

heaps & hashing

slides

bit.ly/abhi-disc

attendance

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announcements

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1. Homework 6 due Tuesday 3/29

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2. Week 9 Survey due Tuesday 3/29

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3. Project 2 due Friday 4/01

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2. Week 9 Survey due Tuesday 3/29
3. Project 2 due Friday 4/01
4. Test 2 Review Sessions
 - a. Wednesday 3/30
 - b. Friday 4/01

announcements

1. Homework 6 due Tuesday 3/29
2. Week 9 Survey due Tuesday 3/29
3. Project 2 due Friday 4/01
4. Test 2 Review Sessions
 - a. Wednesday 3/30
 - b. Friday 4/01
5. Test 2 on Wednesday 4/06

general questions, lecture, etc.

heaps

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- special trees following two basic rules

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1) heap property

- a) each node in a min heap is \leq all of its child nodes. each node in a max heap is \geq than all of its child nodes

heaps

- special trees following two basic rules

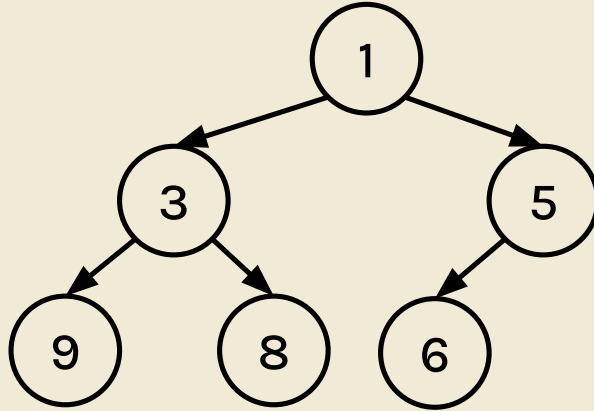
1) heap property

- a) each node in a min heap is \leq all of its child nodes. each node in a max heap is \geq than all of its child nodes

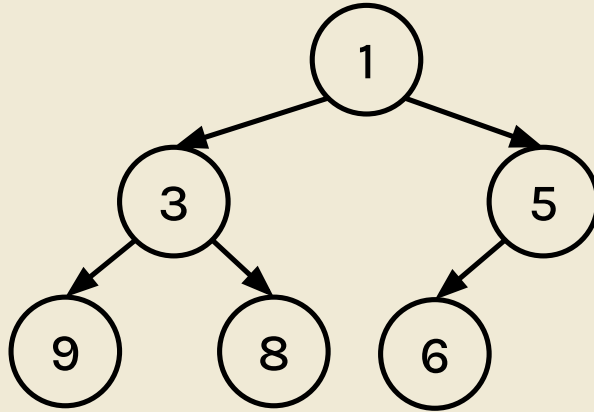
2) completeness

- a) the only empty parts of a heap are in the bottom row, towards the right

heap rules, exemplified



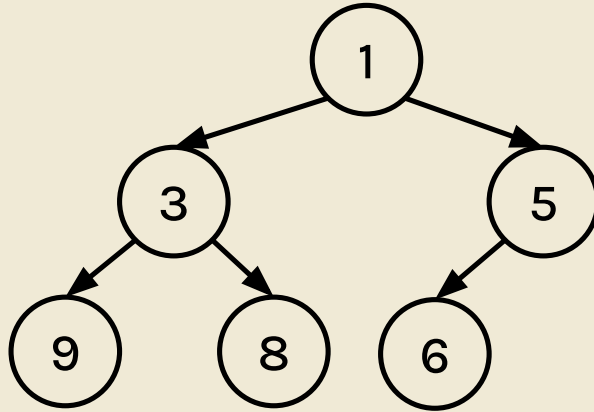
heap rules, exemplified



1) heap property

- a) each node in a min heap is smaller than all of its child nodes. each node in a max heap is larger than all of its child nodes

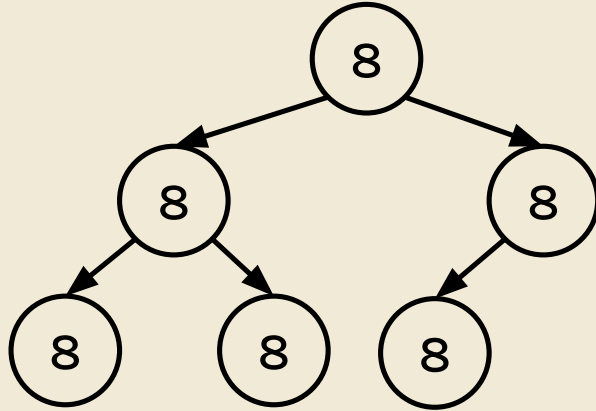
heap rules, exemplified



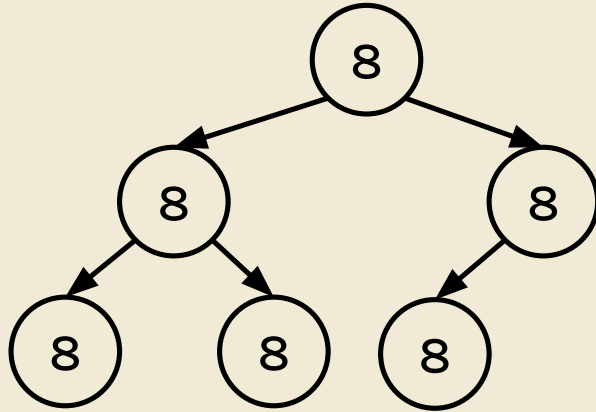
2) completeness

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valid or invalid? (min heap)

