**Exercise 1 (08 pts):** A farmer with a wolf, a goat, and a cabbage must cross a river by boat. The boat can carry only the farmer and a single item. If left unattended together, the wolf would eat the goat, or the goat would eat the cabbage. How can they cross the river without anything being eaten?

- Solve the problem by providing the Breadth-First solution tree, given that the problem states are represented by two sets, W and E, each containing the items on the West and East riverbanks.

- Initial state: W={Farmer, Goat, Wolf, Cabbage}, E={}
- Goal state: W={}, E={Farmer, Goat, Wolf, Cabbage}
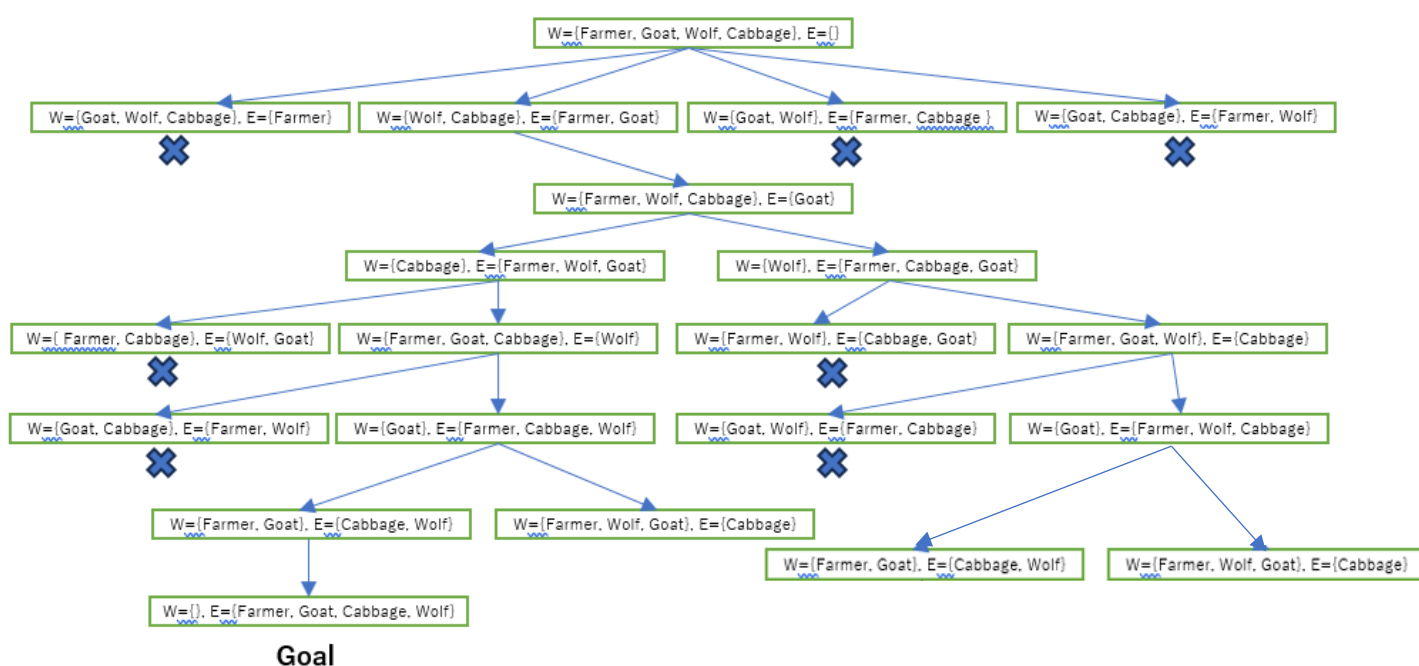
Exercise 2 (12 pts): Given the following search tree in which each node is annotated with a utility value (where utility ≈ evaluation score):
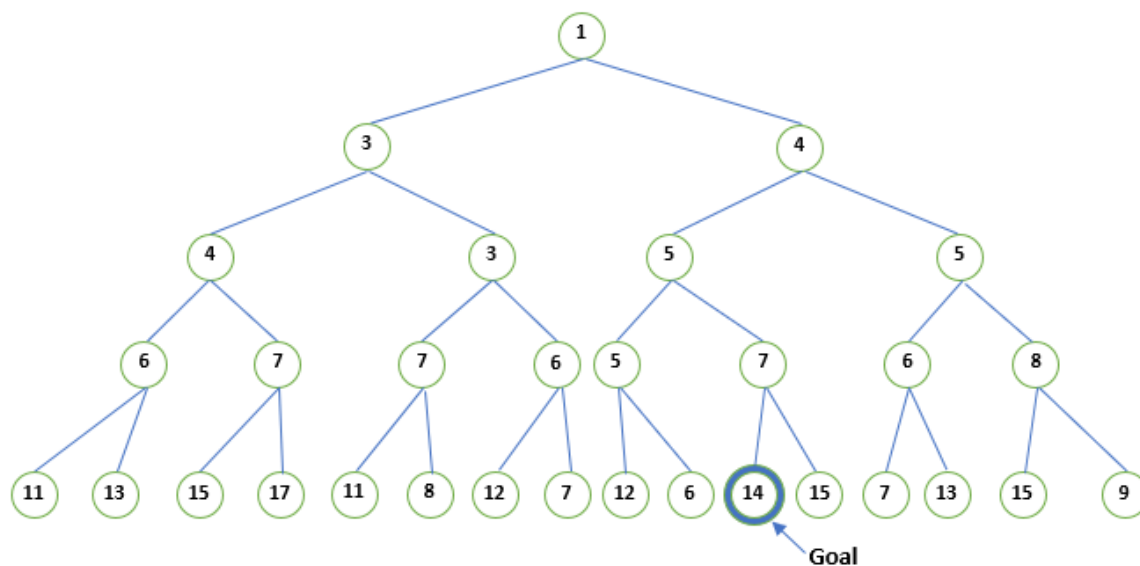
1) Perform an Iterative Depth-First Search (IDFS). For each iteration, present a separate tree diagram that illustrates the progress of the search.
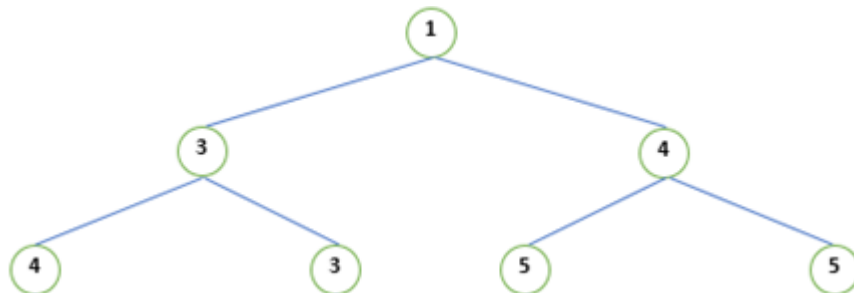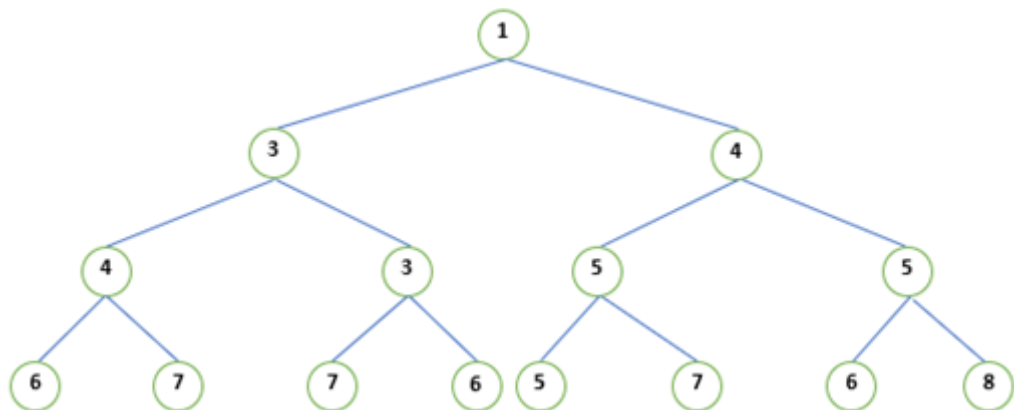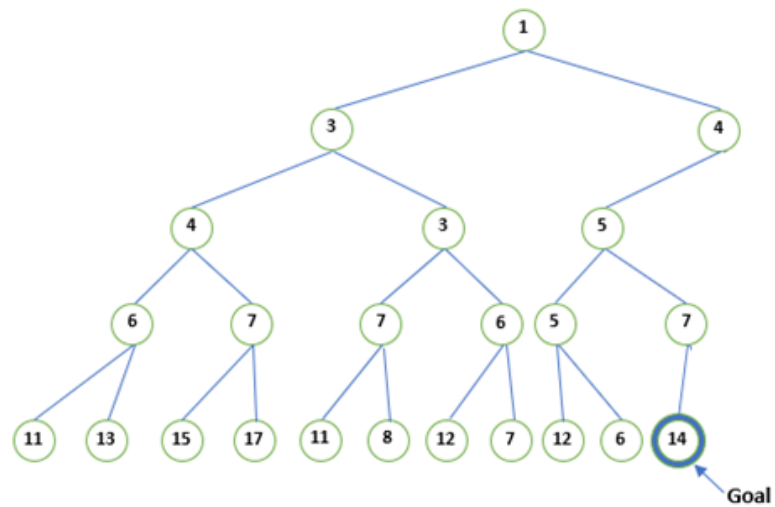
Iteration 1: D = 0

