Assignment_2_q2

January 28, 2025

0.0.1 Problem 2

[14]:
```
from pulp import *
```

[15]:
```
# Dictionary Setup
Passengers = ['INY','INB','INM','NBY','NBB','NBM','IBY','IBB','IBM']
revenues = {
    'INY' : 300,
    'INB' : 220,
    'INM' : 100,
    'NBY' : 160,
    'NBB' : 130,
    'NBM' : 80,
    'IBY' : 360,
    'IBB' : 280,
    'IBM' : 140
}

forecast = {
    'INY' : 4,
    'INB' : 8,
    'INM' : 22,
    'NBY' : 8,
    'NBB' : 13,
    'NBM' : 20,
    'IBY' : 3,
    'IBB' : 10,
    'IBM' : 18
}
```

[20]:
```
prob = LpProblem("Question2b", LpMaximize)
# variables
num_passengers = LpVariable.dicts("passengers", Passengers, lowBound=0,␣
 ↪cat='Integer')

# objective function
prob += lpSum([revenues[i] * num_passengers[i] for i in Passengers])
```

```python
#constraints
for i in Passengers :
    prob += num_passengers[i] <= forecast[i]

prob += num_passengers["INY"] + num_passengers["INB"] + num_passengers["INM"] +␣
 ↪num_passengers["IBY"] + num_passengers["IBB"] + num_passengers["IBM"] <= 30
prob += num_passengers["NBY"] + num_passengers["NBB"] + num_passengers["NBM"] +␣
 ↪num_passengers["IBY"] + num_passengers["IBB"] + num_passengers["IBM"] <= 30

print(prob)
```

```
Question2b:
MAXIMIZE
280*passengers_IBB + 140*passengers_IBM + 360*passengers_IBY +
220*passengers_INB + 100*passengers_INM + 300*passengers_INY +
130*passengers_NBB + 80*passengers_NBM + 160*passengers_NBY + 0
SUBJECT TO
_C1: passengers_INY <= 4

_C2: passengers_INB <= 8

_C3: passengers_INM <= 22

_C4: passengers_NBY <= 8

_C5: passengers_NBB <= 13

_C6: passengers_NBM <= 20

_C7: passengers_IBY <= 3

_C8: passengers_IBB <= 10

_C9: passengers_IBM <= 18

_C10: passengers_IBB + passengers_IBM + passengers_IBY + passengers_INB
 + passengers_INM + passengers_INY <= 30

_C11: passengers_IBB + passengers_IBM + passengers_IBY + passengers_NBB
 + passengers_NBM + passengers_NBY <= 30

VARIABLES
0 <= passengers_IBB Integer
0 <= passengers_IBM Integer
0 <= passengers_IBY Integer
0 <= passengers_INB Integer
```

```
0 <= passengers_INM Integer
0 <= passengers_INY Integer
0 <= passengers_NBB Integer
0 <= passengers_NBM Integer
0 <= passengers_NBY Integer
```

[17]:
```
prob.solve()
print("Status: ", LpStatus[prob.status])
```

```
Welcome to the CBC MILP Solver
Version: 2.10.3
Build Date: Dec 15 2019

command line - /Users/mercurymcindoe/Documents/Mercury/UBC/CPEN 4-2/MATH
340/Assignments/.venv/lib/python3.13/site-packages/pulp/solverdir/cbc/osx/64/cbc
/var/folders/py/b14h3jpn1036ckyvg60q2fp40000gn/T/e59fe6404c734b139a62d5602ea4a18
8-pulp.mps -max -timeMode elapsed -branch -printingOptions all -solution /var/fo
lders/py/b14h3jpn1036ckyvg60q2fp40000gn/T/e59fe6404c734b139a62d5602ea4a188-
pulp.sol (default strategy 1)
At line 2 NAME          MODEL
At line 3 ROWS
At line 25 COLUMNS
At line 83 RHS
At line 104 BOUNDS
At line 114 ENDATA
Problem MODEL has 20 rows, 9 columns and 30 elements
Coin0008I MODEL read with 0 errors
Option for timeMode changed from cpu to elapsed
Continuous objective value is 9790 - 0.00 seconds
Cgl0004I processed model has 2 rows, 9 columns (9 integer (0 of which binary))
and 12 elements
Cutoff increment increased from 1e-05 to 9.9999
Cbc0012I Integer solution of -9790 found by DiveCoefficient after 0 iterations
and 0 nodes (0.01 seconds)
Cbc0001I Search completed - best objective -9790, took 0 iterations and 0 nodes
(0.01 seconds)
Cbc0035I Maximum depth 0, 0 variables fixed on reduced cost
Cuts at root node changed objective from -9790 to -9790
Probing was tried 0 times and created 0 cuts of which 0 were active after adding
rounds of cuts (0.000 seconds)
Gomory was tried 0 times and created 0 cuts of which 0 were active after adding
rounds of cuts (0.000 seconds)
Knapsack was tried 0 times and created 0 cuts of which 0 were active after
adding rounds of cuts (0.000 seconds)
Clique was tried 0 times and created 0 cuts of which 0 were active after adding
rounds of cuts (0.000 seconds)
MixedIntegerRounding2 was tried 0 times and created 0 cuts of which 0 were
```

```
active after adding rounds of cuts (0.000 seconds)
FlowCover was tried 0 times and created 0 cuts of which 0 were active after
adding rounds of cuts (0.000 seconds)
TwoMirCuts was tried 0 times and created 0 cuts of which 0 were active after
adding rounds of cuts (0.000 seconds)
ZeroHalf was tried 0 times and created 0 cuts of which 0 were active after
adding rounds of cuts (0.000 seconds)

Result - Optimal solution found

Objective value:                9790.00000000
Enumerated nodes:               0
Total iterations:               0
Time (CPU seconds):             0.00
Time (Wallclock seconds):       0.01

Option for printingOptions changed from normal to all
Total time (CPU seconds):       0.00   (Wallclock seconds):       0.02

Status:  Optimal
```

[18]:
```
for i in Passengers :
    print(f"Ticket ({i}): ",num_passengers[i].varValue)
```

```
Ticket (INY):  4.0
Ticket (INB):  8.0
Ticket (INM):  5.0
Ticket (NBY):  8.0
Ticket (NBB):  9.0
Ticket (NBM):  0.0
Ticket (IBY):  3.0
Ticket (IBB):  10.0
Ticket (IBM):  0.0
```

[19]:
```
print("Max Revenue: ", value(prob.objective))
```

```
Max Revenue:  9790.0
```