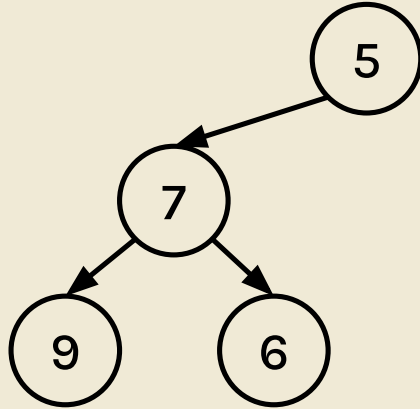


valid or invalid? (min heap)

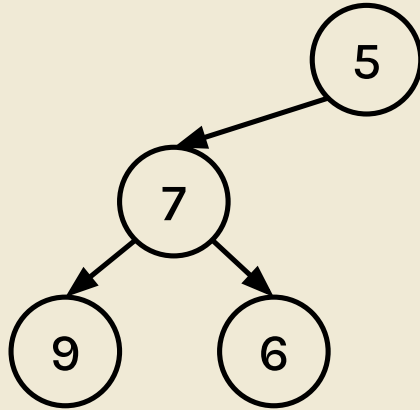


valid min heap

valid or invalid? (min heap)

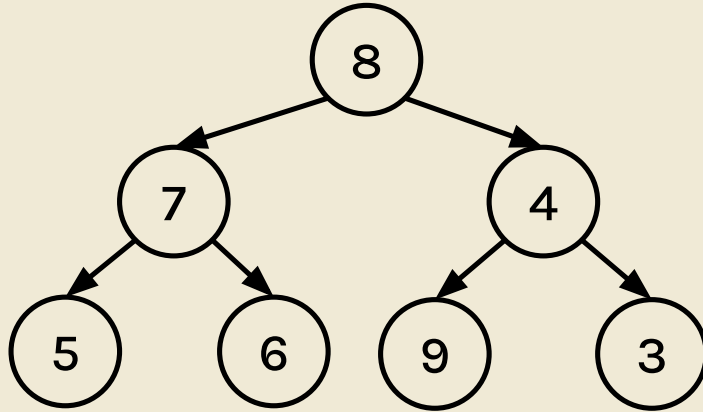


valid or invalid? (min heap)

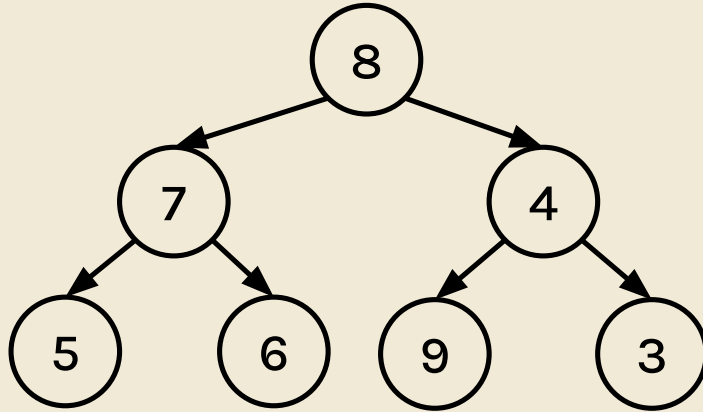


invalid min heap (incomplete)

valid or invalid? (max heap)

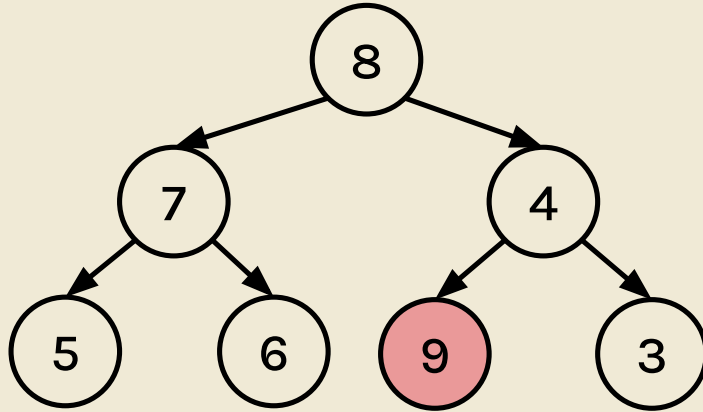


valid or invalid? (max heap)



