Neighborhood structures

a two-step approach is employed to apply neighborhood structures to a solution encoding. First, a randomly generated binary number is assigned to each segment. If the assigned number is one, then a neighborhood structure is applied to that segment otherwise, no change is applied. For example, in below figure we either select plants or warehouses randomly.

Suppliers 0						Plants 1						Warehouses 1						Distribution centers 0			
1	0	1	1	0	1	0	0	1	1	1	1	0	1	0	1	1	0	1	1	0	0

Fig. solution representation

Shaking structures

- Move/inversion operator: A subsequence of cells is selected, inversed, and moved to a new position. For instance,

Suppliers						Plants						Warehouses						Distribution centers			
1	0	1	1	0	1	0	0	1	1	1	1	0	1	0	1	1	0	1	1	0	0

Suppliers						Plants						Warehouses						Distribution centers			
1	0	1	1	0	1	0	0	1	1	1	1	0	1	1	1	0	0	1	1	0	0

- Multiple swaps: Values of pairs of randomly selected cells are exchanged for a specific number of iterations. For instance,

Suppliers						Plants						Warehouses						Distribution centers			
1	0	1	1	0	1	0	0	1	1	1	1	0	1	0	1	1	0	1	1	0	0

Suppliers						Plants						Warehouses						Distribution centers			
1	0	1	1	0	1	0	0	1	1	1	1	1	0	1	0	0	1	1	1	0	0

Local search

- Two-exchange operator: Two cells are selected from selected segment (echelon). One has value 1 and the second is zero and then their values are exchanged.
- Adjacent swap operator: One cell is selected randomly and replaced with its nearest adjacent cell.