END5504: Evolutionary Algorithms

Example 1 (Nonlinear-Pricing Models):

Suppose you sell Menthos candy. Most people value the first pack of Menthos they purchase more than the second pack. They also value the second pack more than the third pack, and so on. How can you take advantage of this when pricing Menthos? If you charge a single price for each pack of Menthos, only a few people are going to buy more than one or two packs. Alternatively, however, you can try the two-part tariff approach, where you charge an “entry fee” to anyone who buys Menthos, plus a reduced price per pack purchased. For example, if a reasonable single price per pack is \$1.10, then a reasonable two-part tariff might be an entry fee of \$1.50 and a price of \$0.50 per pack. This gives some customers an incentive to purchase many packs of Menthos. Because the total cost of purchasing n packs of Menthos is no longer a linear function of n- it is now piecewise linear - the two-part tariff is a nonlinear pricing strategy.

As usual with pricing models, the key input is customer sensitivity to price. Rather than having a single demand function, however, we now assume that each customer has a unique sensitivity to price. To keep the example fairly small, we assume that four typical customers from the four market segments for the product have been asked what they would pay for each successive pack of Menthos. For example, customer 1 is willing to pay \$1.24 for the first pack of Menthos, \$1.03 for the second pack, and only \$0.35 for the tenth pack. These four customers are considered representative of the four market segments. If it costs \$0.40 to produce a pack of Menthos, determine a profit-maximizing single price and a profit-maximizing two-part tariff. Assume that the four market segments have 10,000, 5000, 7500, and 15,000 customers, respectively, and that the customers within a market segment all respond identically to price.

Example 2 (Combinatorial Models):

A gas truck contains five compartments with the capacities listed in Table 8.1. Three products must be shipped on the truck, and there can be only one product per compartment. The demand for each product, the shortage cost per gallon, and the maximum allowable shortage for each product are listed in Table 8.2. How should the truck be loaded to minimize the shortage costs?

Compartment	Capacity
1	2,700
2	2,800
3	1,100
4	1,800
5	3,400

Table 2.1: Problem Data

Product	Demand	Max Shortage Allowed	Cost per Gallon Short
1	2,900	900	$10
2	4,000	900	$8
3	4,900	900	$6

Table 2.2: Problem Data

Example 3 (Discriminant Analysis):

Consider the annual income and size of investment portfolio (both in thousands of dollars) for 16 people. It also indicates whether or not each of these people subscribes to the Wall Street Journal. Using income and size of investment portfolio, determine a classification rule that maximizes the number of people correctly classified as subscribers or nonsubscribers.

Example 4 (TSP):

Willie Lowman is a salesman who lives in Boston. He needs to visit each of the cities listed in Table 4 and then return to Boston. What route should Willie use to minimize the total distance traveled?

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
Boston	0	983	1815	1991	3036	1539	213	2664	792	2385	2612
Chicago	938	0	1205	1050	2112	1390	840	1729	457	2212	2052
Dallas	1815	1205	0	801	1425	1332	1604	1027	1237	1034	2404
Denver	1991	1050	801	0	1174	2057	1780	836	1411	1765	1373
Los Angeles	3036	2112	1425	1174	0	2757	2825	398	2456	403	1919
Miami	1539	1390	1332	2057	2757	0	1258	2359	1250	3097	3389
New York	213	840	1604	1780	2825	1258	0	2442	386	3063	2900
Phoenix	2664	1729	1027	836	398	2359	2442	0	2073	800	1482
Pittsburgh	792	457	1237	1411	2456	1250	386	2073	0	2653	2517
San Francisco	2385	2212	1034	1765	403	3097	3063	800	2653	0	817
Seattle	2612	2052	2404	1373	1919	3389	2900	1482	2517	817	0

Table 4: Problem Data