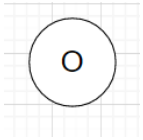
Justin Li
2/16/23

COEN 379 HW 5

1. 2-3 Tree:
   Insert OPENAIGM

   Insert O:



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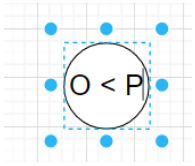

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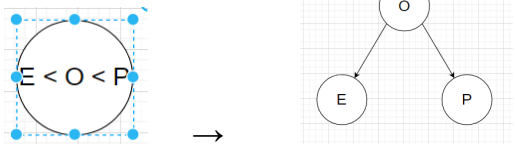

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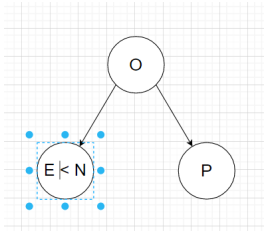

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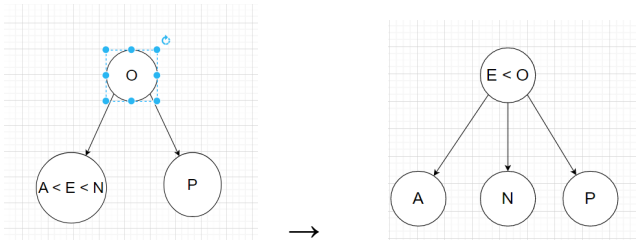

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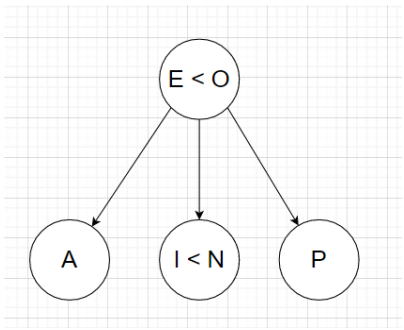

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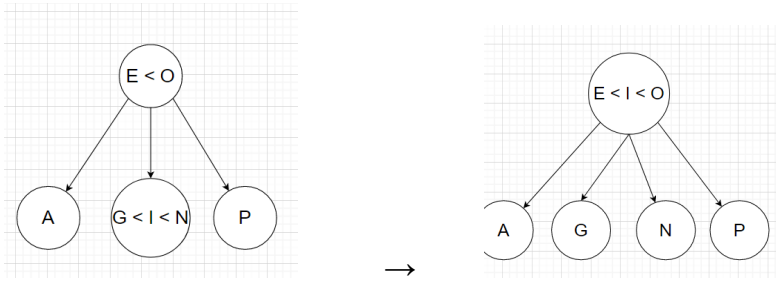

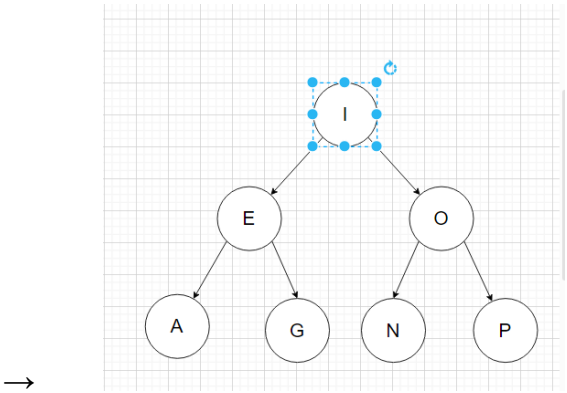

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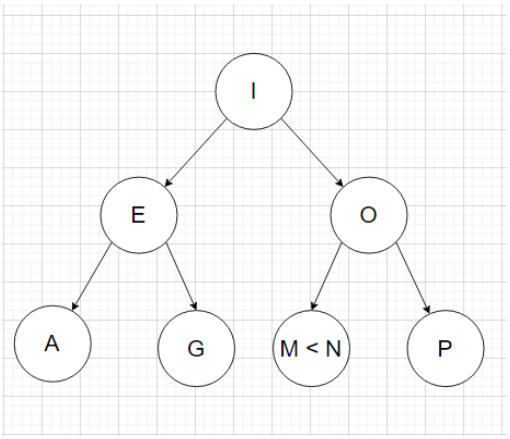

