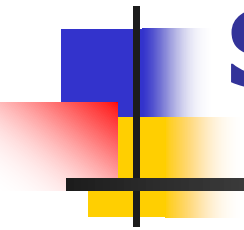
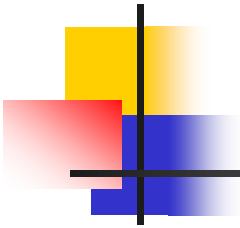


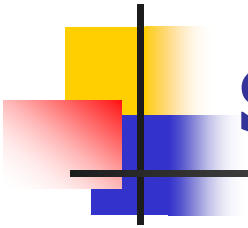
# Branch and Bound Searching Strategies

# Introduction: Feasible Solution vs. Optimal Solution

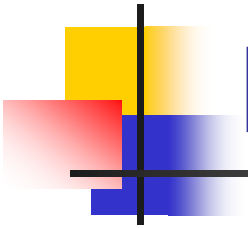


- DFS, BFS, hill climbing and best-first search can be used to solve some searching problem for searching a feasible solution.
- However, they cannot be used to solve the optimization problems for searching an (the) optimal solution.

# The branch-and-bound strategy

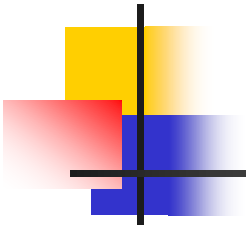


- This strategy can be used to solve optimization problems without an exhaustive search in the average case.



# Branch-and-bound strategy

- 2 mechanisms:
  - A mechanism to generate branches when searching the solution space
  - A mechanism to generate a bound so that many braches can be terminated