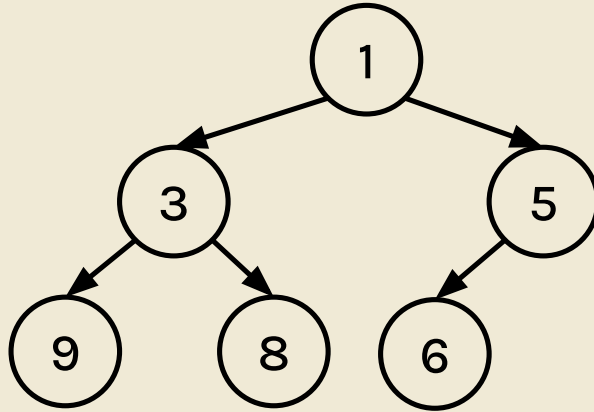
invalid max heap (heap property)

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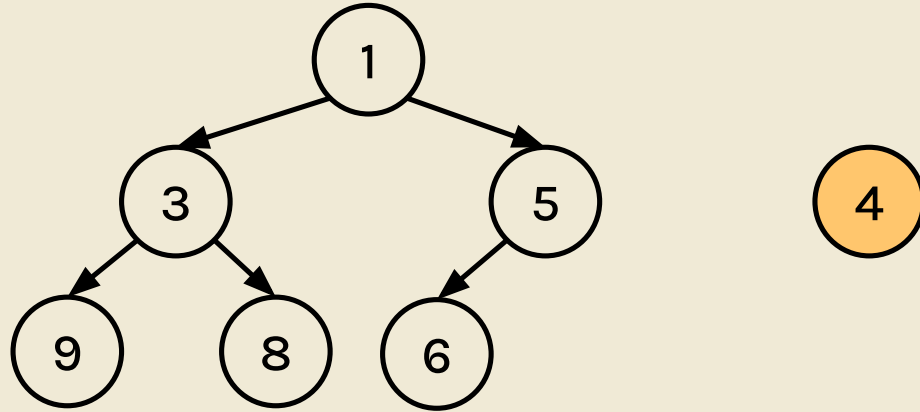


invalid max heap (heap property)