Iteration 2: D = 1

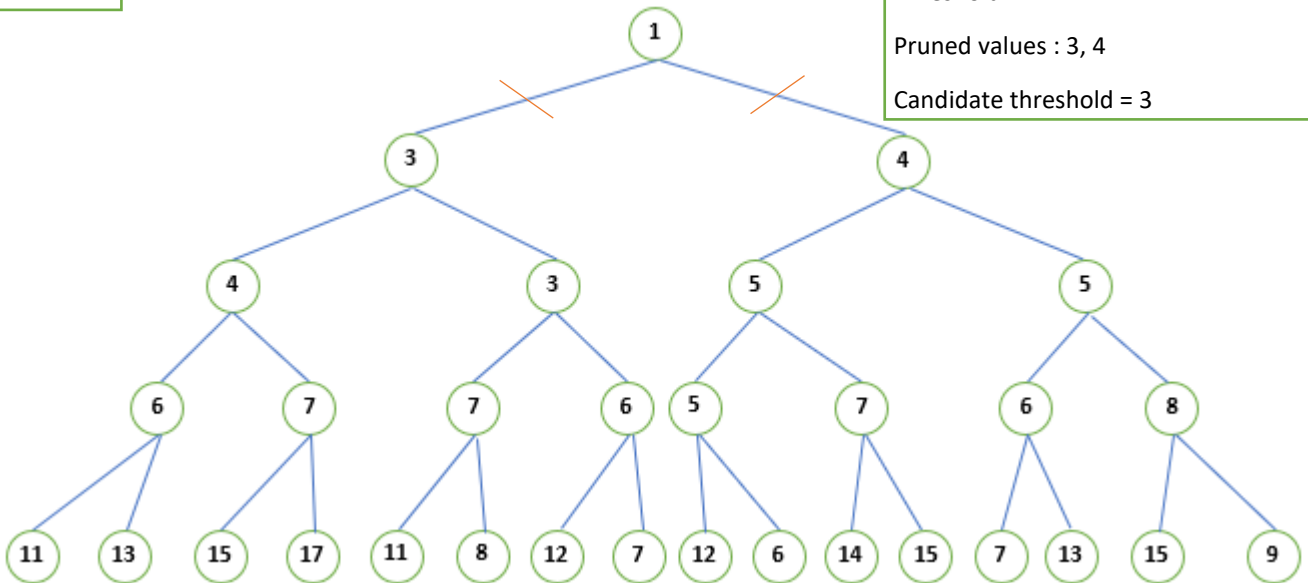Iteration 3: D = 2

Iteration 4: D = 3

Iteration 5: D = 4

2) Execute an Iterative Deepening A* (IDA*) Search (Minimizing version). For each iteration, provide a separate tree diagram and clearly indicate: the current threshold, the pruned values, and the candidate threshold.