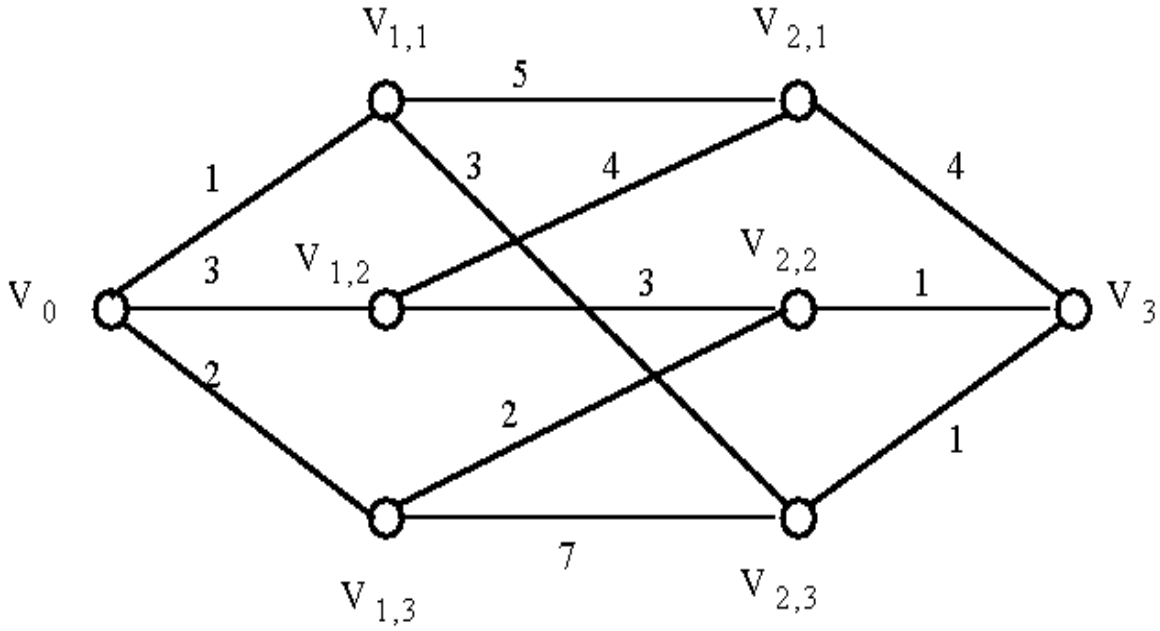


# Branch-and-bound strategy

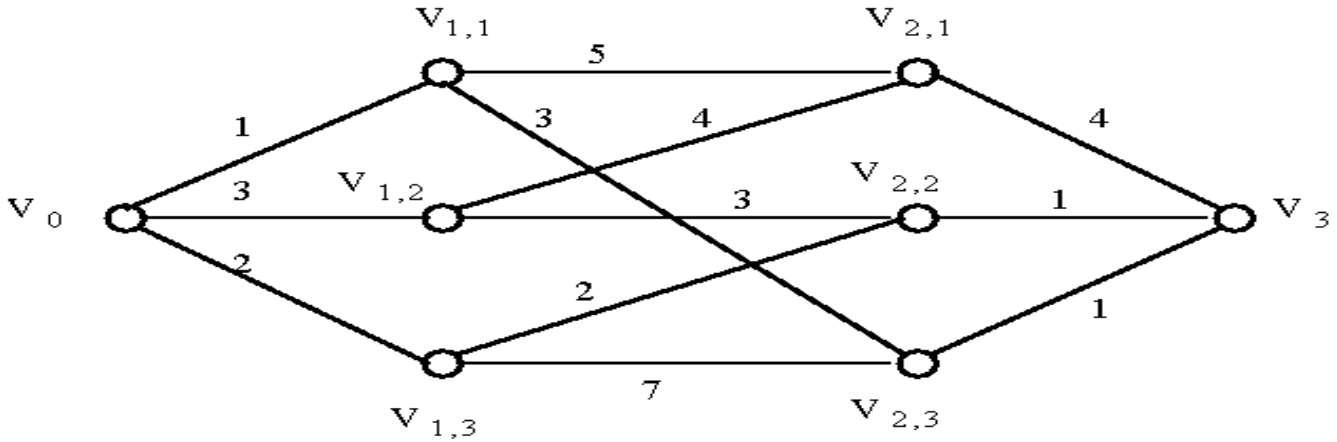
- It is efficient in the average case because many branches can be terminated very early.
- Although it is usually very efficient, a very large tree may be generated in the worst case.
- Many NP-hard problem can be solved by B&B efficiently in the average case; however, the worst case time complexity is still exponential.

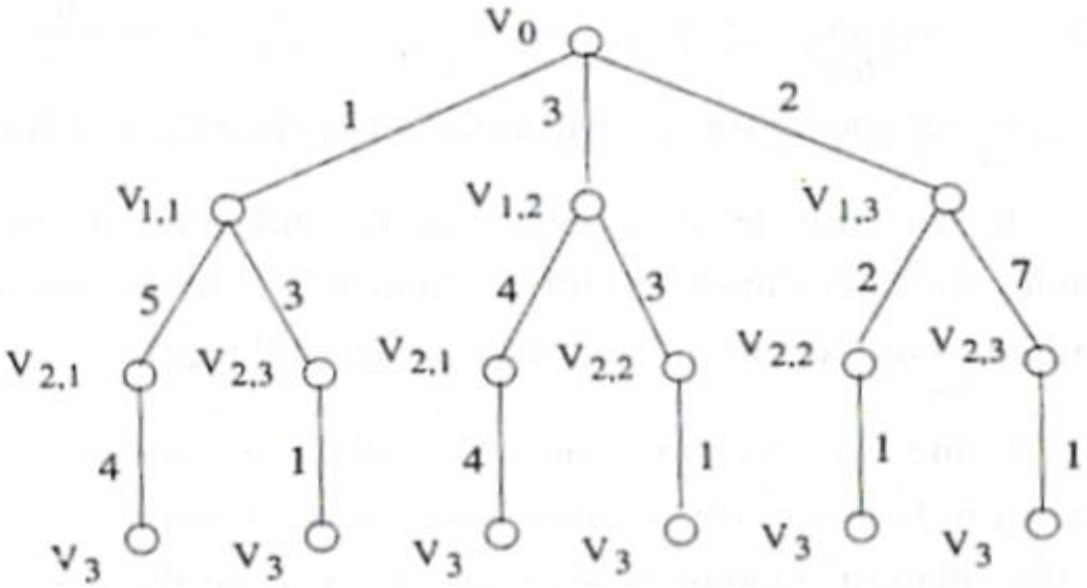
# A Multi-Stage Graph Searching Problem.