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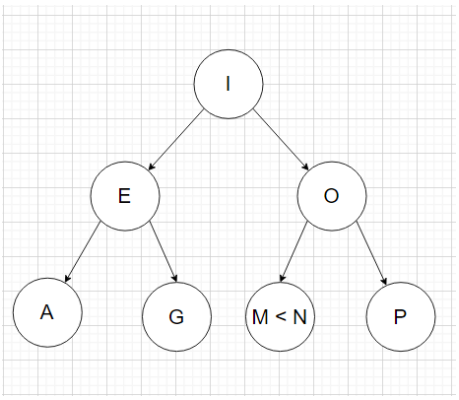

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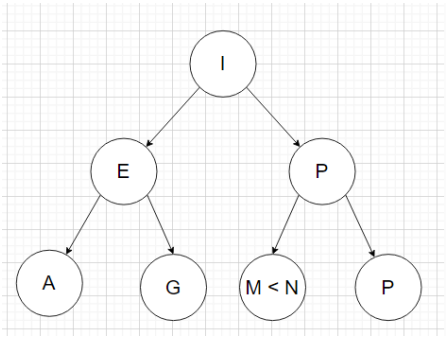

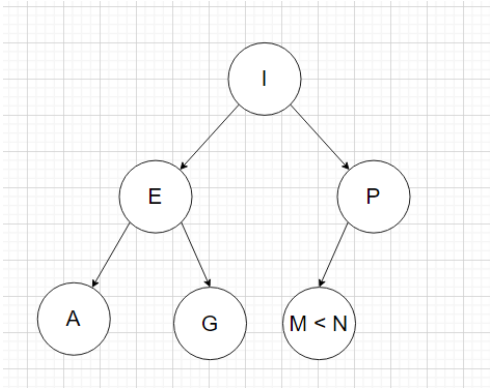

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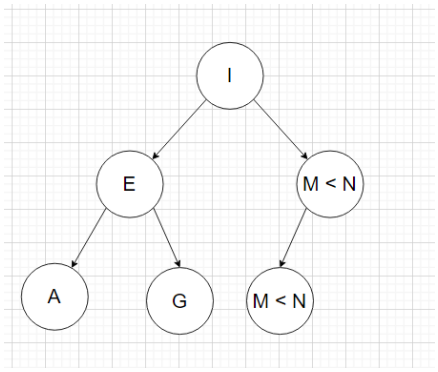

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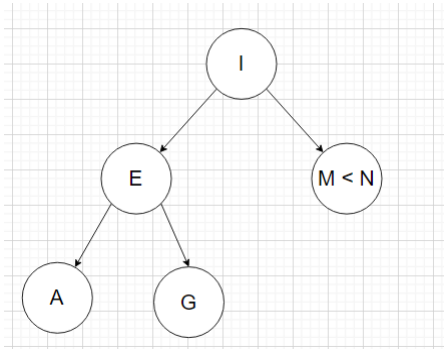

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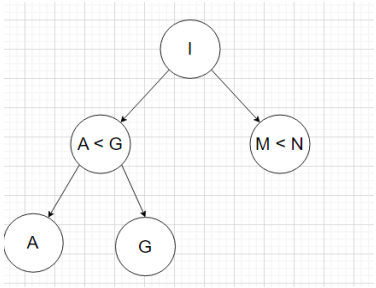

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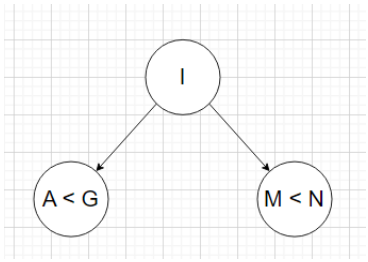