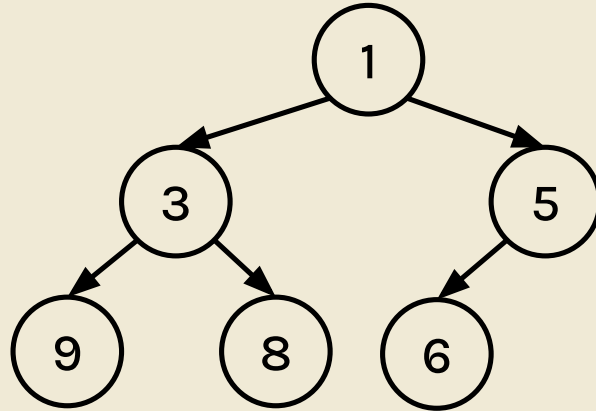
inserting into heaps



inserting into heaps

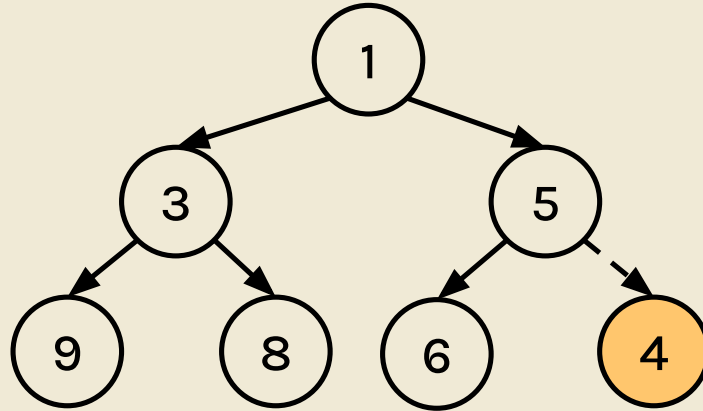


inserting into heaps

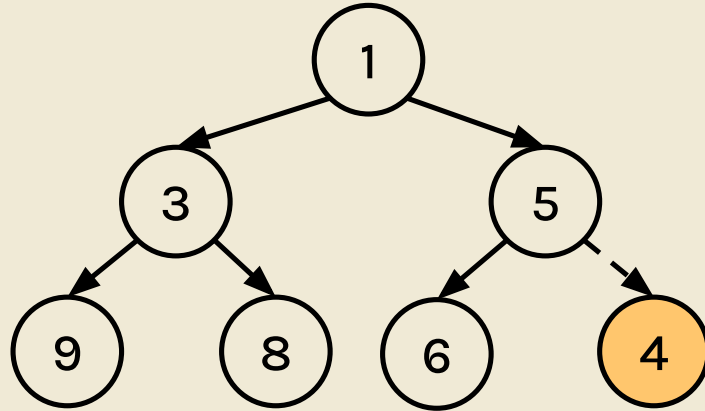


add to next available
spot to maintain
completeness

inserting into heaps

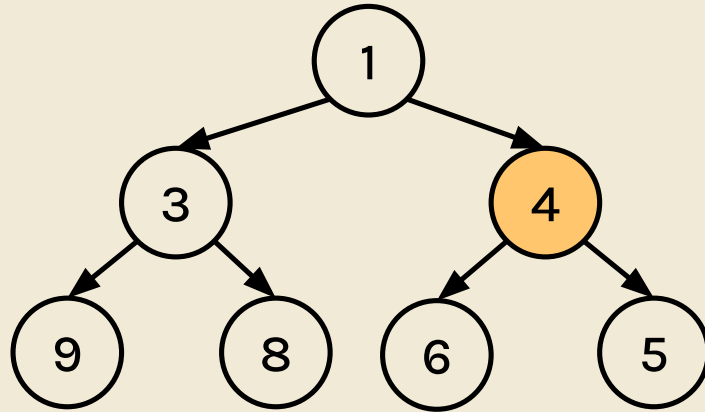


inserting into heaps



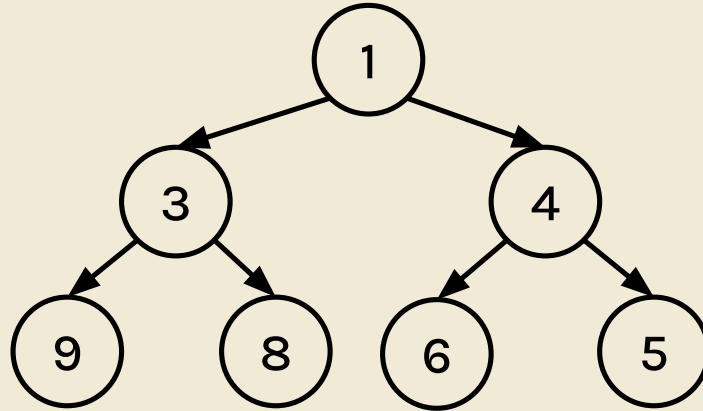
“bubble up”

inserting into heaps

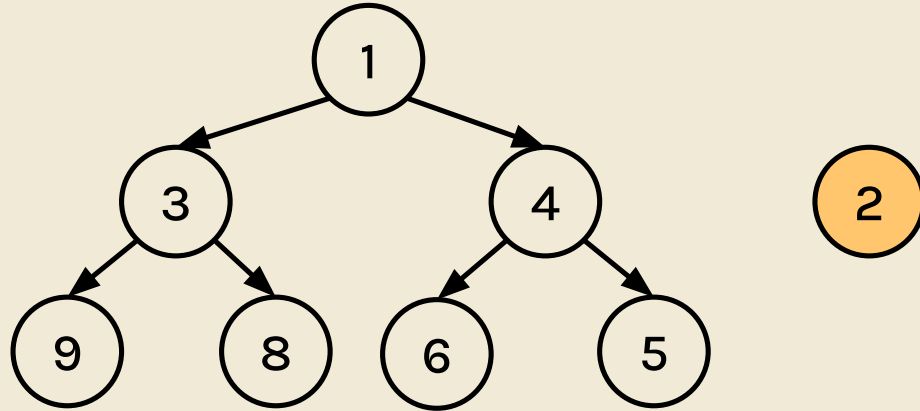


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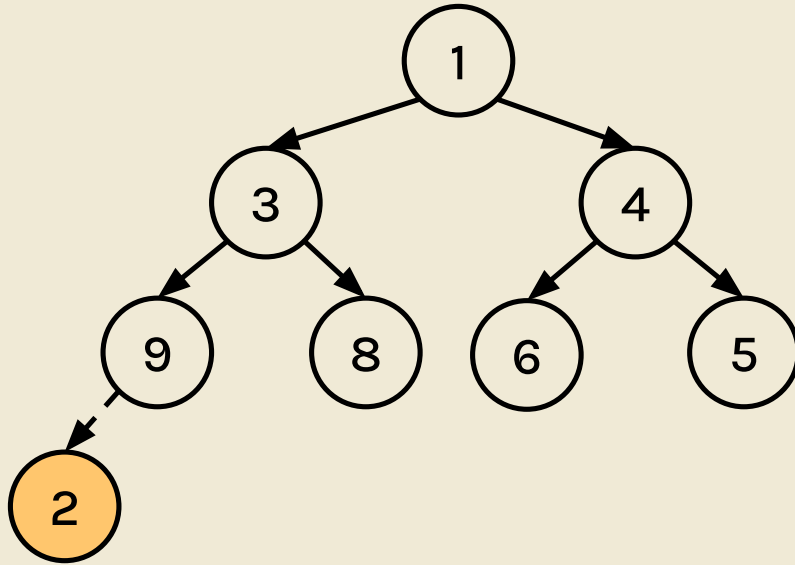
inserting into heaps



