**Seat Allocation Optimization**

***Optimization Model used:*** ILP (Integer Linear Programming)

***Sets and Indices:***

*F f,* indicating Set of flights (F1, F2)

*C c,* indicating Set of classes (Economy, Business, First)

***Parameters:***

*Dfc,* Forecasted Demand *D* for class *c* in flight *f*

*Kf,* Total Seat Capacity *K* for flight *f*

*Df,* Distance *d* of route for flight *f*

*cfuel,* fuel cost per km (flat for all flights)

*cfcseat,* base fare per seat for class *c* in flight *f*

*cfcoverbook,* compensation cost for overbooked passengers in class *c*, flight *f*

*cfcunsold,* penalty for unsold seats in class *c*, flight *f*

*ßc [0,1],* Maximum allowed overbooking fraction for class *c*

***Decision Variables:***

*Xfc,* Number of seats allocated in class *c*, flight *f*

*Ofc,* Number of overbooked passengers in class *c*, flight *f*

*Ufc,* Number of unsold seats in class *c*, flight *f*

***Objective Function:***

***Constraints:***

1. ***Demand Fulfilment:***

Number of passengers assigned with seats (*Xfc*) does not exceed the true Demand (*Dfc*) after accounting for overbooking (*Ofc*).

1. ***Seat Accounting:***

Balancing number of physical seats with booking decisions.

Total available physical seats = Total expected show-ups

(used + unused) = (real demand + overbooked)

1. ***Overbooking Limit:***

Overbooking is capped to a safe regulated threshold (*ß*) – small percentage of demand.

1. ***Flight Capacity:***

Number of seats sold on any class on any flight must not exceed the available physical capacity.

1. ***Non-negativity:***