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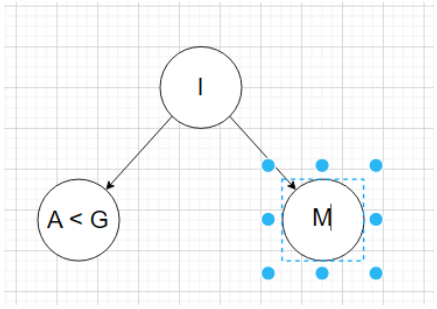

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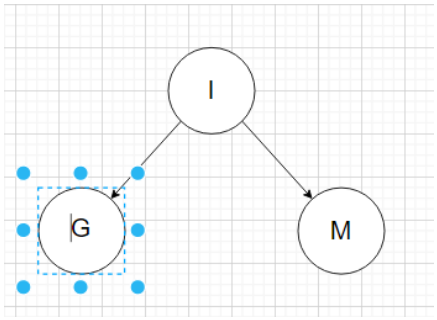

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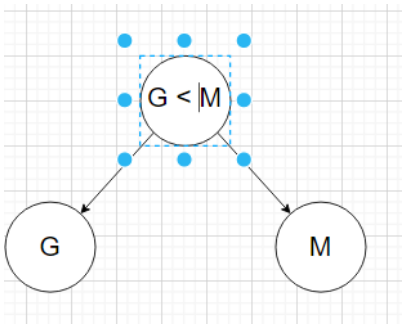

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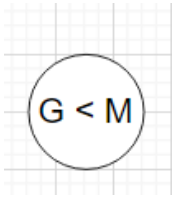

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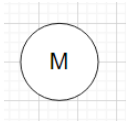
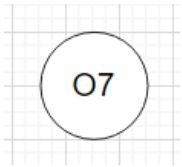


Remove M:

2. Treap:
   Insert OPENAIGM
   (7, 1, 4, 8, 2, 5, 3, 6)

   Insert O:



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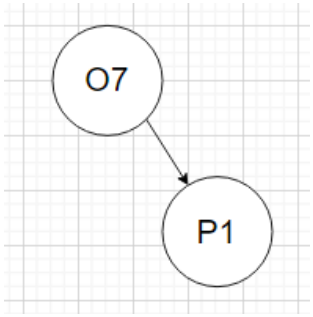

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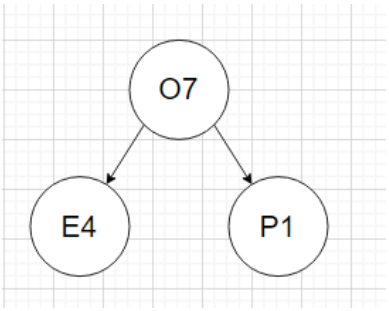

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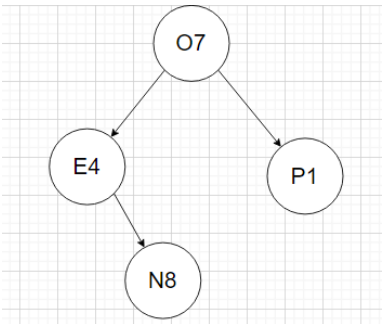

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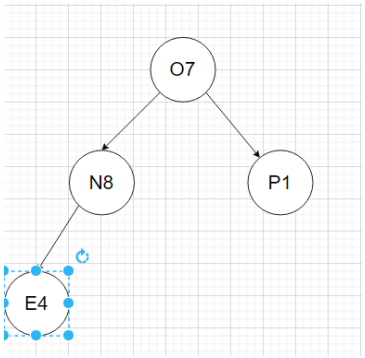

