COL226: Programming Languages

Sat 08 Jan 2022   **Quiz 1**   20+5 minutes   Max marks 10

Instructions:

1. Download the paper and write your name and entry number in the designated space on top and *do not forget to sign the honour statement below.*

2. Answer the question(s). *Answers will be judged for correctness, efficiency and elegance.*

4. If there are <u>minor mistakes</u> in the question, correct them <u>explicitly</u> and answer the question accordingly. If the question is <u>totally wrong</u>, give an adequate reasons why it is wrong with detailed counter-examples, if necessary.

4. Scan the paper with your completed answer.

5. Upload it on Gradescope 2102-COL226 page within the given time. *Make sure the first page with your name, entry no and signature is also the first page of your uploaded file*

6. Late submissions (within 2 minutes of submission deadline) on the portal will attract a penalty of 10% of the total marks allotted to the paper for each minute of delay and 20% for each minute of delay thereafter.

7. Email submissions after the closing of the portal will not be evaluated (You get a 0).

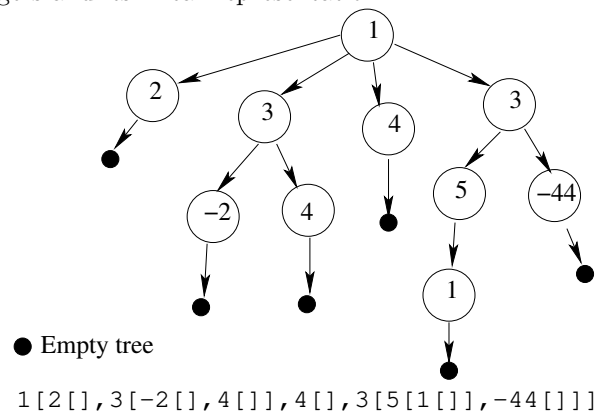8. Uploads without the first page details (including signature) may be awarded 0 marks.

I abide by the Honour code that I have signed on my admission to IIT Delhi. I have neither given any help to anybody nor received any help from anybody nor from any site or other sources in solving the question(s) in this paper.

Signature: _____   **Date:** _____

[2+4+4=10 marks]

(Multi-way) trees may be defined as a recursive data-structure which is either an empty list representing an empty tree, or consisting of a root node with a list of (sub-)trees under the root. A leaf node is simply a (sub-)tree with an empty list of sub-trees under it. The following figure shows a multi-way tree whose nodes are labelled by integers and its linear representation.

● Empty tree

```
1[2[],3[-2[],4[]],4[],3[5[1[]],-44[]]]
```

1. Define a data-type `mtree` for multi-way trees with integer labels on the nodes.

2. Given a (multi-way) tree with integer labels, write a function (in pseudo-code) to output its linear representation as a string.

3. Given a string, representing a valid multi-way tree with integer labels, write a function (in pseudo-code) to construct the tree (belonging to the data-type `mtree`) it represents.