Assignment No. 6: Multi-way Trees

Transforms between different representations

Allocated time: 2 hours

Implementation

The correct and efficient implementation of linear complexity algorithms is required for transforming multi-way trees between the following representations:

> **R1**: *Parent representation*: for each index, the value in the vector represents the parent's index, e.g.: $\Pi = \{2,7,5,2,7,7,-1,5,2\}$
>
> **R2**: *Multi-way tree representation*: each node contains the key and a vector of child nodes.
>
> **R3**: *Binary representation*: each node contains the key and two pointers, one to the first child and the second to the right sibling (e.g., the next sibling).

Therefore, you need to define transformation **T1** from the parent representation (**R1)** to the multi-way tree representation (**R2**), and then the transformation **T2** from the multi-way tree representation (**R2**) to the binary representation (**R3**). For all representations (**R1**, **R2**, **R3**), you need to implement the Pretty Print (**PP**) display (see page 2).

Define the data structures. You can use intermediate structures (e.g., additional memory).

Requirements

1. **Pretty-print for R1 (5p)**

2. **Correct implementation for *T1* and pretty-print for *R2* (1p) + *T1* in linear time (1p)**

3. **Correct implementation for *T2* and pretty-print for *R3* (2p) + *T2* in linear time (1p)**

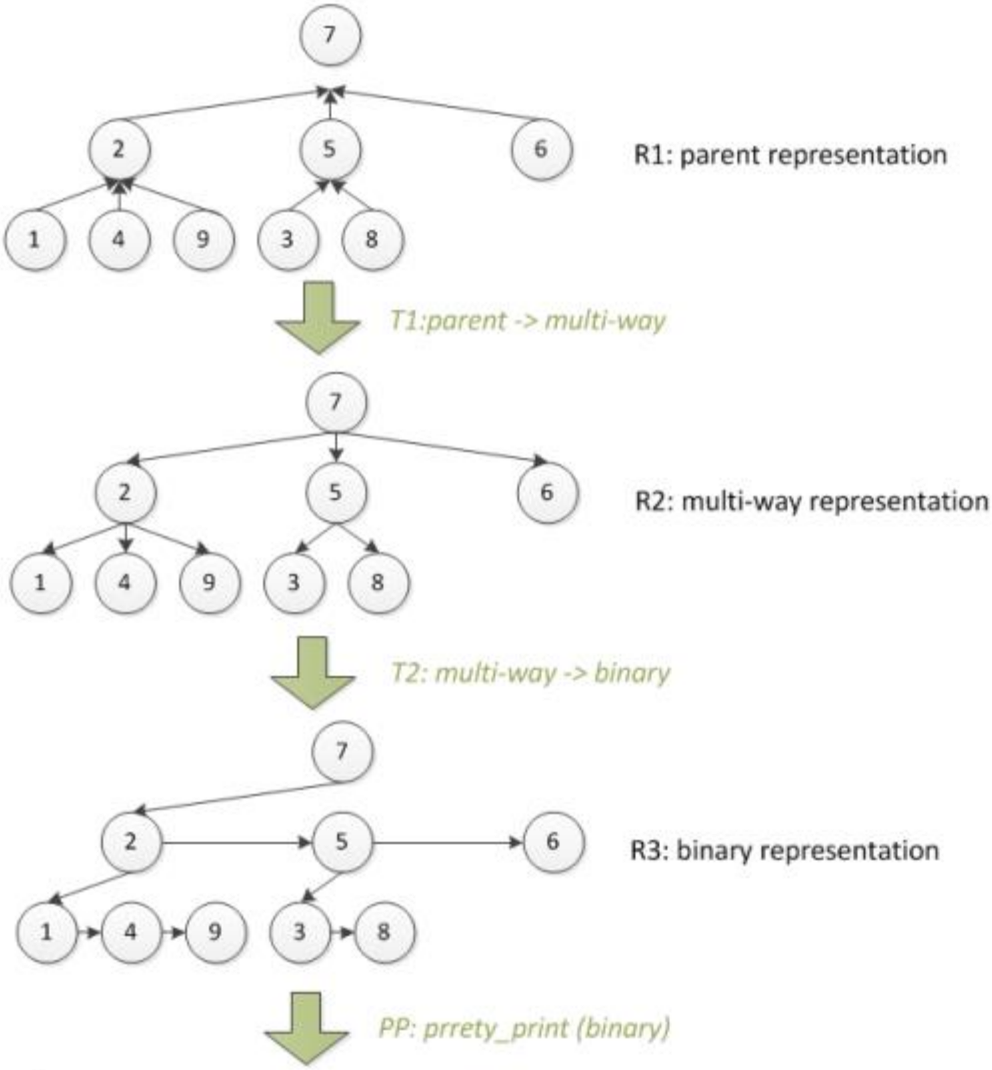
The correctness of the algorithms should be demonstrated using the example from **R1** (*Π*). Use Pretty Print for all three representations.

Explain the data structures you used for representations **R2** and **R3**.

Analyse the time and space efficiency of the two transformations. Did you achieve *O(n)*? Did you use additional memory?

Input (R1): Π = {2, 7, 5, 2, 7, 7, -1, 5, 2}

1 2 3 4 5 6 7 8 9


7
2
5
6
1
4
9
3
8
R1: parent representation
T1:parent -> multi-way
R2: multi-way representation
T2: multi-way -> binary
R3: binary representation
PP: prrety_print (binary)

```
7
    2
        1
        4
        9
    5
        3
        8
    6
```

Pretty print