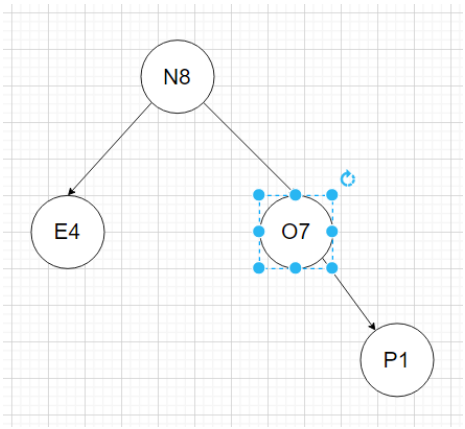

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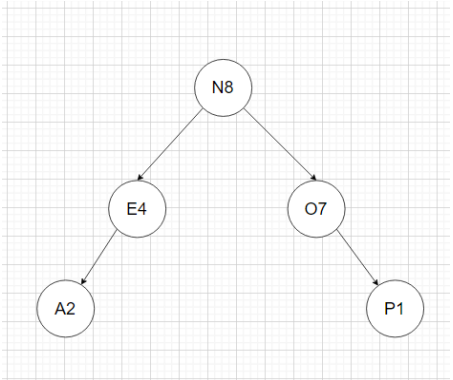

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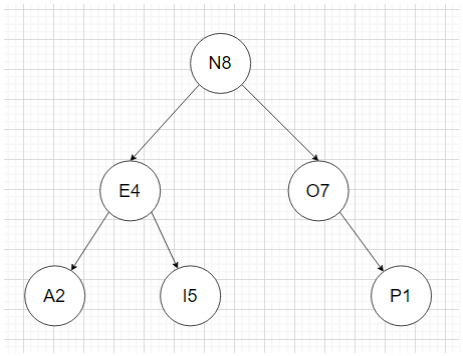

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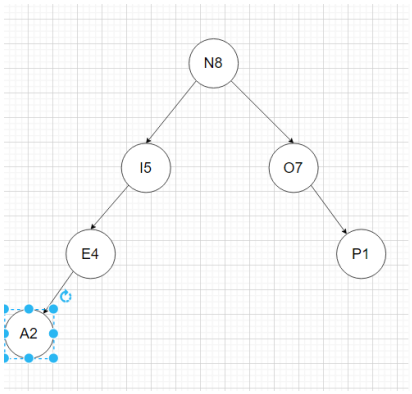

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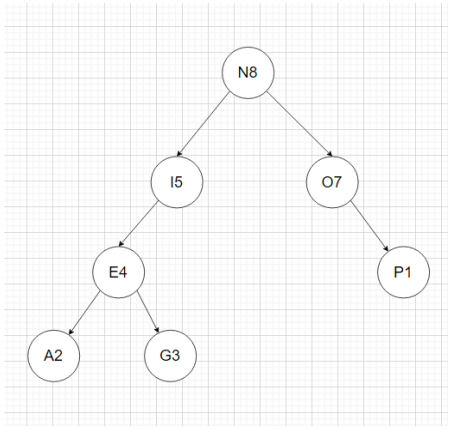

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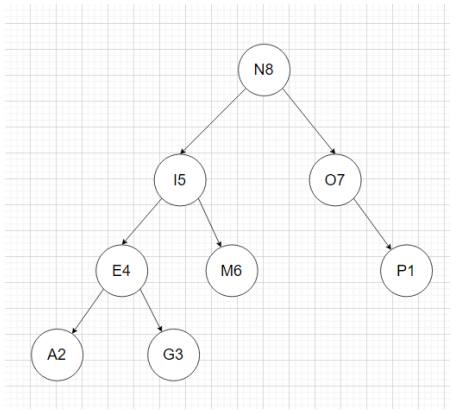

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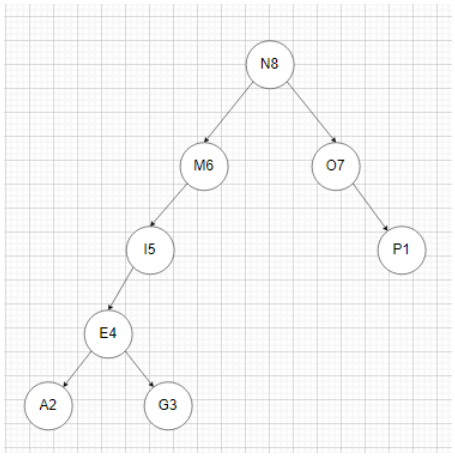

