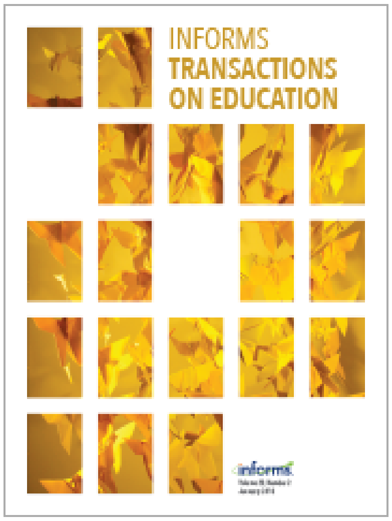

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Case Series

BlueSky Airlines: Network Revenue Management

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Case A

BlueSky flies three airplanes between Houston and three cities, Chicago, Miami, and Phoenix. These three cities are the *spokes* connected by the Houston *hub*. A few times each day the three airplanes fly from the spoke cities to Houston. They arrive simultaneously at Houston; connecting passengers change aircraft during a 45-minute layover, and the three airplanes depart for the spokes. One set of six flights (three inbound to Houston and three outbound) is called a *bank*. Each bank can serve passengers flying on 12 different *routes*: three inbound direct routes (Chicago-Houston or C-H, Miami-Houston or M-H, and Phoenix-Houston or P-H), three outbound direct routes (H-C, H-M, and H-P), and six routes requiring two flights each (C-M, C-P, M-C, M-P, P-C, and P-M).

BlueSky charges a single fee for a one-way coach-class ticket on each passenger route. Table 1 shows the prices charged by BlueSky. The marginal cost of flying a passenger on each route is virtually zero.

Each of the three airplanes currently has 240 coach seats. Table 2 shows demand for the routes in a bank; assume in this case that demand is known, with no uncertainty. From Table 2 we can see that passenger demand exceeds airplane capacity on every flight.

Table 1 **Price for Each Passenger Route**

	Destination			
Origin	Houston ($)	Chicago ($)	Miami ($)	Phoenix ($)
Houston	—	197	110	125
Chicago	190	—	282	195
Miami	108	292	—	238
Phoenix	110	192	230	—

Table 2 **Demand During One Bank**

	Destination				
Origin	Houston	Chicago	Miami	Phoenix	Total demand for flight to hub
Houston	0	123	80	110	—
Chicago	130	0	98	88	316 (C-H)
Miami	72	105	0	68	245 (M-H)
Phoenix	115	90	66	0	271 (P-H)
Total demand for flight to spoke	—	318 (H-C)	244 (H-M)	266 (H-P)	

For example, on the C-H flight, the total demand is the sum of demands for three passenger routes, C-H, C-M, and C-P, totaling $130+98+88=316$ passengers (this is the sum of the second row of Table 2). Because only 240 passengers can travel on the C-H flight, at least 76 passengers must be turned away.

When the total demand for a particular flight may be larger than the available capacity, an airline can decide whether to accept or reject an offer to buy a ticket for a particular route. Controlling sales in this way to maximize revenue is called *revenue management*. For example, BlueSky may decide that it is optimal to sell large numbers of tickets for the C-H and C-M routes, but might severely restrict the number of C-P tickets sold. Given the data above, BlueSky might sell tickets for 130 C-H routes, 98 C-M routes, and only 12 C-P routes, thus filling all 240 seats on the C-H flight.

Build a model to determine the number of tickets to sell for each route. The objective is to maximize revenues over a single bank. The tables above are available in *BlueSky Network Data.xls*.[1]

[1] This Excel spreadsheet file can be found and downloaded from http://ite.pubs.informs.org.

Case B

Frequently other airlines offer to pay BlueSky to fly passengers on its planes (this is one purpose of an alliance among airlines). For example, Air France often flies passengers from Paris to Miami. A few of Air France's passengers then go on from Miami to Houston, while other passengers are headed to Chicago.

(1) Air France asks BlueSky to reserve five seats on BlueSky's flights from Miami to Houston, to be used for connecting Air France passengers. Air France offers to pay $104 per seat. Should BlueSky accept the offer?

(2) In addition to the offer in (1), Air France offers BlueSky $285 per seat to reserve 10 seats for passengers traveling from Miami to Chicago. Should BlueSky accept this offer?

Case C

BlueSky is replacing the three aircraft that fly in and out of its Houston hub. It plans to purchase the three new aircraft from the Airbus A330/A340 family. BlueSky has already decided to configure the three aircraft with only coach seats and no first-class cabin, but the airline has not yet decided on the size of the aircraft. The A330/A340 family comes in a wide range of sizes, from 240 to 380 coach seats.

To decide on an aircraft size, BlueSky must consider both the cost and revenue implications. On the cost side, a larger aircraft is more expensive to purchase and more costly to operate. The purchasing terms and performance data show that the total cost of one flight from, say, Houston to Miami, includes a fixed cost of $12,000 and an additional cost of $40 *per seat*. These numbers are calculated from all costs associated with the flight, including fuel, labor, and maintenance. The cost parameters for the other five flights in each bank in and out of Houston are nearly identical because all six flights are approximately the same length.

(1) Assume that BlueSky purchases three identical aircraft. How many coach seats should BlueSky order for the three new aircraft?

(2) Now suppose that the three aircraft can be different sizes, between 240 and 380 coach seats.

(a) How do you think the three aircraft should be allocated among the six routes? In other words, should the same aircraft always fly the same routes? Why or why not? (Hint: You do not need an optimization model to answer this question).

(b) How many coach seats should BlueSky order for each of the three new aircraft?

(3) Because it is cheaper to manufacture three identical planes, Airbus is offering BlueSky a one-time, $5 million discount if it will order three identical aircraft. Should BlueSky take the discount? In deciding this, you may assume that BlueSky operates 3 banks per weekday through Houston, and that the revenues and demands for every bank on every weekday are equal to the demands in Tables 1 and 2 of the (A) Case.