Consider the search problem defined by:

- State space: {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18}

- Initial state: 1

- Goal states: 10, 12 and 17

- Successor function:

* 1 🡪 {2, 3, 4} [Meaning that state 1 has three successors: states 2, 3 and 4]
* 2 🡪 {5, 6}
* 3 🡪 {7, 8}
* 4 🡪 {9, 10}
* 5 🡪 {11}
* 6 🡪 {12, 13}
* 7 🡪 {14, 15, 16}
* 8 🡪 {17, 18}
* 9 🡪 {} [Meaning that state 9 has no successor]
* 10 🡪 {}
* 11 🡪 {}
* 12 🡪 {}
* 13 🡪 {}
* 14 🡪 {}
* 15 🡪 {}
* 16 🡪 {}
* 17 🡪 {}
* 18 🡪 {}

1. Give the sequence of states generated by a search algorithm using:
   * 1. Breadth-first strategy?
     2. Depth-first strategy?
     3. Iterative deepening strategy?

[Notes:

- Note that each state can be attained in a single way. So, for each state there is at most one node in the search tree. So, identify a node with its state.

- A node is generated when it is “inserted” in the fringe

- In each of the 3 questions, assume that the nodes are inserted in the fringe (at the front or at the end) according to the ordering shown in the rules above.

- In this question 1, assume that the search algorithm checks whether a node N is a goal node when it inserts it in the fringe (not when it removes it from the fringe).

- Give the 3 sequences of states without explanation.]

**Your answer:**

i. {1,2,3,4,5,6,7,8,9,10}

ii. {1,2,5,11,6,12}

iii. {1,2,3,4,5,6,7,8,9,10}

1. The search algorithm now uses a best-first strategy. Let the cost of each edge in the search tree be 1, and the heuristic function be h(N) defined in the following table:

|  |  |
| --- | --- |
| N | h(N) |
| 1 | 1.5 |
| 2 | 1.5 |
| 3 | 0.8 |
| 4 | 0.5 |
| 5 | 1 |
| 6 | 0.5 |
| 7 | 2 |
| 8 | 0.5 |
| 9 | 2 |
| 10 | 0 |
| 11 | 2 |
| 12 | 0 |
| 13 | 2 |
| 14 | 2 |
| 15 | 2 |
| 16 | 2 |
| 17 | 0 |
| 18 | 2 |

Is the function h admissible? Consistent? Why?

**Your answer:**

1. Assuming that h is admissible, give the sequence of states generated by A\* until a solution is found. [For the algorithm to be A\*, it must test whether a node is a goal node only when it removes it from the fringe, so make this change.]

**Your answer:**

{1,4,9,10}