Remove OPENAIGM:

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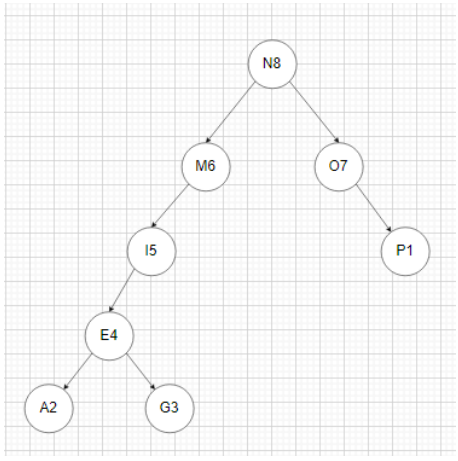

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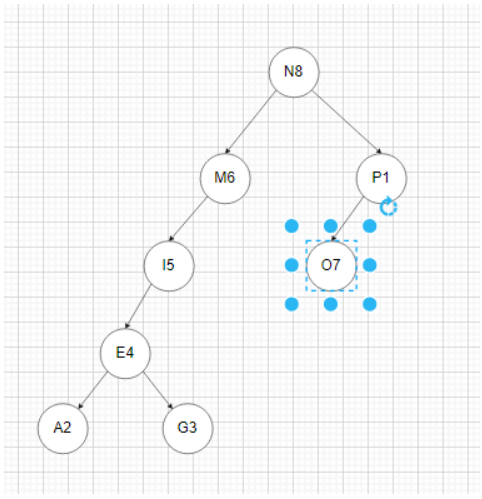

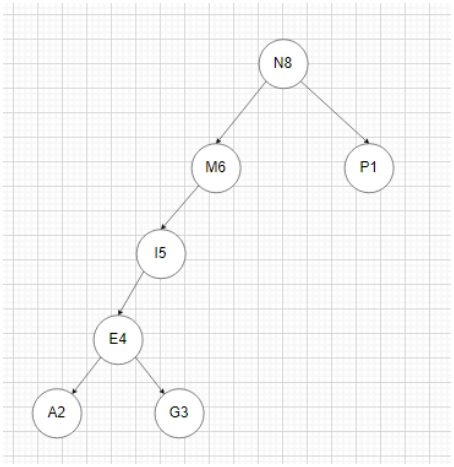

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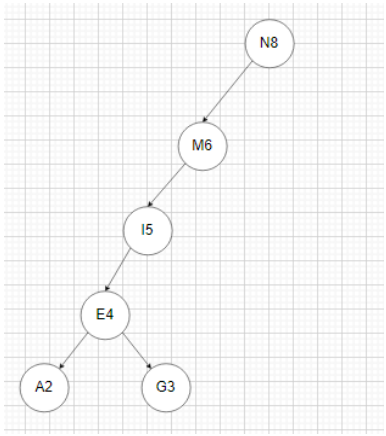

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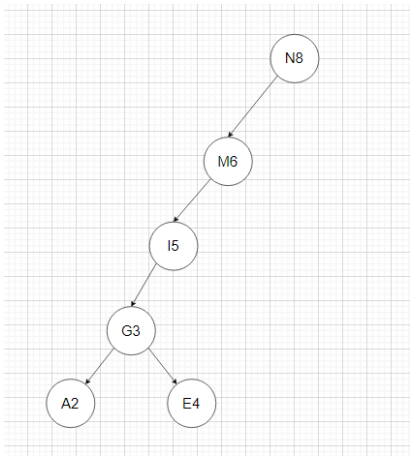