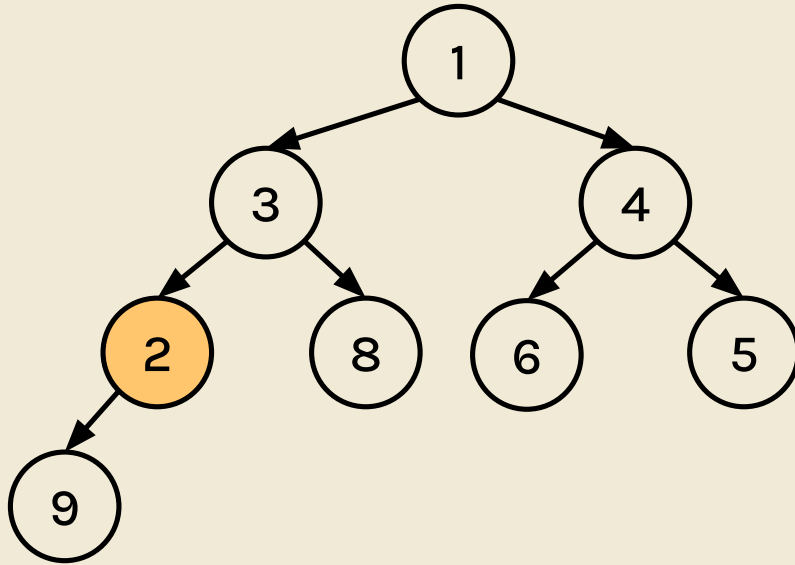
inserting into heaps



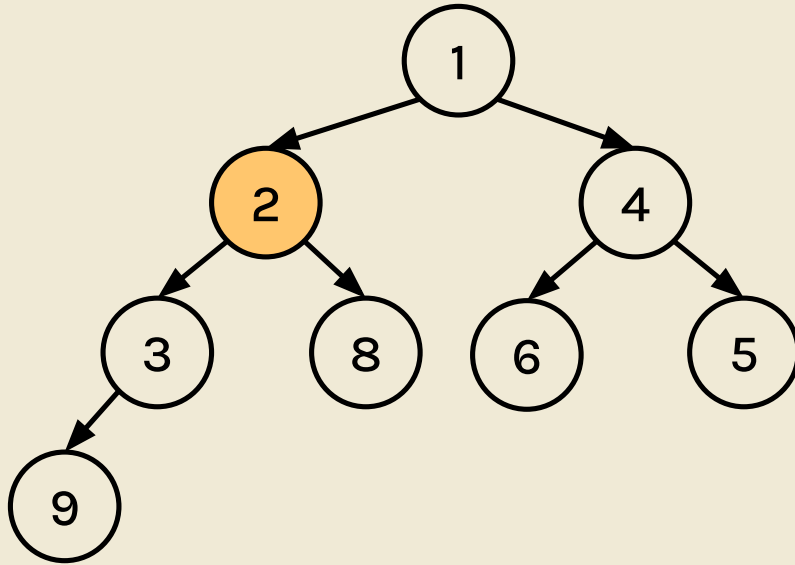
inserting into heaps



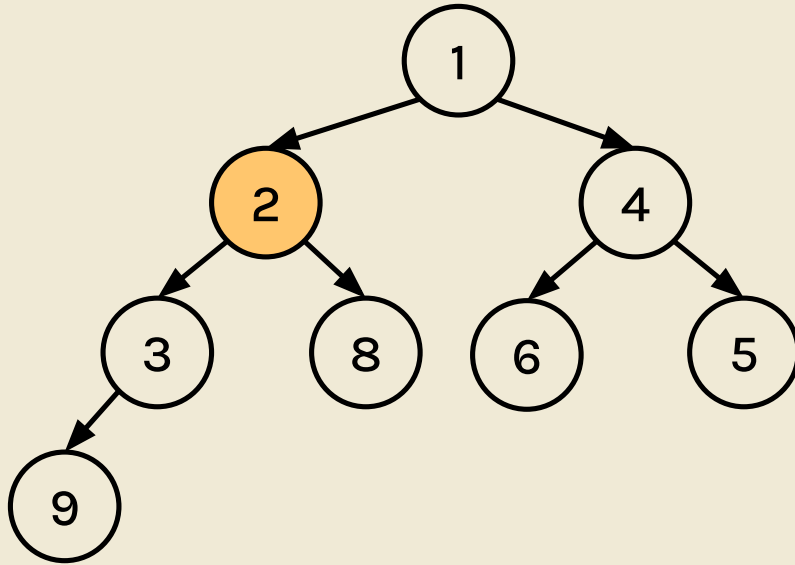
inserting into heaps



