

USE OF TRIANGULAR DISTRIBUTION AND ANT COLONY OPTIMISATION IN SOLVING MULTI-OBJECTIVE ASSIGNMENT PROBLEMS UNDER UNCERTAINTY

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This study investigates the use of Triangular Distribution (TD) and Ant Colony Optimization Algorithm (ACOA) in solving Multi-Objective Assignment Problems (MOAP) under uncertainty. ACOA is one of the most prominent biologically inspired algorithms to solve optimization problems. Multi - Objective Ant Colony Optimization Algorithm (MOACOA), which is based on the ACOA, is a probabilistic approach for finding the optimal path of the MOAP. In many real-world problems, Assignment Cost (AC) is not deterministic. In fact, it can be observed that AC behaves in an unpredictable manner. Also, depending on the application, AC may not be estimated precisely due to insufficient information related to the application. This study assumes that an AC follows a TD, where AC fluctuates between two estimated values known as optimistic and pessimistic values in a probabilistic manner, where most probable value lies in between. The Monte Carlo simulation technique is used to determine the expected AC. Subsequently, the uncertain assignment problem is reformulated as a deterministic model. The deterministic model is solved separately for each objective using ACOA and subsequently, the positive ideal solution and the negative ideal solution are obtained. In MOAP, a fuzzy exponential membership function (FEMF) is obtained for each objective, according to the different aspiration levels of the decision maker (DM). Then, the FEMF is obtained for each objective and the sum of the FEMF values for each path is determined. This study finds that the change in the shape parameter of the FEMF influences the level of satisfaction for each objective function, and it also finds that all the obtained solutions are reliable with the preference of the DM. If the DM is not satisfied with a specific assignment, alternative assignments can be generated by changing the values of the shape parameter in FEMF as well as by adjusting the aspiration level. The ACOA and TD approaches provide solutions to the MOAP using FEMF under various choices of shape parameters and their corresponding alternative assignments. The findings also describe how different shape parameters affect the objectives and influence convergence to the optimal solution. This in-depth analysis concludes that the proposed technique yields the optimal assignment in accordance with the DM's aspirations.

Keywords: Ant colony optimization algorithm, Assignment problem, Monte Carlo simulation, Triangular distribution, Uncertainty