CMPT 280

Tutorial: Arrayed Binary Trees

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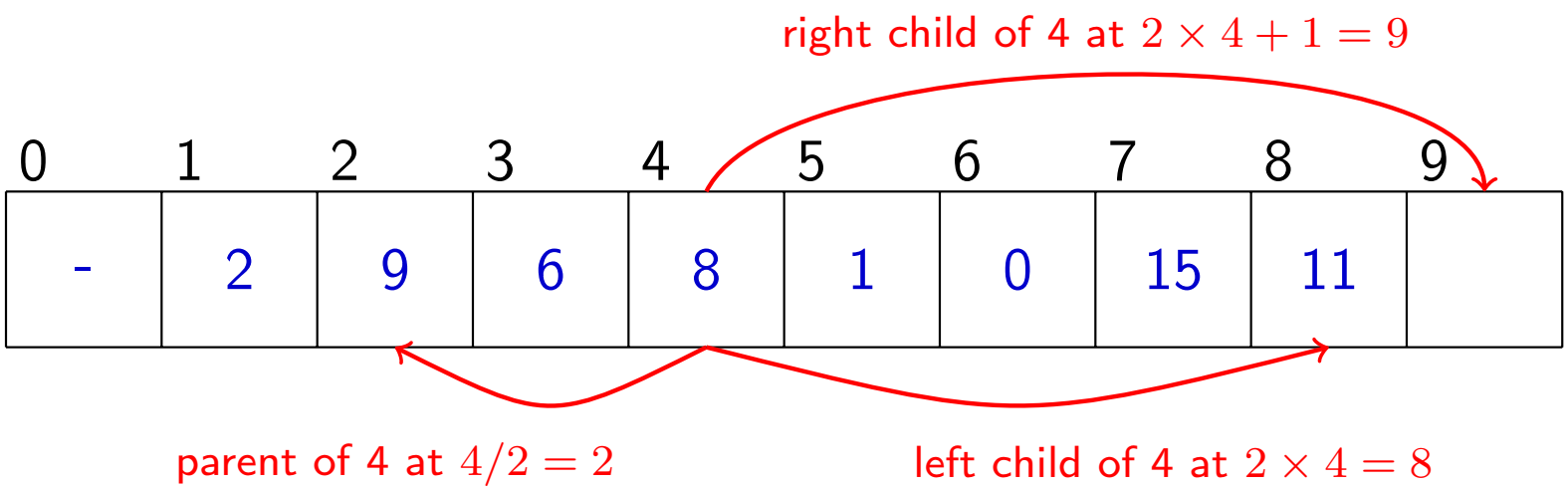
Arrayed Binary Trees

- Representation: an array of tree elements
- Each array location is like a tree node.
- Contents of array location is the contents of the node.

