CHAPTER 8

CONCLUSION AND SCOPE FOR FUTURE RESEARCH

8.1 CONCLUSION

Four FCT models of practical significance are addressed in this thesis. They are:

- Model – 2 : Two-Stage Supply Chain ‘SC’ transportation problem associated with a fixed charge.
- Model – 4 : Two-Stage TLC-FCT problem of a SC.

The mathematical models for all the four FCT problems are formulated. FCT problems are much more difficult to solve due to the presence of fixed costs, which cause discontinuities in the objective function and are known to be Non-Polynomial ‘NP’ hard.

In recent years, Genetic Algorithm ‘GA’ and Simulated Annealing Algorithm ‘SAA’ has been increasingly applied to various search and optimization problems and has emerged as potential techniques to provide solutions with acceptable accuracy for NP hard problems. In the light of the above consideration, this thesis proposed GA and SAA based heuristics to
Evolve optimal or near-optimal solution for all the four FCT models for minimization of total cost of transportation.

In the proposed GA, a new type of coding scheme (i.e. matrix form of chromosome) has been adopted for the two-stage FCT problem. A feasible transportation plan $X_{jk}$ that satisfies the requirements of customers from the distribution centres forms a chromosome. During the crossover operation, two cut points are generated randomly within the number of customers $k$ in the chromosome. The columns of genes bracketed by these crossover-cutting points are interchanged between parent chromosomes, produce their offspring without any complexity, and thus maintain the feasibility for the demand of the customers.

The performance of the proposed GA and SAA for the first and second FCT models are evaluated by comparing it with the approximate and lower bound solutions. The capability of the proposed GA and SAA for the third and fourth FCT models are analysed by comparing it with the approximate and lower bound solutions under relaxed truck load capacity. Thus, the comparison reveals that the proposed GA and SAA generates better solution than the approximation method and are capable of providing solution either equal or closer to the lower bound solution of the problem. The two proposed heuristics are, therefore, effective tools for solving FCT problems instances.
8.2 SCOPE FOR FUTURE RESEARCH

This research may be extended for further research in the following directions/environments:

- This research work concentrates on single-stage and two-stage FCT. In the future research work, the FCT model may be extended to multi-stage supply chain.

- In the two-stage FCT, the product is transported from plant to customers through distribution centres. However in practical case, demand of some customers may be satisfied directly from the plant. This type of case would be addressed in future research.

- In the fourth FCT model, truck load capacity of both the stages is assumed as same. However, the truck load capacity may be different at different stages. The varying truck load concept may be attempted in future research.

- This research work concentrates on fixed charge transportation problems. In the future research, fixed charge transhipment problems may be attempted.

- In this research, the capacity of the distribution centres is assumed as infinite in the Second and fourth FCT model. In the future work, the capacity of the distribution centres may be kept as finite.

- In all the four FCT models, a fixed charge is only considered. In the future research, in addition to the fixed charges, resource
losses may be addressed. The losses may be evaporation losses when the commodity is a liquid, heat losses in an electrical distribution network, or deterioration losses in distribution networks involving perishable commodities such as, for example, food items.

In addition to the above mentioned directions, research can be extended in the application of search heuristics as follows:

- A future research issue would be to evolve hybrid algorithms by incorporating local search mechanisms like tabu search, scatter search etc., and global search mechanisms like particle swarm optimisation algorithm, ant colony algorithm etc., into the proposed heuristics to enhance their performance.

- The current coding scheme of the proposed heuristics is limited to partial feasible allocations. In future research, the coding scheme may be restructured for exploring all feasible allocations.

- The operators and parameters used in the proposed heuristics can be varied and an analysis could be made to identify the most effective operators and parameters for solving the FCT models.

- Another future research direction would be to extend the proposed heuristics to solve the FCT models for multi-objective criteria such as delivery period, production planning etc.