Homework 6
Submission by: Mohammad Mirza (mmmirza)

Model 1

Decision Variable:

- x_i: number of class i seats configured ← First Stage
- y_{is}: number of class i seats sold in scenario s ← Second Stage

Sets:

- s = 1, …, 1000 scenarios
- i = 1, …, 4 classes i.e. economy, economy+, business, first class

Parameters:

- q_s: probability of scenario s
- d_{is}: demand for class i seats under scenario s
- p_i: price of class i seat
- α_i: space required by class i seat with respect to economy
- C: aircraft capacity in terms of economy seats

Objective Function (maximize future expected revenues):

- Max $\sum_{s=1}^{1000} \sum_{i=1}^{4} (q_s * p_i * y_{is})$

Constraints:

- Demand Constraint:
  $y_{is} \leq d_{is}$, $\forall s = 1, \ldots, 1000$; $\forall i = 1, \ldots, 4$

- Availability Constraint (RHS is scenario independent):
  $y_{is} \leq x_i$, $\forall s = 1, \ldots, 1000, \forall i = 1, \ldots, 4$

- Capacity Constraint:
  $\sum_{i=1}^{4} \alpha_i x_i \leq C, \forall i = 1, \ldots, 4$

- Integer & Non-negativity constraint:
  x_i , y_{is} integer, $\forall i = 1, \ldots, 4, \forall s = 1, \ldots, 1000$
  $x_i \geq 0, y_{is} \geq 0$, $\forall i = 1, \ldots, 4, \forall s = 1, \ldots, 1000$

Model 2

Sets:

- s = 1, …, 3000 scenarios
- i = 1, …, 4 classes i.e. economy, economy+, business, first class

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Parameters:

- q_s: probability of scenario s (q_d i.e. demand scenario x q_p i.e. price scenario)
- d_{is}: demand for class i seats under scenario s
- p_{is}: price of class i seat under scenario s
- α_i: space required by class i seat with respect to economy
- C: aircraft capacity in terms of economy seats

Objective Function (maximize future expected revenues):

- Max $\sum_{s=1}^{3000} \sum_{i=1}^{4} (q_s * p_{is} * y_{is})$

Constraints:

- Demand Constraint:
  $y_{is} \leq d_{is}$, $\forall s = 1, \ldots, 3000$; $\forall i = 1, \ldots, 4$

- Availability Constraint (RHS is scenario independent):
  $y_{is} \leq x_i$, $\forall s = 1, \ldots, 3000, \forall i = 1, \ldots, 4$

- Capacity Constraint:
  $\sum_{i=1}^{4} \alpha_i x_i \leq C, \forall i = 1, \ldots, 4$

- Integer & Non-negativity constraint:
  x_i , y_{is} integer, $\forall i = 1, \ldots, 4, \forall s = 1, \ldots, 3000$
  $x_i \geq 0, y_{is} \geq 0, \forall i = 1, \ldots, 4, \forall s = 1, \ldots, 3000$