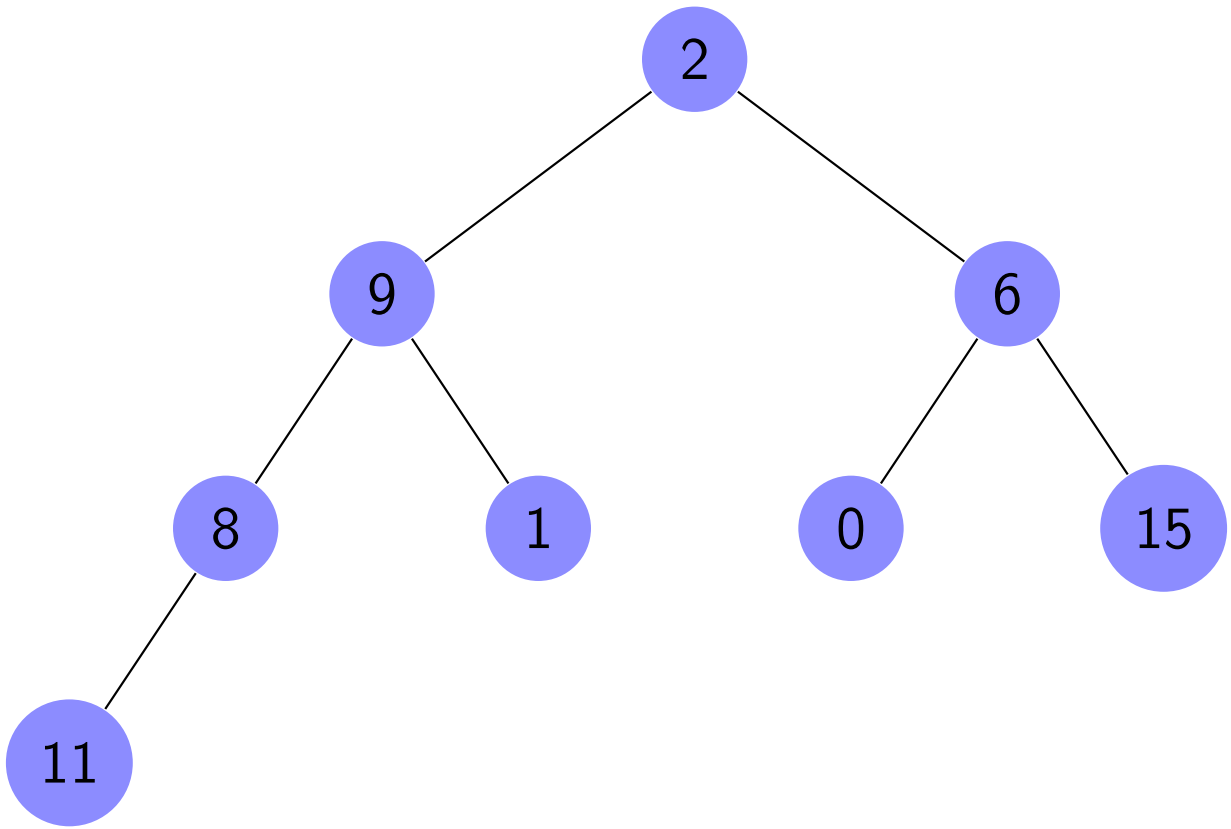
Arrayed Binary Trees

- Store the root node at array index 1 (index 0 is unused).
- If there is an element at array index i, then:
  - The left child of i (if it exists) is at index $2i$.
  - The right child of i (if it exists) is at index $2i + 1$.
  - The parent of i is at index $i/2$ (integer division).



Arrayed Binary Trees

0	1	2	3	4	5	6	7	8	9
-	2	9	6	8	1	0	15	11	



Arrayed Binary Trees

Binary trees that satisfy the following can be represented by an array:

- All levels except possibly the lowest level are full.
- All nodes in the lowest level are as far to the left as possible.

This implies that the offsets of the array which contain a data item will always be contiguous.

Which arrays represent trees?

Draw the ones that are trees!

0	1	2	3	4	5	6	7	8	9
-	7	9	16	8	1	10			

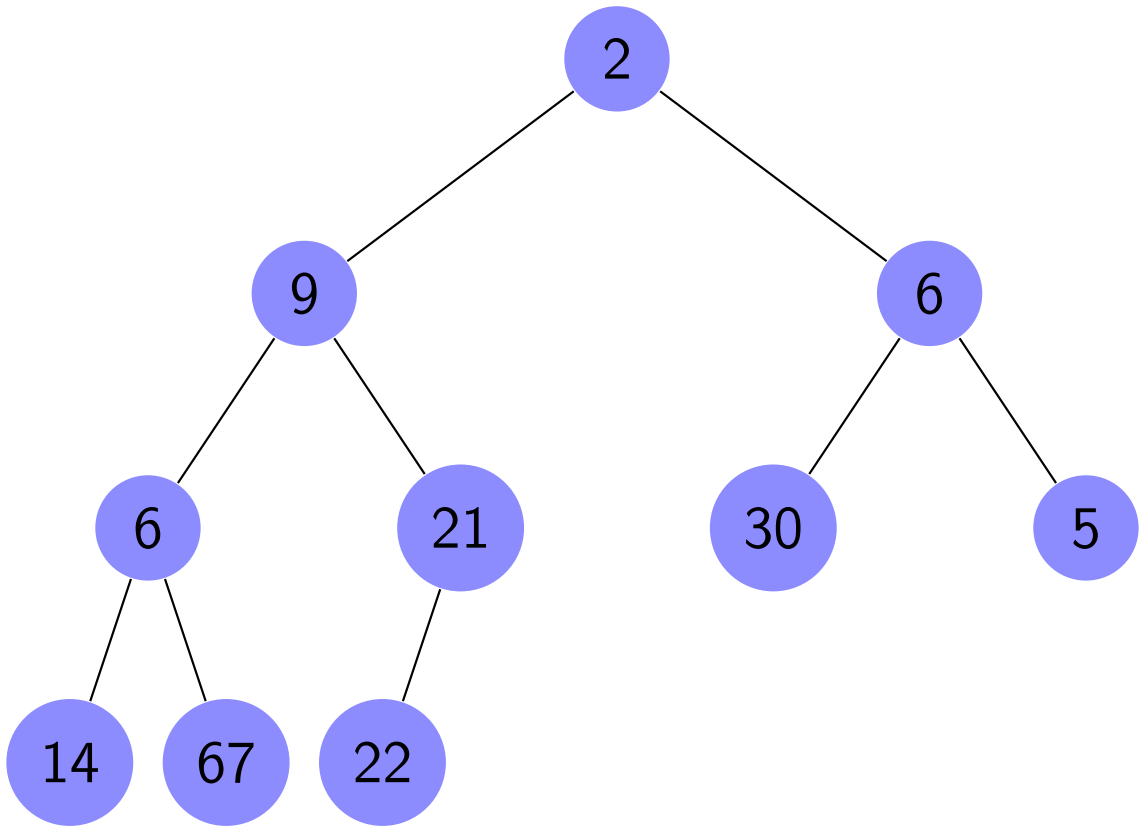
0	1	2	3	4	5	6	7	8	9
22	17	6	14	28	15	20	1	12	

