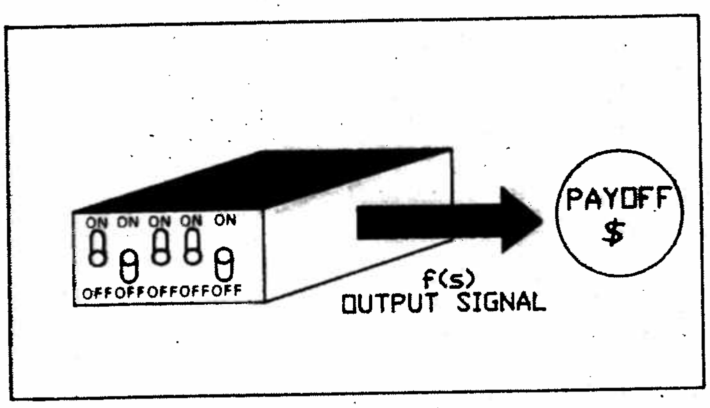

FIGURE 1.6 A black box optimization problem with five on-off switches illustrates the idea of a coding and a payoff measure. Genetic algorithms only require these two things: they don't need to know the workings of the black box.

TABLE 1.2 A Genetic Algorithm by Hand

String No.	Initial Population (Randomly Generated)	x Value (Unsigned Integer)	$f(x)$	pselect$_i$ $\frac{f_i}{\Sigma f}$	Expected count $\frac{f_i}{\bar{f}}$	Actual Count from Roulette Wheel
1	0 1 1 0 1	13	169	0.14	0.58	1
2	1 1 0 0 0	24	576	0.49	1.97	2
3	0 1 0 0 0	8	64	0.06	0.22	0
4	1 0 0 1 1	19	361	0.31	1.23	1
Sum			1170	1.00	4.00	4.0
Average			293	0.25	1.00	1.0
Max			576	0.49	1.97	2.0

TABLE 1.2 (*Continued*)

Mating Pool after Reproduction (Cross Site Shown)	Mate (Randomly Selected)	Crossover Site (Randomly Selected)	New Population	x Value	$f(x)$
0 1 1 0 | 1	2	4	0 1 1 0 0	12	144
1 1 0 0 | 0	1	4	1 1 0 0 1	25	625
1 1 | 0 0 0	4	2	1 1 0 1 1	27	729
1 0 | 0 1 1	3	2	1 0 0 0 0	16	256
					1754
					439
					729

Inversion:

Inside of a string, randomly select two cities and flip them around

A: 9 8 4 2 3 10 1 6 5 7

A': 9 1 4 2 3 10 8 6 5 7

<u>PMX (Partially Matched Crossover):</u>

A: 9 8 4 | 5 6 7 | 1 3 2 10
B: 8 7 1 | 2 3 10 | 9 5 4 6

exchange 2 <-> 5
6 <-> 3
7 <-> 10

resulting in:

A’: 9 8 4 | 2 3 10 | 1 6 5 7
B’: 8 10 1 | 5 6 7 | 9 2 4 3

Greedy Mutation:

1. Pick two cities at random
2. Switch them, if the new tour is shorter than the old one.

Greedy Crossover (Grefenstette):

A: 9 8 4 5 6 7 1 3 2 10
B: 8 7 1 2 3 10 9 5 4 6

Create a child by doing the following:

1) Pick a start city at random
2) Look at successor cities in both parents
3) Pick the one with the lower distance
4) If the selected city creates a cycle, pick the one from the other parent
5) If the selected city creates a cycle, pick a non-selected city at random
6) Goto (2)