Find the shortest path from $V_0$ to $V_3$

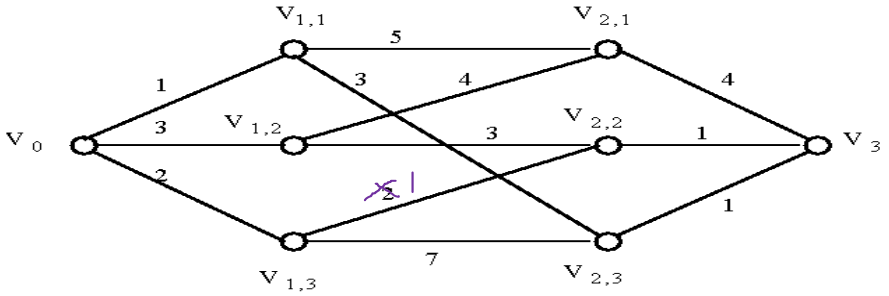


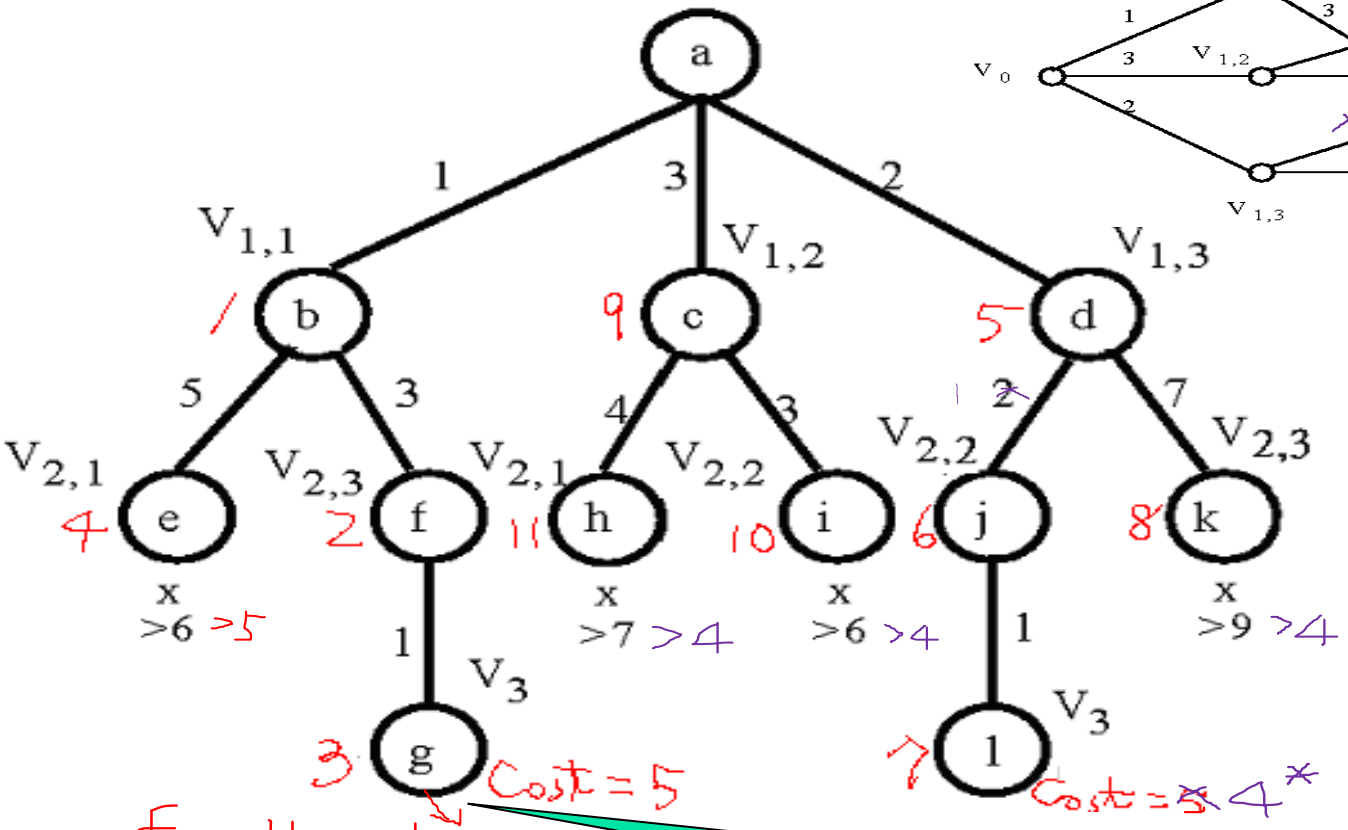
# E.G.:A Multi-Stage Graph Searching Problem



