

Branch and Bound Technique

- **Branch and bound** is an algorithm design paradigm which is generally used for solving minimization problems.
- It is similar to the backtracking since it also uses the state space tree.
- The branch and bound algorithm create branches and bounds for the best solution.

Basic Terminologies:

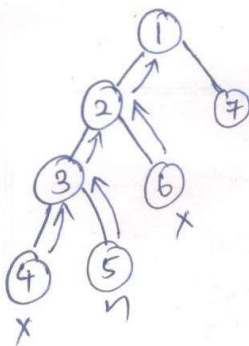
- **Live Node:** A node which has been generated and all of whose children have not yet been generated is called a live node.
- **E-Node:** The live node whose children are currently being generated is called E-node (node being expanded).
- **Dead Node:** A dead node is generated node which has not to be expanded further or all of whose children have been generated.

Types:

The Branch and Bound method can be classified into three types based on the order in which the state space tree is searched.

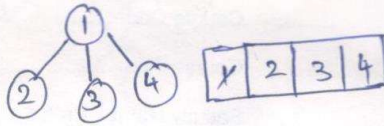
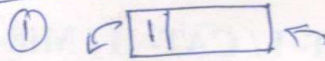
1. FIFO B&B – Queue data structure is used select next E-node.
 2. LIFO B&B – Stack data structure is used select next E-node.
 3. Least Cost (LC) B&B – Node with minimum cost is selected as next E-node.
- By using cost function, we calculate cost of each node in the state space tree of B&B.
 - In both FIFO and LIFO B&B, the selection of next E-node is rigid and blind (i.e.) it is based on queue and stack data structure respectively. But in LC B&B, next E-node selection is based on cost. Minimum cost node will be selected as E-node.

Backtracking

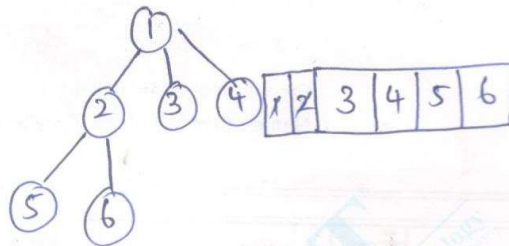


Branch and Bound

FIFO → Queue

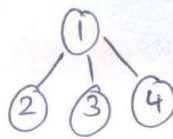
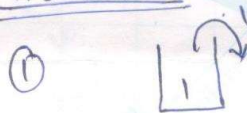


Enode = 1
Live nodes = 2, 3, 4

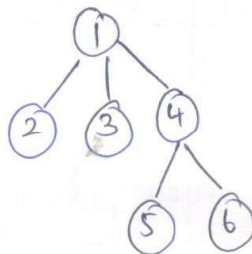


Enode = 2
Live nodes = 5, 6

LIFO → Stack

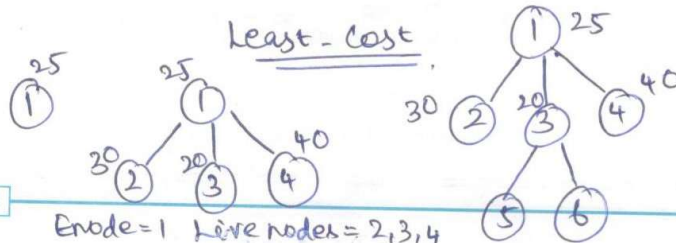


Enode = 1
Live nodes = 2, 3, 4



Enode = 4
Live nodes = 2, 3, 5, 6

Least-Cost



Enode = 3
Live nodes = 2, 5, 6, 4