0	1	2	3	4	5	6	7	8	9
-	17	6			15	0	1	12	

0	1	2	3	4	5	6	7	8	9
-	33								

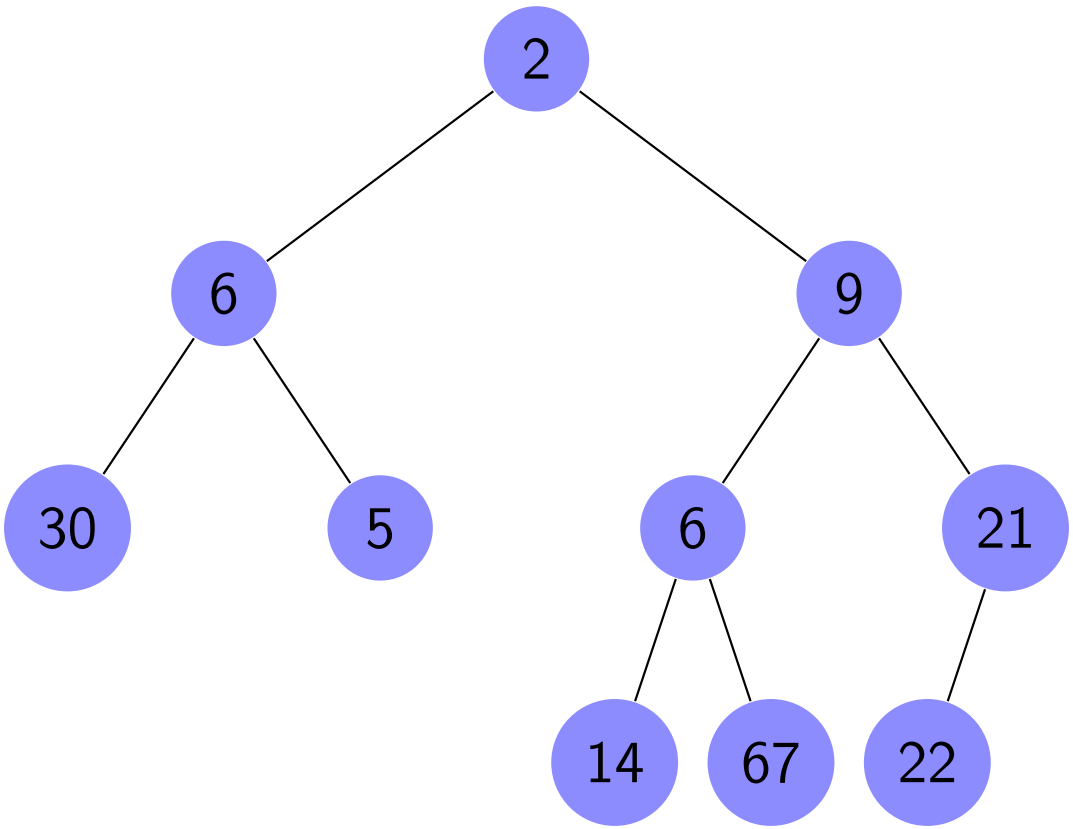
Can this tree be represented by an array?

