

## Airline Scheduling

I'll cut to the chase, NWF (NorthWest Flights) needs your help. NWF is trying to decide how many airplanes to lease in the coming year to maximize their profit. Each of the 22 possible flights available are indicated in the table below (also available as an Excel sheet). Revenue is in thousands of dollars per day.

Flight #	From	To	Depart	Arrive	Revenue
1257	Seattle	San Francisco	8:00am	10:00am	37
2576	Seattle	Portland	9:30am	10:30am	20
8312	Seattle	San Francisco	9:30am	11:30am	25
1109	Seattle	San Francisco	12:00pm	2:00pm	27
3752	Seattle	San Francisco	2:30pm	4:30pm	23
2498	Seattle	Portland	3:00pm	4:00pm	18
8787	Seattle	San Francisco	5:00pm	7:00pm	29
8423	Seattle	Portland	6:30pm	7:30pm	27
7922	Portland	Seattle	9:00am	10:00am	20
5623	Portland	San Francisco	9:30am	11:00am	23
2448	Portland	San Francisco	11:00am	12:30pm	19
1842	Portland	Seattle	12:00pm	1:00pm	21
3487	Portland	Seattle	2:00pm	3:00pm	22
4361	Portland	San Francisco	4:00pm	5:30pm	29
4299	Portland	Seattle	6:00pm	7:00pm	27
1288	San Francisco	Seattle	8:00am	10:00am	32
3335	San Francisco	Portland	8:30am	10:00am	26
9348	San Francisco	Seattle	10:30am	12:30pm	24
7400	San Francisco	Seattle	12:00pm	2:00pm	27
7328	San Francisco	Portland	12:00pm	1:30pm	24
6386	San Francisco	Portland	4:00pm	5:30pm	28
6923	San Francisco	Seattle	5:00pm	7:00pm	32

The cost to lease a plane is \$30,000 per day and each flight can be covered only once (e.g. you can't have 2 planes cover flight #1257) and not all flights need to be covered. At the end of the day, an airplane might remain in the city where it landed on its last flight, or it can fly empty overnight to another city to be ready to start a flight from there the next morning, though this option costs \$5000.

At first, assume there is no turn-around time between flights so the next flight can begin as soon as the current flight ends. Example: a plane could travel from Seattle to Portland from 3-4 and then Portland to San Francisco from 4-5:30 (otherwise the airplane would wait until a later flight from that city.)

Note: The 22 nodes are already available in the excel document. I've also added an additional 72 potential "ground arcs" and 9 overnight arcs to save you the time. The basic concept is this: Let's say we have one plane. Let's choose the first flight from Seattle to SF, 8-10, the plane would then have to wait in SF from 10-10:30 for the next flight which happens to be back to Seattle, 10:30-12:30. The plane would then wait again, this time till 2:30. This is indicated through ground nodes: SEA1230-SEA1300 and SEA1300-SEA1330 and SEA1330-SEA1400 etc. (The ground nodes keep track of the planes location.) The constraints (you do this) of net flow and supply/demand are kept at zero—unlike the in-class example of a "1" at the start and a "-1" at the end. We want all nodes to be "flowed through," equal to zero.

Develop a network model for feasible routings of the flights and find the maximum profit for leasing one, two, three, four, five, six, and seven airplanes.

Repeat for a turnaround time of 60 minutes. (You'll have to relabel some of the "To" nodes).

Provide a brief report to NWF explaining their options along with an excel doc of support. Due Dec 13 at midnight. I'm available for assistance during class and I'll also be around for help during our scheduled final time: Tuesday, December 13 from 12-1:50.