

Optimization Applications in Airline Planning

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20 February 2016

Relevant models for many of the applications discussed, in LINGO modeling language form and What'sBest! spreadsheet form, are at

www.lindo.com, Click on: MODELS -> Keywords index -> Airline.

Keywords: Airline;

+ Fleet assignment and routing:

Given a flight schedule, number available of each aircraft type, and profitability of each aircraft type on each flight, which aircraft type should be assigned to each flight leg?

+ Plane to flight assignment to minimize passenger transfer cost:

Given estimated number of passengers continuing on from one flight leg to another at a hub, which plane (tail number) should be assigned to each leg to minimize number of passengers needing to change planes?

+ Charter aircraft route planning with deadheads:

Given a set of flights, with associated aircraft type needed, that need to be covered, which aircraft should cover which flight and what deadhead/repositioning legs are needed?

+ Crew scheduling:

Given a set of flights to be covered and associated crew restrictions such as duty time, how should crews be assigned?

+ Revenue/Yield management:

Customers who need a flight just a few days before departure are willing to pay more than customers who reserve early. Each day, as flight departure time approaches, how many seats should be made available at a low price and how many seats should be held back in hopes of later sale to high price customers?

+ Over-Booking decisions:

On many flights, a predictable fraction of reservations are no-shows. If we do not overbook, we will regularly have empty seats. Given the penalty cost for a denied boarding, how many seats should we overbook?

+ Fuel purchasing/ferrying/tankering:

There may be big differences in the cost of fuel among airports. How much fuel should each aircraft buy at each airport, taking into account not only cost differences, but also the fact that carrying/tankering/ferrying fuel between airports burns more fuel.

+ Load balancing/freight packing:

An aircraft carrying a heavy cargo load should have the center of gravity of the load close to the center of lift. Given the weight of each item to be loaded, where should each item be placed on the aircraft?

+ Runway aircraft sequencing for landings and takeoffs:

For safety reasons related to turbulence, when a small aircraft follows a large aircraft, there must be a greater separation. Given a time window for each flight, how should takeoffs and landings on a runway be sequenced to minimize delay?

+ Gate scheduling/assignment:

Given the time window for each flight at a gate, limits on which aircraft types can be handled at each gate, and interactions between flights such as transferring passengers, which gate should be assigned to each flight?

+ Ground personnel scheduling:

The demand for gate agents and baggage handlers during the course of a day is very uneven. What start times and shift lengths should be chosen so as to supply the needed staff at minimum cost, using reasonable work shifts?

+ Schedule recovery after disruption:

After a major storm, aircraft have been stranded at various airports around the country. Given good weather now, how should aircraft be moved around the country to resume a normal schedule as quickly as possible?

+ Maintenance scheduling:

Given that each aircraft must be taken out of service periodically for maintenance, how do we decide when to take each aircraft out for service yet fully cover all the required flights?

+ Air traffic control:

Given the amount of runway congestion/delay at various airport and weather conditions, when should each aircraft be released for takeoff, and what route should it fly so as to minimize in-air delays?

+ Schedule design:

Given forecast demand for various itineraries for each period of each day of the week, what flight schedule should we use? Should it be hub and spoke? Where should the hubs be located?

+ Passenger mix:

Given our current aircraft fleet, what mix of passengers, e.g., business and economy, should we plan to carry?