Title: Multi-stage decision making in imprecise and uncertain environment

Authors response to Reviewer

Comments for Chapter 2:

- In definition 2.2.1 the word crisp is not mentioned.
  Explanation: In the revised version of the thesis we have added the word crisp.
- Some graphical representations of the concept introduced in section 2.1.1. ......
  Explanation: Graphical representations for LR-type fuzzy number and triangular fuzzy number has been added in the revised version.
- Definition of Sigma-Algebra in definition 2.1.13. ......
  Explanation: In the revised version, we have given the definition of Sigma Algebra.
- It is not clear why section 2.3 is introduced.
  Explanation: Section 2.3 is used to calculate the fuzzy decision matrix in example 2 of chapter 3.

Comments for Chapter 3:

- If I understood Correctly, in the definition of Possibility index, the role of b_1 in the definition of possibility index ...
  Explanation: b_1 is the first component of triangular fuzzy number, but to calculate possibility index there is no use of b_1 in the definition.
- What happens if $b_3 \geq a_3$ and $a_2 \geq b_2$?
  Explanation: The fuzzy weight $\widetilde{A}$ can be completely filled in to the fuzzy weight $\widetilde{B}$ i.e. possibility index is one.
- What happens when $b_3 \leq a_3$ and $a_2 = b_2$ ......
  Explanation: The condition is included in the first case of the definition of possibility index.
- It could help the reader to explain in detail how the PI in table:3.2 is calculated ......
  Explanation: The explanation of calculating PI has been given in the revised version of the thesis.
- Why Table 3.4 is shown for only $d = 10$ ......
  Explanation: We started the problem from the last stage where the available knapsack capacity was 10 unit. At stage 2, after filling the knapsack with some fuzzy weight there is some part is required to be filled from stage 1 for the remaining weight. But at the first stage, we don't have any further stage in backward direction so we don't need the optimized results from first stage for each value of d.

Comments for Chapter 4:

- In section 4.2.4, it is not clear how you get the model presented at the end of page 65. It is not clear what are the decision variable over which optimization is performed ......
  Explanation: To get the equivalent deterministic bi-level programming model from fuzzy

bi-level programming problem. We have taken the upper bound of the $\alpha-cut$ of the follower objective function since it was obtained in terms of LR-type fuzzy number. The decision variable over which the optimization is performed are X, Y and λ.

- Some words on how the deterministic bi-level programming problem is solved is needed ......
  Explanation: The papers which review and gives the approach to solve deterministic bi-level programming problem has been cited in the revised version of manuscript. There are various approaches in the literature to solve the deterministic bi-level programming problem and the approach using KKT condition is used in Wen and Hsu's article titled "Linear Bi-level programming problem- A review". Since our work deals with fuzzy stochastic bi-level programming problem the equivalent deterministic bi-level programming problem is easy to solve by goal programming method.

Comments for Chapter 5:

- The normalized fuzzy number of $(10; 0, 40)$ is correct? similarly for table 5.2, 5.3, 5.4 and 6.2, 6.3. ......
  Explanation The correction has been made in the revised version of the thesis.

- Where do the GA and PSA values comes from ......
  Explanation The example given the research work has been taken from the article Chakraborty et. al. (2015). The GA and PSA values are used to compare our result to the existing result. We have given a dynamic programming approach to solve the model in different stages. Since it deals with one variable at one stage the procedure is easy and giving better result then the GA and PSO.

- In the dissertation, there are details on the computational time required to the perform the experiments in any of the case presented in 3,4,5,6,7 ......
  Explanation The Computational time required for each case is $O(n^2)$, where n is the number of stages used in each case, since our approach uses only one state variable at a time. The curse of dimensionality affects the dynamic programming approach when large number of variable are taken as state variable.

- There are several typos throughout the entire manuscript ......
  Explanation : Grammatical errors in "Introduction chapter" and other sections of the thesis are corrected and the care is taken to improve the language of the paper.

The authors would like to thank the referees for carefully reading the thesis and for valuable comments.