If so, draw the array.



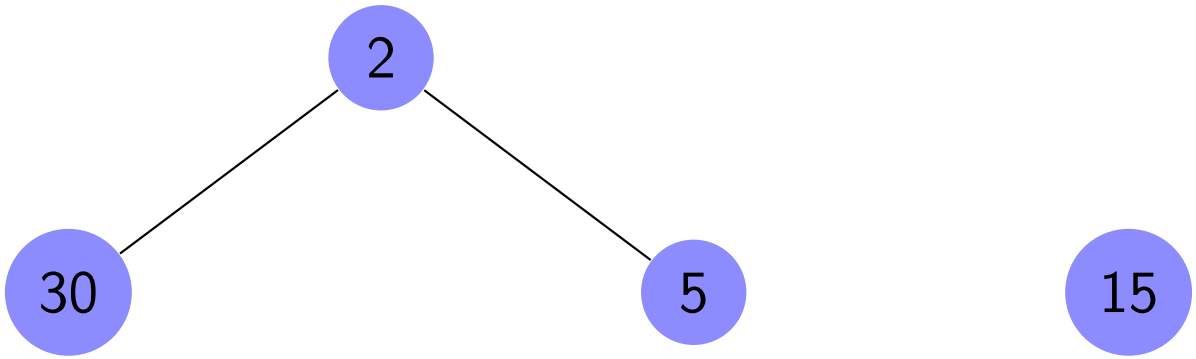
Can this tree be represented by an array?

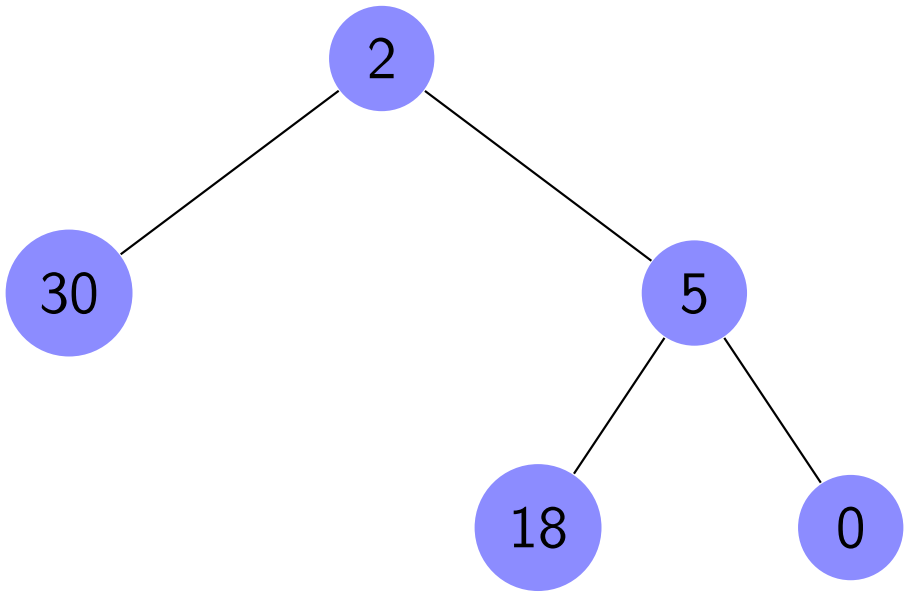
If so, draw the array.



Can these trees be represented by an array?

If so, draw the array.



