

## Traveling Salesman Problem (TSP)

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Given a graph  $G = (N, A)$  with set of nodes  $N$  and set of arcs  $A = \{(i, j); i, j \in N\}$  with arc traversal cost  $c_{ij}; (i, j) \in A$ , the objective is to develop a least cost route visiting every node exactly once.  $\forall$

$$\min z = \sum_{(i,j) \in A} c_{ij} x_{ij}$$

Subject to,

Service constraint,

$$\sum_{i \in T_j} x_{ij} = 1 \quad \forall j \in N$$

Flow constraint,

$$\sum_{i \in T_j} x_{ij} = \sum_{k \in H_j} x_{jk} \quad \forall j \in N$$

Sub-tour elimination constraint,

$$\sum_{(i,j) \in S} x_{ij} \leq |S| - 1 \quad \forall S \subset N, |S| \geq 2$$

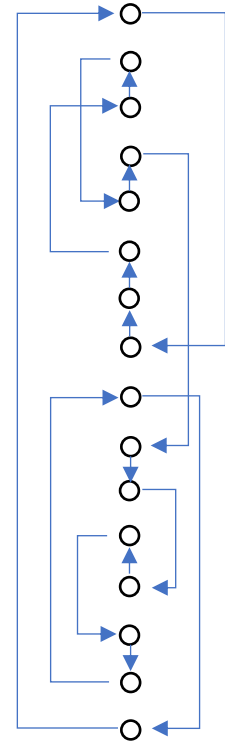
Binary constraint,

$$x_{ij} \in \{0,1\} \quad \forall (i,j) \in A$$

Where,

$$T_j = \{i; (i,j) \in A\}$$

$$H_j = \{k; (j,k) \in A\}$$



**Fig.** A typical TSP solution