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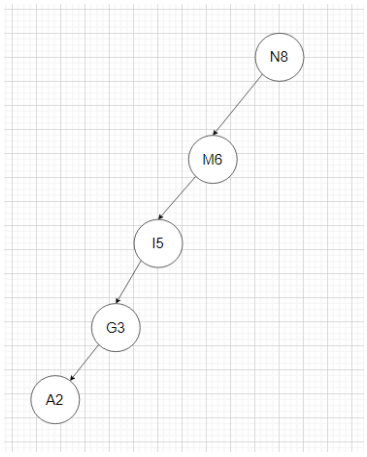

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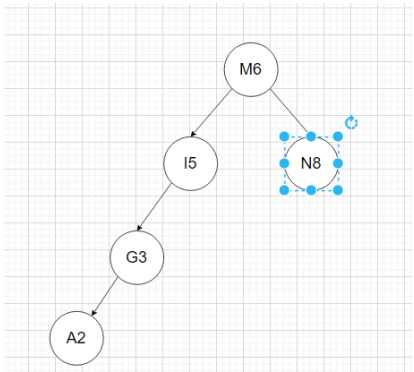

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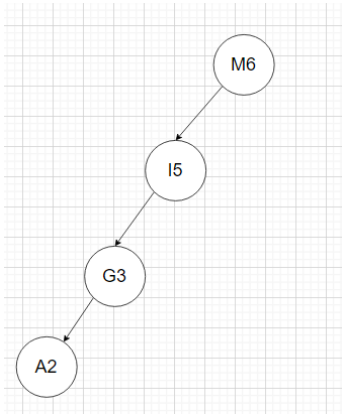

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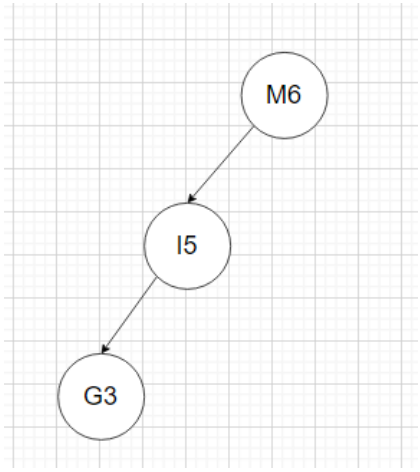

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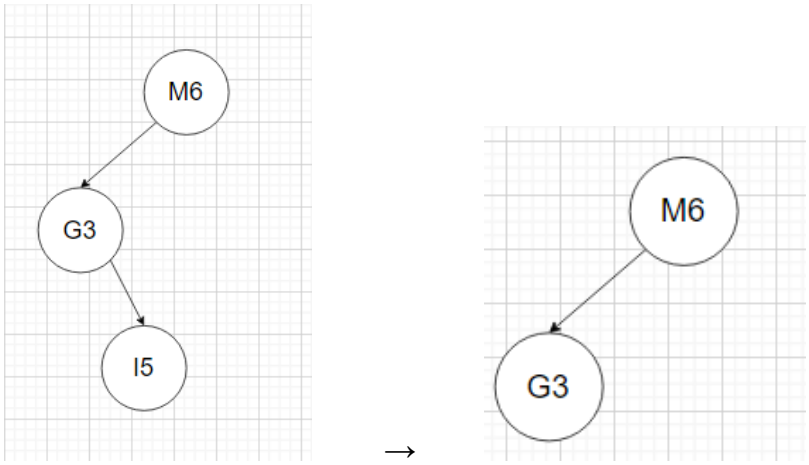

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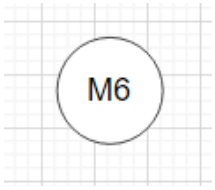

Remove M:

3. The expected number of nonleaves in a treap of size n (E[NL]) is related to the E[P] of homework 2 relating to partitions for random quicksort.

   Looking at the structure of a treap, we notice that all of the nonleaves act just like pivot values, separating all lesser values to the left and all greater values to the right. Thus, we know that a treap can actually be a way to represent a partitioned array, and that all of the nonleaves can actually represent pivot values, meaning that E[NL] == E[P] == (2n-1)/3