# Solved by branch-and-bound (hill-climbing with bounds)



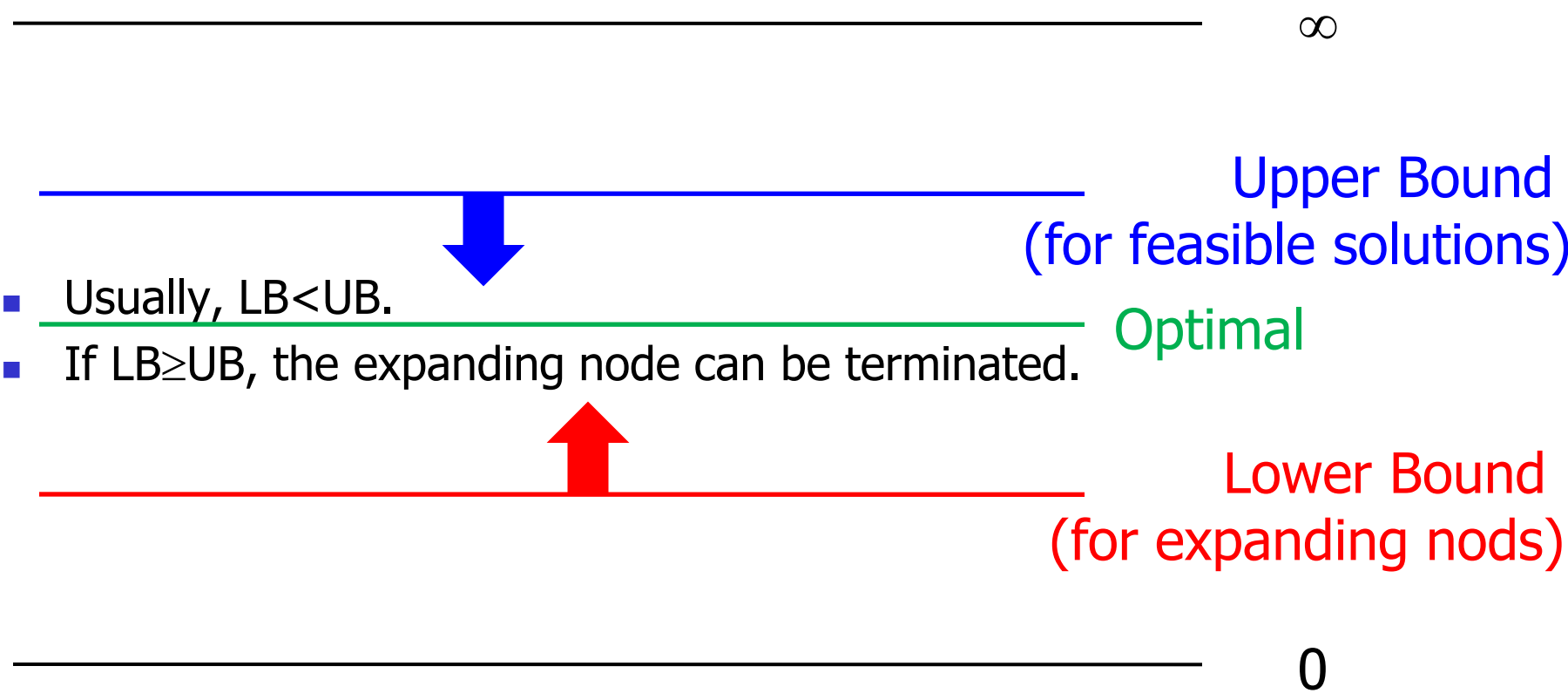




#: checking & expanding order

Feasible solution (upper bound)

