Meta Heuristic Approach to Optimize Airline Fleet Re-Assignment

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Disruptive situations occur very often in airline environments where daily operational plans related to airline fleet deviate from the original schedules due to unanticipated circumstances, particularly as airlines operate in extremely uncertain and cost intensive environments. The frequency and cost associated with disruptions affect airline profitability to a great extent. In a disrupted state, it is needed by the airline to dynamically change fleet schedules; re-assign fleet to stabilize operational continuity. The research aims at developing a model based on meta-heuristics for the formal optimization of disruption recovery decisions. The mathematical model proposed, has the objective of recovering the disrupted flight(s) with minimum deviation from the original schedule, minimizing the total cost of disruption management. When deciding on the recovery action, the best suited option that implies the lowest cost must be chosen. In order to achieve this, flights can be swapped, delayed, cancelled or its passengers could be rerouted using a flight offered by the same airline or a different airline. The costs of different recovery strategies such as delaying, cancelling, swapping and passenger rerouting are therefore included in the objective function of the model. Costs related to passengers are incorporated to the cost calculations of each of the recovery strategies. The constraints involved in the model support consistent operations in a practical airline environment and are related to aircraft, airports, itineraries, turn-round times, configuration of aircrafts and maintenance. Variables in the model could be categorized as input data and cost coefficients, strategic decision variables and computed output variables and cost factors which will be reported from the optimization process. Variables and constraints in the proposed model were identified through a thorough survey of literature and interviews conducted with airline operations control personnel to gather and cross validate the industrial acceptability of the propositions and to identify possible revisions. Solving one disruption has a downstream impact on the entire airline operations plan and may require changes to be made in the overall operational schedule subsequent to the recovery of one disruption. This is solved using a metaheuristic algorithm based on tabu search, where the optimum way of adjusting the rest of the flight schedule is found. The study identifies and validates the heuristics involved in the current procedure followed in aircraft schedule recovery and the rational/logic behind the process practiced, that can support the optimization of disruption recovery decisions.

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