Iteration 1

Threshold = 1

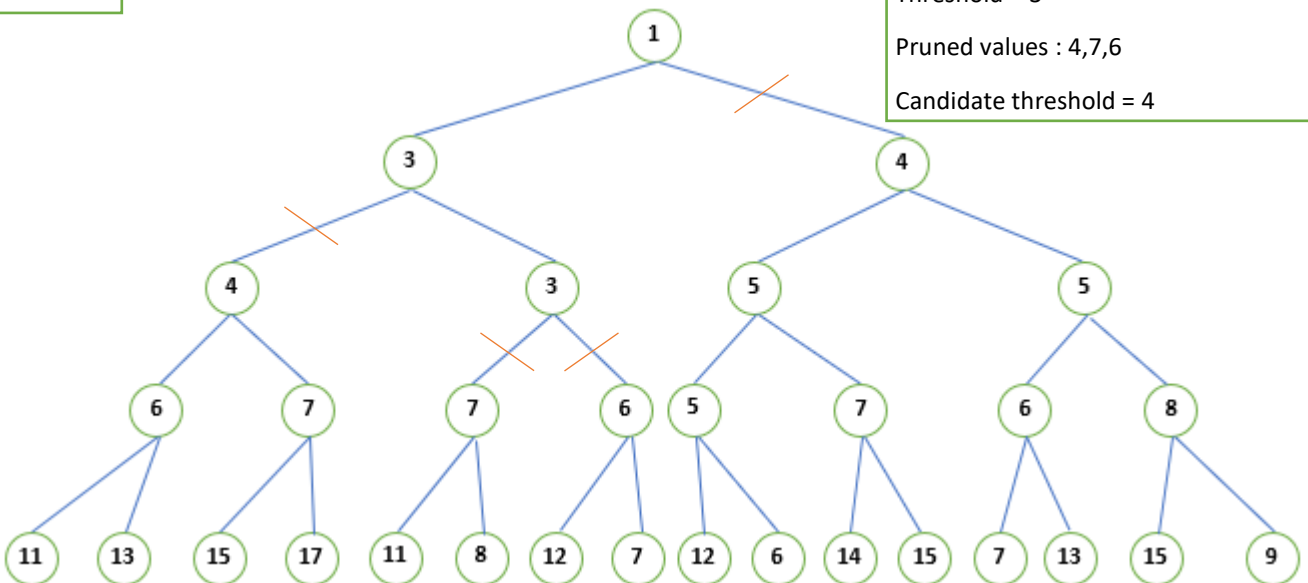Pruned values : 3, 4

Candidate threshold = 3

Tree (root = 1):
- 1
  - 3
    - 4
      - 6 → 11, 13
      - 7 → 15, 17
    - 3
      - 7 → 11, 8
      - 6 → 12, 7
  - 4
    - 5
      - 5 → 12, 6
      - 7 → 14, 15
    - 5
      - 6 → 7, 13
      - 8 → 15, 9

Iteration 2

Threshold = 3

Pruned values : 4,7,6

Candidate threshold = 4

Tree (root = 1):
- 1
  - 3
    - 4
      - 6 → 11, 13
      - 7 → 15, 17
    - 3
      - 7 → 11, 8
      - 6 → 12, 7
  - 4
    - 5
      - 5 → 12, 6
      - 7 → 14, 15
    - 5
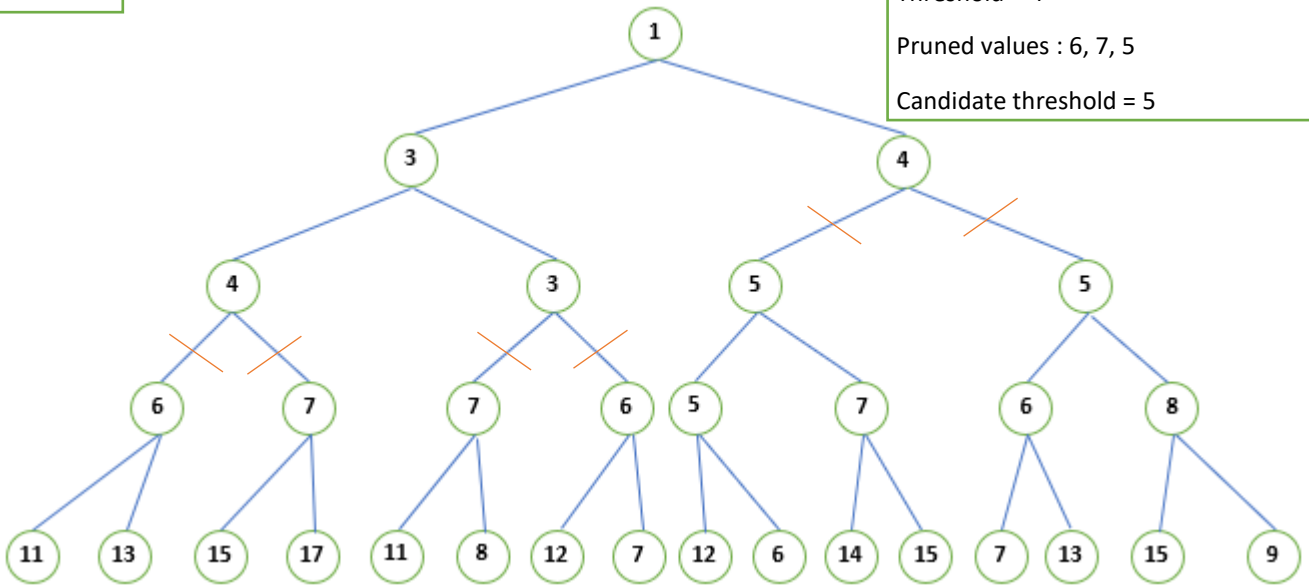   - 6 → 7, 13
      - 8 → 15, 9