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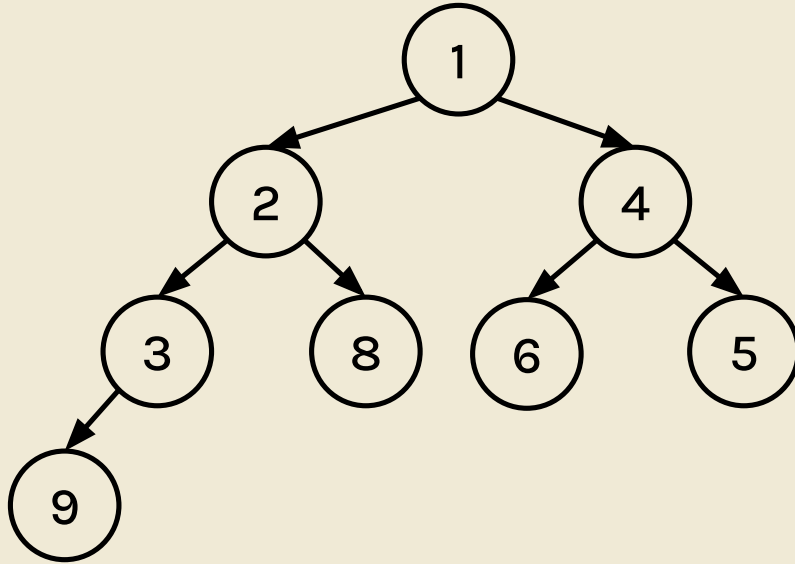


inserting into heaps

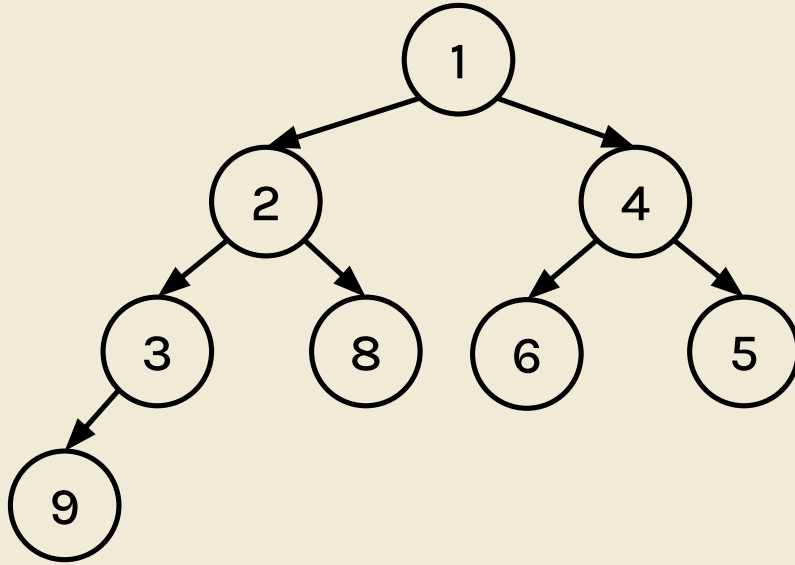


can i bubble
up again?

