Executive Summary

Study of Soft Set Theory and Its Applications

To be submitted

University Grants Commission Sponsored

Minor Research Project

(Project F. No. 42-994/2013 (SR) Dated 25.03.2013)

Principal Investigator

Prof. Shyamal Kumar Mondal

Department of Applied Mathematics with Oceanology and Computer Programming

VIDYASAGAR UNIVERSITY

Midnapore, West Bengal, India, Pin- 721102

2015

Executive Summary

1. OBJECTIVES OF THE PROJECT:

(i) To develop the certain aspects in algebra in the parlance of soft set theory.

(ii) To develop the certain aspects in analysis in the parlance of soft set theory.

(iii) To implement such new aspects in real life decision making problems.

(iv) Modify/generalize the certain related theories which have been already developed in the area of soft set theory.

(v) To develop all this algebra and analysis in the field of soft set theory in different environments like fuzzy, intuitionistic fuzzy, interval-valued fuzzy etc.

(vi) Apply these new concepts to solve soft set based real life decision making problems.

2. WHETHER OBJECTIVES WERE ACHIEVED: Yes

The project has been started from 1st April, 2013. At first literature survey has been carried out on soft set theory, fuzzy set theory, rough set theory and other related areas during first three months. During this period, one research paper entitled "Soft - Matrix and its Application" has been formulated. Then, one research paper entitled "A New Solution Approach for Solving Intuitionistic Fuzzy Soft Set Based Multi-Criteria Ranking Problems And Its Application in Medical Science" has been prepared. After that along with the literature survey on fuzzy cognitive map, another research paper entitled "A New Solution Approach Using Intuitionistic Fuzzy Cognitive Map to Solve Intuitionistic Fuzzy Multi-Criteria Ranking Problems in Medical Science" has been developed and solved. After that the research paper entitles "Matrices in interval - valued fuzzy soft set theory and their application" has been formulated and solved. Finally, one more research paper on neutrosophic soft matrix has been developed and solved.

3. ACHIEVEMENTS FROM THE PROJECT:

Along with the literature survey, a research paper on Soft - Matrix and its application has been formulated and it is also published in a Proceeding (ISBN-13: 978-9-35-134273-1, ISBN-10: 9-35-134273-5) in 2^{nd} International conference on Computing & Systems, organized by Department of Computer Science, The University of Burdwan, Golapbag, Burdwan, West Bengal, September 21 - 22, 2013 published by McGraw Hill Education (India) Private Limited, New Delhi, Technically supported by IEEE Computer Society, Kolkata Section, Pages 67 - 74. After that another research paper on solution approach for solving Intuitionistic

Fuzzy Soft Set Based Multi-Criteria Ranking Problems has been developed and then it is applied in Medical Science which is communicated to an International Journal of publication till now. Along with literature survey, the third research paper has been formulated on Intuitionistic Fuzzy Soft Set Based Multi-Criteria Ranking Problems using Intuitionistic Fuzzy Cognitive Map. This paper has been communicated to an international journal for publication. Then, the another problem on matrices in interval - valued fuzzy soft set theory and their application has been developed and implemented as well as it also already published in South Asian Journal of Mathematics in 2014. Finally the fifth paper on Neutrosophic soft matrix and its application in group decision making problems from medical science has been formulated and recently it has been published in Computer Communication & Collaboration in 2015.

4. SUMMARY OF THE FINDINGS:

In first paper entitled "Soft -Matrix and its Application", the purpose is to introduce the concept of Interval-Valued Fuzzy Soft Matrix (-matrix) together with some different types of matrices in interval-valued fuzzy soft set theory. We have defined here some new operations on these matrices and proposed some theorems along with few properties on these matrices. Moreover a new efficient -algorithm based on these new matrix operations has been developed to solve interval-valued fuzzy soft set based real life group decision making problems. Finally the -algorithm has been applied to a more relevant subject- the Drastic Change of Climate in present world scenario.

In second paper entitled "A New Solution Approach for Solving Intuitionistic Fuzzy Soft Set Based Multi-Criteria Ranking Problems and Its Application in Medical Science", we have introduced the concept of intuitionistic fuzzy soft set based multi-criteria ranking problem. Then an algorithm has been developed for solving intuitionistic fuzzy multi-criteria ranking problems and finally we have applied this new algorithm to solve an intuitionistic fuzzy soft set based multi - criteria ranking problem in medical science.

In third paper entitled "A New Solution Approach Using Intuitionistic Fuzzy Cognitive Map to Solve Intuitionistic Fuzzy Multi-Criteria Ranking Problems in Medical Science", the concept of a generalized intuitionistic fuzzy multi-criteria ranking problem has been introduced. Then an algorithm, named IFCM-Algorithm, based on intuitionistic fuzzy cognitive map (IFCM) and few basic properties of intuitionistic fuzzy soft set, has been developed for solving intuitionistic fuzzy multi-criteria ranking problems and finally the IFCM-Algorithm has been applied to rank the effectiveness of the treatment procedures in respect to the diseases from medical science.

The fourth paper is Matrices in interval - valued fuzzy soft set theory and their application. The purpose of this paper is to introduce the concept of Interval-Valued Fuzzy Soft Matrix

(IV FS-matrix) together with some different types of matrices in interval-valued fuzzy soft set theory. We have defined here some new operations on these matrices and discussed all these definitions and operations by appropriate examples. In addition we have proven some theorems along with few properties on these matrices. Moreover a new efficient IV FSM-algorithm based on these new matrix operations has been developed to solve interval-valued fuzzy soft set based group decision making problems. After that the IV FSM-algorithm has been applied to a real life group decision making problem and then we have described the feasibility of this proposed method.

The main purpose of the fifth paper entitled "Neutrosophic soft matrix and its application in group decision making problems from medical science", is to introduce the concept of Neutrosophic Soft Matrix (NS-Matrix). We have proposed different types of NS-Matrix along with various operations on them. A new methodology, named as NSM -Algorithm based on some of these new matrix operations, has been developed to solve neutrosophic soft set based real life group decision making problems efficiently. Finally NSM-Algorithm has been applied to solve the problems of diagnosis of a disease from the myriad of symptoms as well as to evaluate the effectiveness of different habits of human being responsible for a disease from medical science.

5. CONTRIBUTION TO THE SOCIETY:

There are many practical applications especially, in decision making problems, where soft set concept has been utilized to take some decisions. Actually, it is a parameterized general mathematical tool which deals with a collection of approximate descriptions of objects. In this project work, some new efficient algorithms such as -algorithm, IFCM-Algorithm, NSM-Algorithm have been developed based on soft matrix, intuitionistic fuzzy cognitive map, neutrosophic soft matrix to solve some real life decision making problems such as- the Drastic Change of Climate, the effectiveness of the treatment procedures, diagnosis of a disease from the myriad of symptoms in respect to the diseases from medical science which are very useful in our present society.