Iteration 3

Threshold = 4

Pruned values : 6, 7, 5

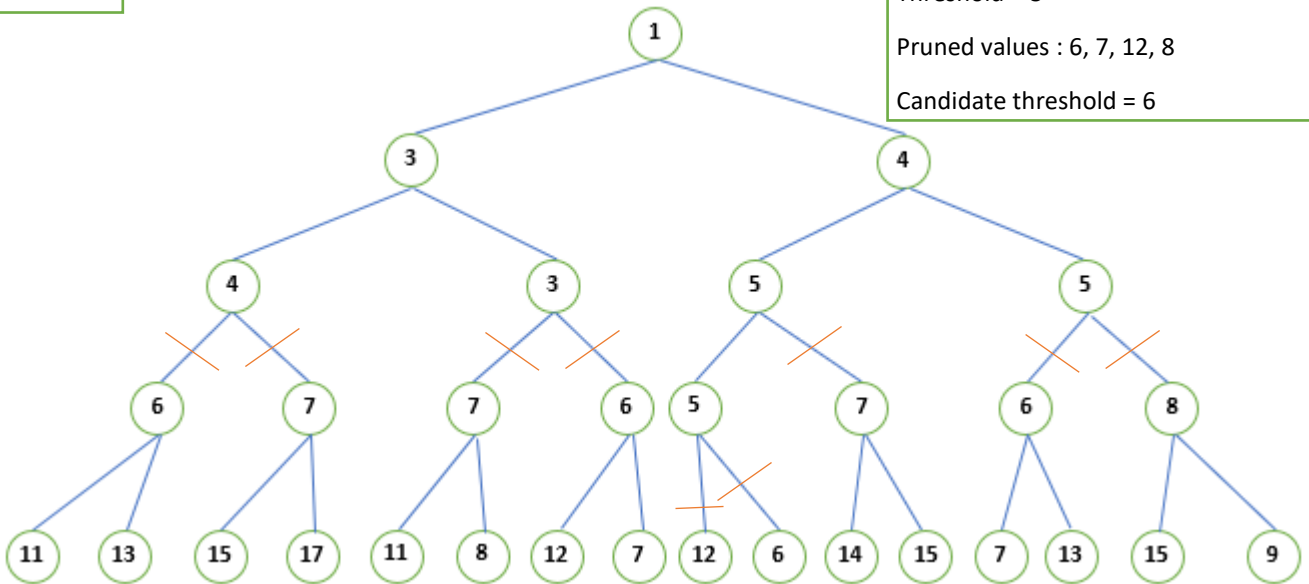Candidate threshold = 5

Iteration 4

Threshold = 5

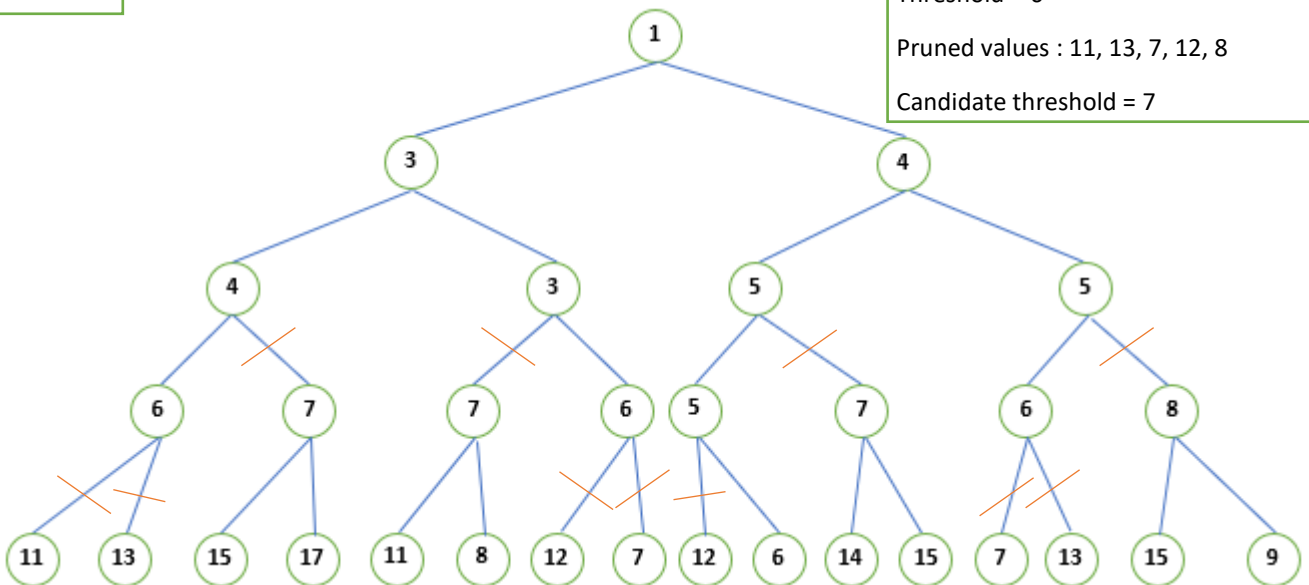Pruned values : 6, 7, 12, 8

