This paper introduces an effective algorithm for solving large-scale qualitative integer programming problems. Maleki uses the QP1 model developed in “Qualitative programming for selection decisions” by F. Zahedi as a starting point. The QP1 model is a selection model that consists of n alternatives, which are evaluated based on comparisons of one or more of the m attributes. However, this model does not consider the intensity of preference between the attributes. Some attributes may be strongly preferred, whereas others may be weakly preferred. The QP1 model shows no distinction between these two attributes. Within the QP1 model, the decision makers choice may change when comparing the alternatives based on different attributes, however some attributes may be more important than others and therefore should receive a higher merit. Zahedi addresses the intensity of preferences by employing a mixed qualitative programming method that modifies the QP1 constraints to include a coefficient representing the strength of the preference.

Maleki presents a way to incorporate the preference of the attributes by modifying the objective function, this new model is known as the QP2 model. The QP2 model’s objective function becomes:

$$\text{Max } z = \sum_{ijk} (e_{ijk}w_{ijk}P_{ijk}) - \sum_{ijk} (e_{ijk}w'_{ijk}P'_{ijk}) - \sum_{ik} (e_{ik}w_{ik}P_{ik})$$
Where $e_{\alpha}$ represents the relationship between the preferences of attributes. For example if a strongly preferred attribute is identified as twice as important as a weakly preferred attribute, then $e_{\alpha} = 2$ for strongly preferred attributes.

The number of feasible solutions for this selection problem method is equal to $n$ when $C = 1$, which means that only one alternative may be chosen. The QP2 model is derived from a theorem that states:

If $C = 1$ and $(Y', X')'$ is a feasible solution for the model QP2 where $Y = e_{i0}$, then the value of the objective function for this solution is equal to the $i0$th component of $Z$.

This allows the decision maker to calculate $z_i$ values for each alternative, rank them in ascending order, and determine the highest $z_i$ value that corresponds to the best alternative. This optimal choice includes the intensity of the preference between attributes.

The algorithm developed in this paper consists only of scalar and matrix addition, it does not require the extensive computing power that other selection algorithms require. The method allows users to “easily” compare different alternatives when only qualitative information is available. The method is easier than other methods because of the simple mathematics involved in solving the algorithm.¹

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