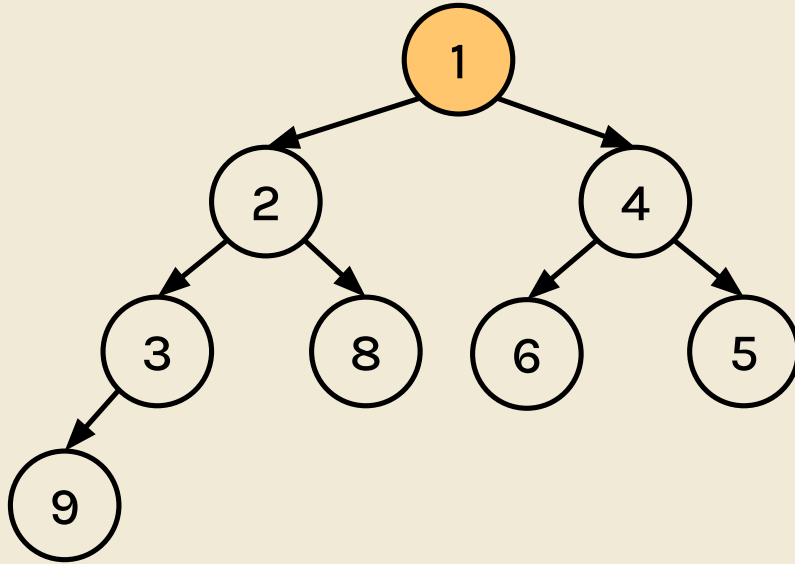
inserting into heaps



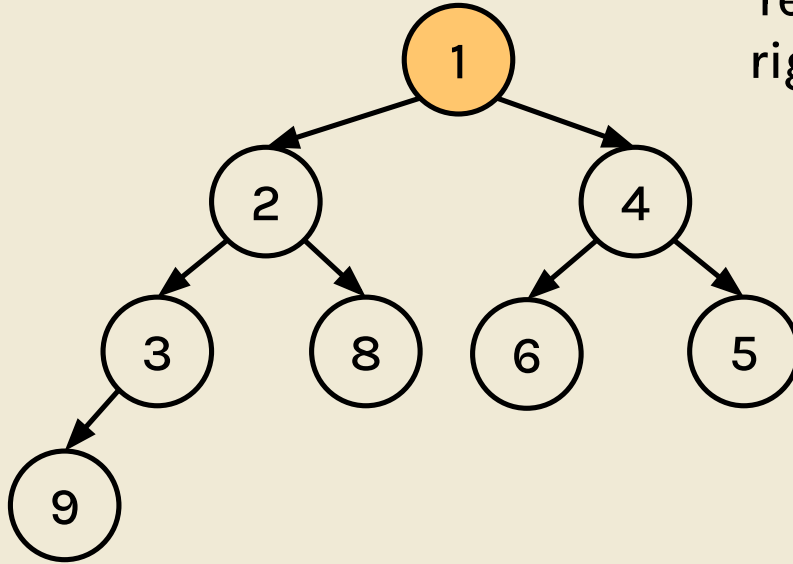
deletion from heaps



deletion from heaps

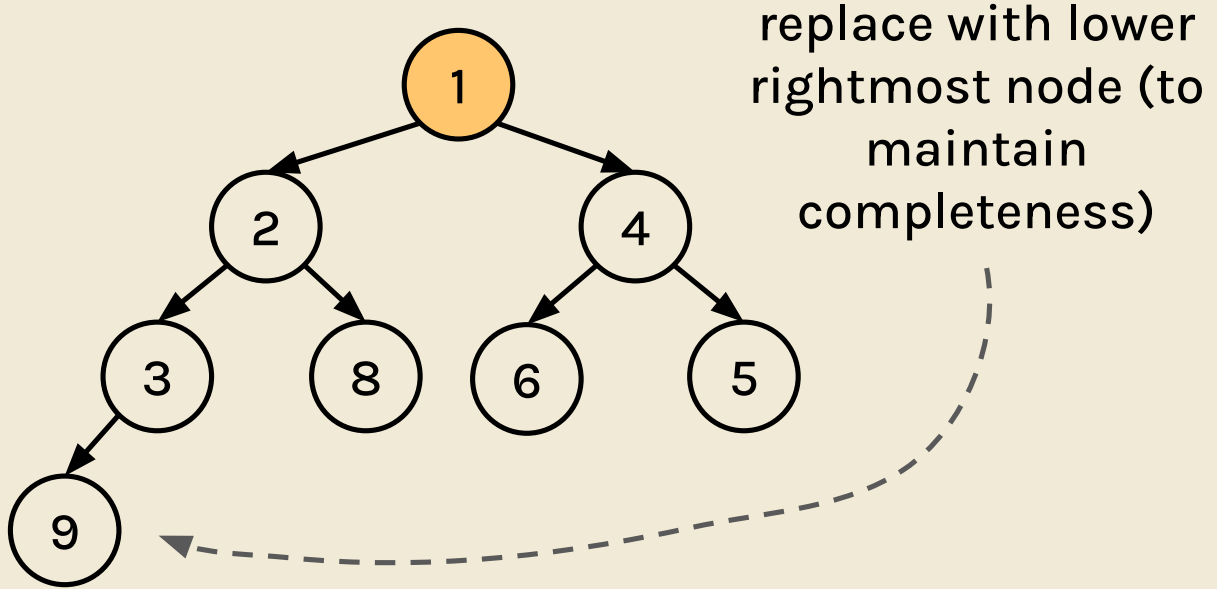


deletion from heaps

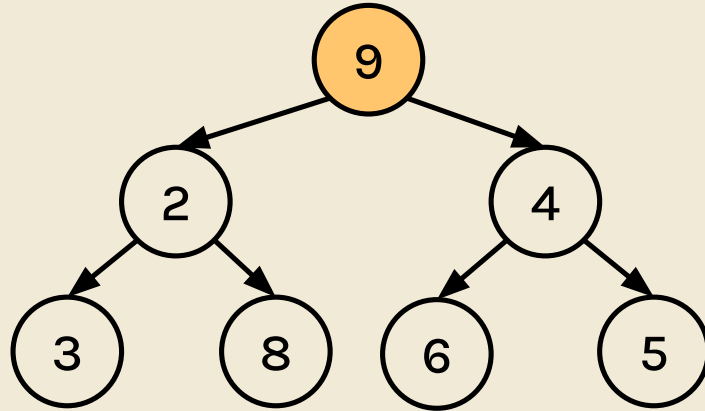


replace with lower
rightmost node (to
maintain
completeness)