Candidate threshold = 6

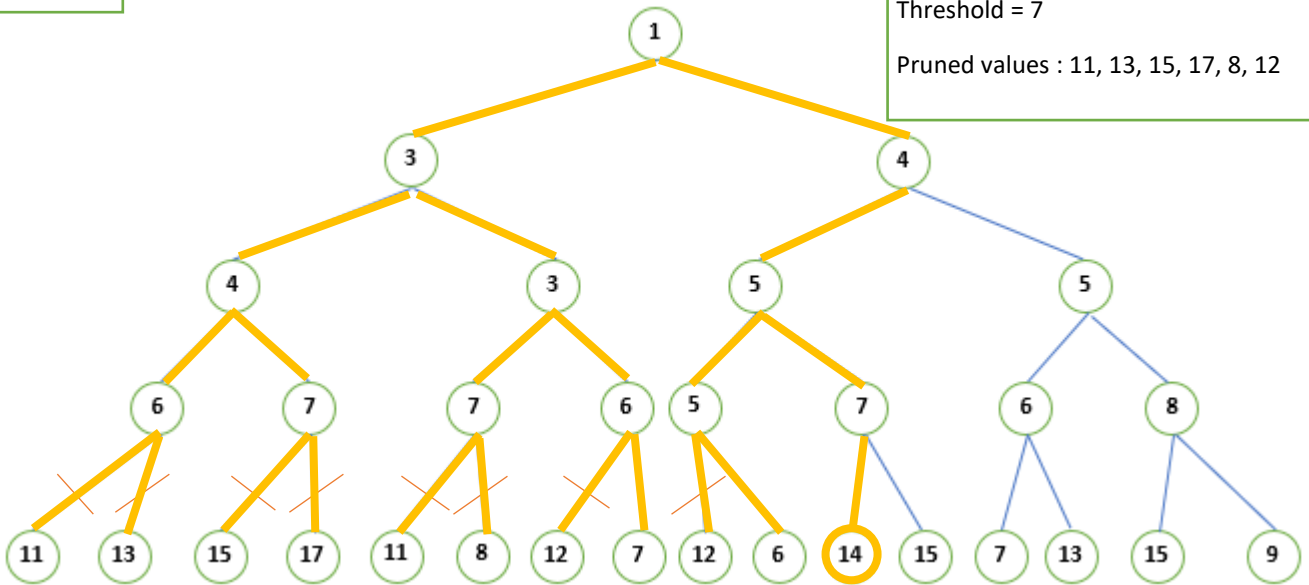**Iteration 5**

Threshold = 6

Pruned values : 11, 13, 7, 12, 8

Candidate threshold = 7

Iteration 6

Threshold = 7

Pruned values : 11, 13, 15, 17, 8, 12