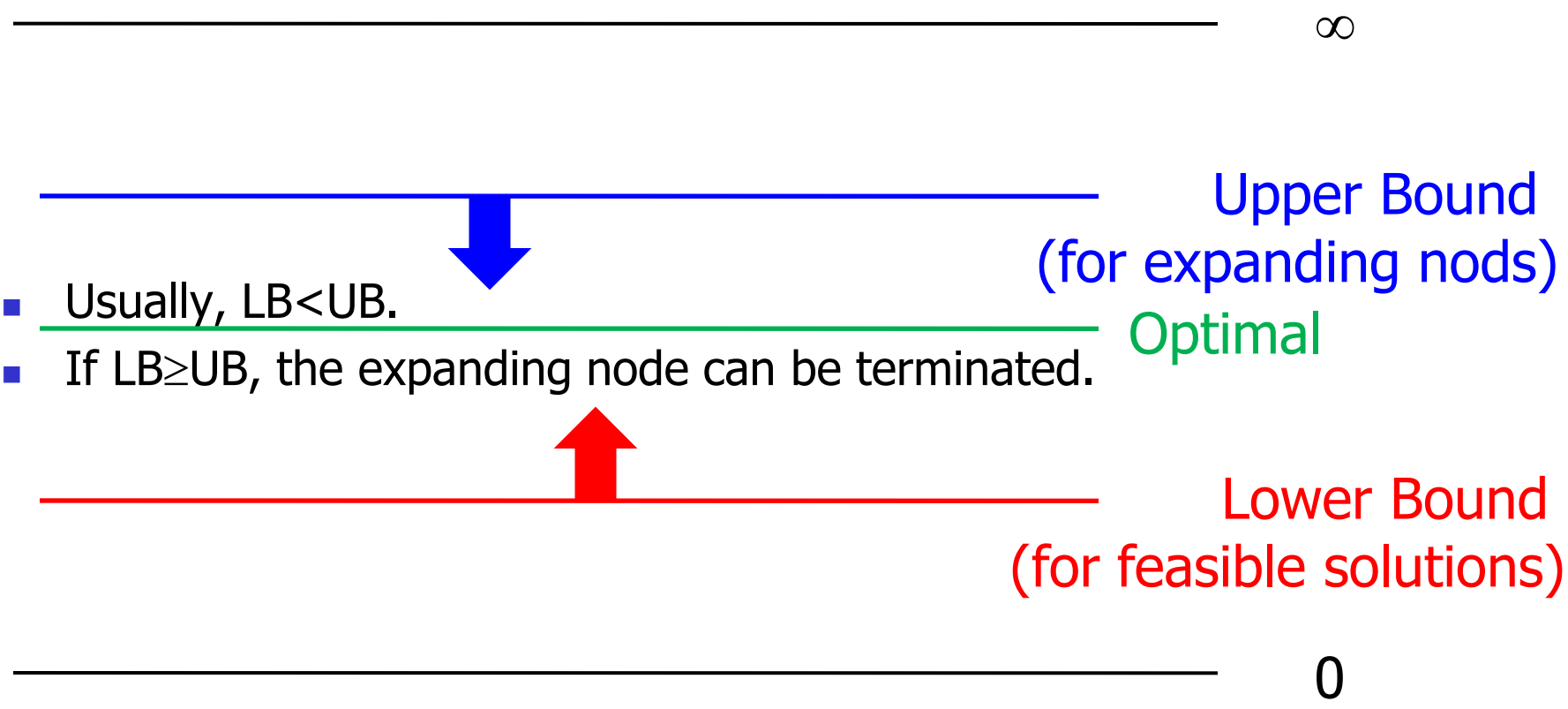
**A feasible solution is found whose cost is equal to 5.**
**An upper bound of the optimal solution is first found here.**

# For Minimization Problems

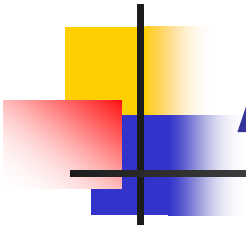



- Usually, LB<UB.
- If LB≥UB, the expanding node can be terminated.

# For Maximization Problems




- Usually, LB<UB.
- If LB≥UB, the expanding node can be terminated.

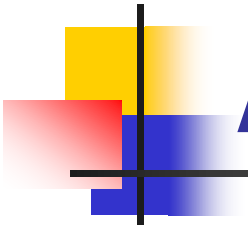


# Application

- Integer programming
- Nonlinear programming
- Nearest neighbour search
- Set inversion
- False noise analysis

# Scope of research

- A Branch and Bound Method for Optimization Problems with Fuzzy Number



# Assignment

Q.1)What is the difference between Branch & Bound method and Backtracking?

Q.2)How muli-stage graph searching problem is solved using branch & bound method?