Friday, 17 Sep 2021, 9 pm**

You may use Excel or any software for your computations, but you must explain your solutions in the submission.  
Submit your solutions as one **single PDF file** via the designated folder on LumiNUS any time before the deadline.

**Question (Total marks 100)**

The Art Museum is undergoing renovation and is calling for tenders for hi-tech companies to submit tender proposals for a state-of-the-art security system. The winning tender price is fixed at \$1 million, and proposals that are submitted will be evaluated on the basis of their features, effectiveness, technology, connectivity, etc. This can be done by AHP in practice.

A Company has been engaged in the R&D of a next-generation security system that would be superior to any product currently in the market. The company must now decide whether or not to continue with the R&D. If the company continues with R&D now, it will need to invest \$200,000 and the chance of success is 40%. On the other hand, if the company chooses not to continue with the R&D, the entire project will terminate.

If the company continues with R&D and succeeds, it must then decide whether or not to submit a tender for the Art Museum Project using the newly developed system for the \$1 million contract. The probability of winning the contract is 0.9.

On the other hand, if R&D is not successful, the company must also decide whether or not to submit a tender for the project using an older technology. However, in this case the chance of winning the contract is only 0.05.

In addition, submitting a tender for the project using any technology requires building a demonstration system at a cost of \$50,000. Finally, if the company wins the contract it will cost \$150,000 to produce, install and commission the final system.

The company is risk neutral and time value of money may be ignored in analyzing this problem.

Answer the following questions:

1. Draw a decision tree representing the company's problem. (20 marks)
2. What is the company's optimal decision policy and certainty equivalent? (5 marks)
3. Plot the risk profiles for the two initial decision alternatives (Continue R&D and Do not continue R&D) under the optimal decision policy. (15 marks)
4. Determine if there is any first or second order Stochastics dominance between the two risk profiles in Q3. Explain your answers. (5 marks)

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5. What is expected value of perfect information on whether R&D will be successful or not?  
(15 marks)
6. The company can engage an expert to review the progress of its R&D and to predict its outcome. The expert's track records in assessing similar R&D projects in the past are as follows: Suppose an R&D project will succeed, it will predict it correctly with probability 0.8; and suppose an R&D project will not succeed, it will predict it correctly with probability 0.75. If it costs \$20,000 to hire the expert, what is the optimal decision policy for the company and certainty equivalent with regard to hiring the expert? (20 marks)
7. What is the expected value of perfect information on whether the company will win the project with the new technology or not? (20 marks)

\*\*\* End of Assignment \*\*\*