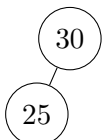


Name: \_\_\_\_\_

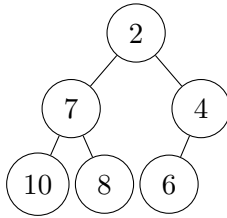
## 6.1 Heaps

Justify your responses.

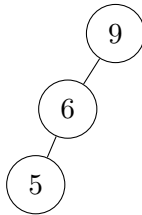
1. Define a **binary tree**
  
  
  
  
  
  
  
  
  
  
2. Define a **(nearly) complete binary tree** and **depth** and **height**
  
  
  
  
  
  
  
  
  
  
3. Define a **max (min) heap**
  
  
  
  
  
  
  
  
  
  
4. Consider a heap,  $H$ , of height 5.
  - (a) What is the minimum number of elements of  $H$ ?
  - (b) What is the maximum number of elements of  $H$ ?
  
  
  
  
  
  
  
  
  
  
5. Consider a heap,  $H$ , of height  $k$ .
  - (a) What is the minimum number of elements of  $H$ ?
  - (b) What is the maximum number of elements of  $H$ ?
  
  
  
  
  
  
  
  
  
  
6. Consider the following binary trees. For each, determine if it is a max heap, a min heap, or neither.
  - (a) Answer:



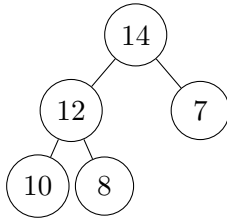
(b) Answer:



(c) Answer:



(d) Answer:



(e) Is the array with values  $\langle 23, 17, 14, 6, 13, 10, 1, 5, 7, 12 \rangle$  a max-heap?

(f) Is an array that is in sorted order a min-heap?

## 6.2 Maintaining the heap order

Justify your responses.

1. Illustrate the operation of  $\text{MAX-HEAPIFY}(A, 3, 14)$  on the array  $A = \langle 27, 17, 3, 16, 13, 10, 1, 5, 7, 12, 4, 8, 9, 0 \rangle$ .