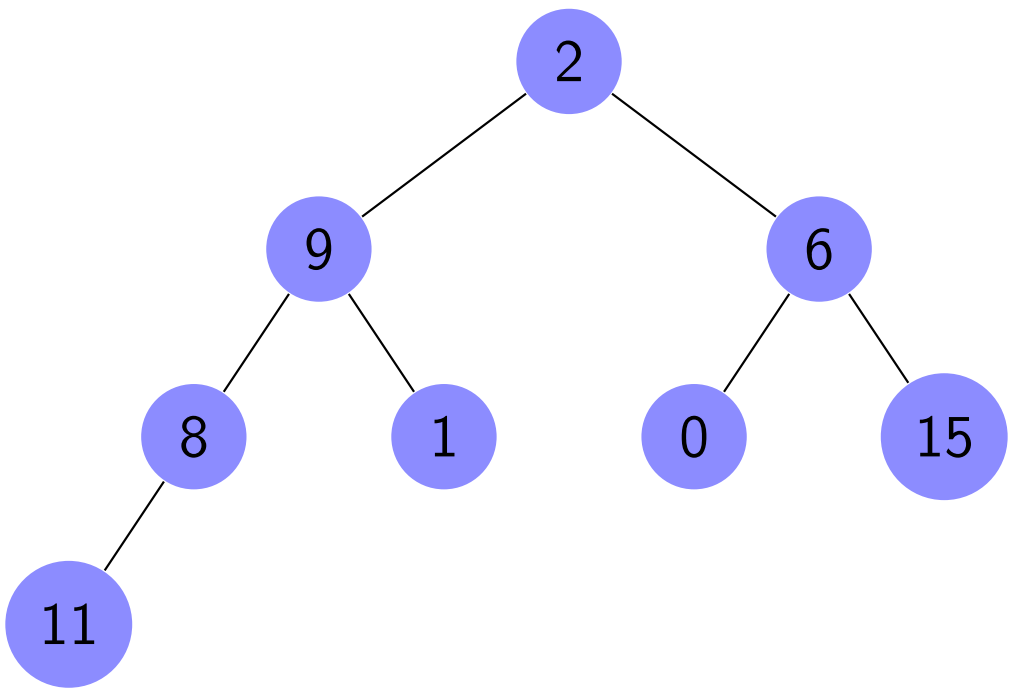


Insertion Algorithm

`insert()` method

When a new item is inserted, where do we put it?

0	1	2	3	4	5	6	7	8	9
-	2	9	6	8	1	0	15	11	

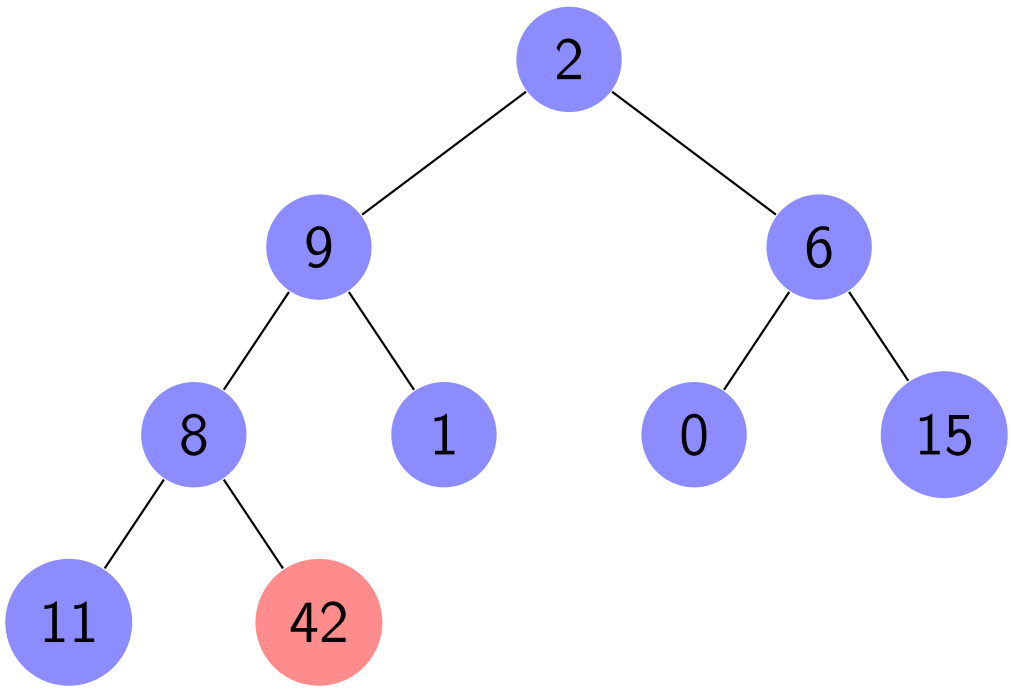


Insertion Algorithm

`insert()` method

When a new item is inserted, where do we put it?

0	1	2	3	4	5	6	7	8	9
-	2	9	6	8	1	0	15	11	42



Insertion Algorithm

`insert()` method

- Inserted elements always go at the end of the array.
- Thus, inserted elements always get inserted into the leftmost open position in the bottom-most level of the tree.

Deletion Algorithm

`deleteItem()` Method

- Erase the deleted item in the array.
- If the array is no longer contiguous, move the last element of the array into the vacated position.
- Let's do an example on the chalkboard...