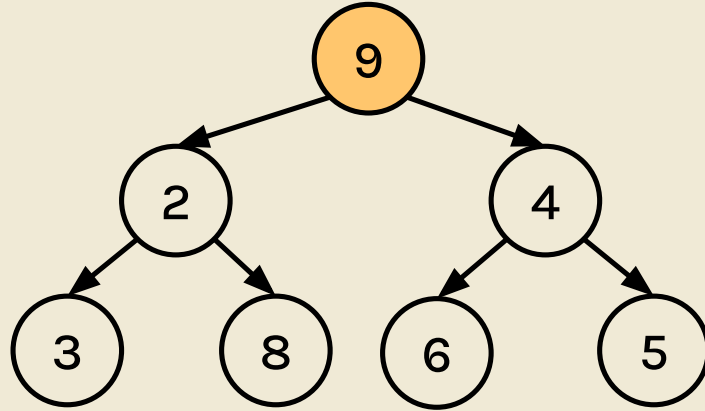
deletion from heaps



deletion from heaps

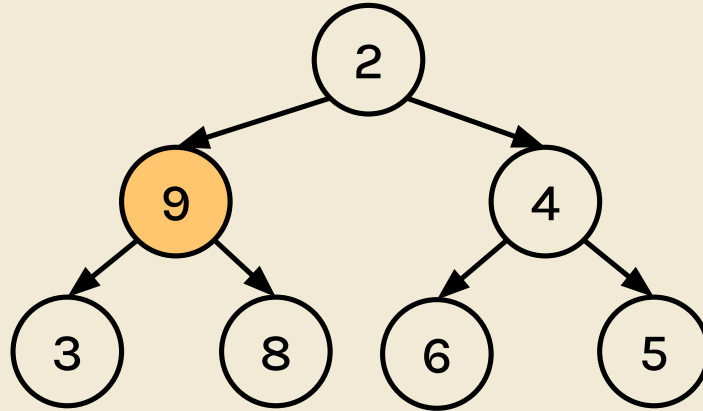


deletion from heaps



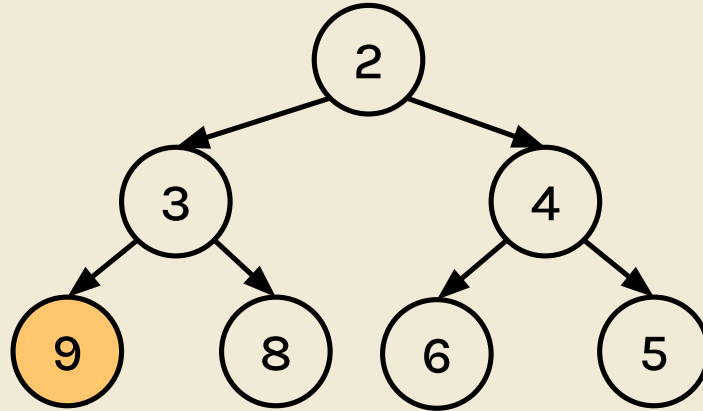
“bubble down”

deletion from heaps



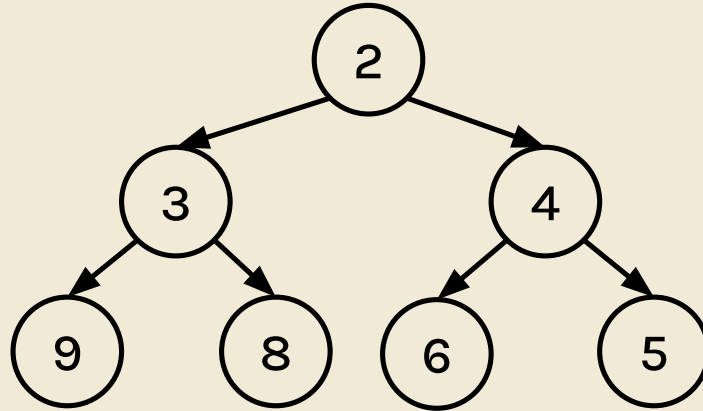
“bubble down”

deletion from heaps

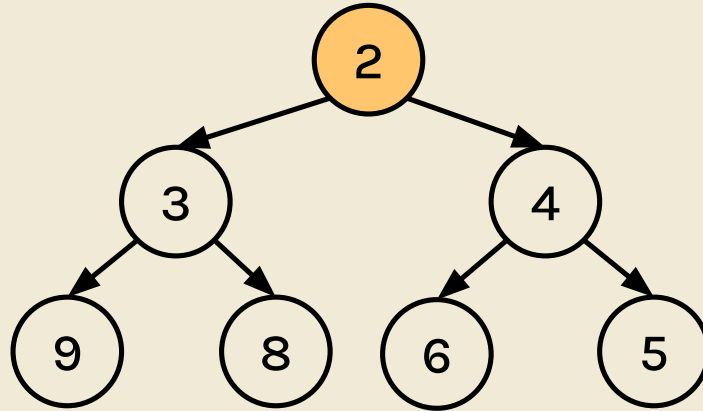


“bubble down”

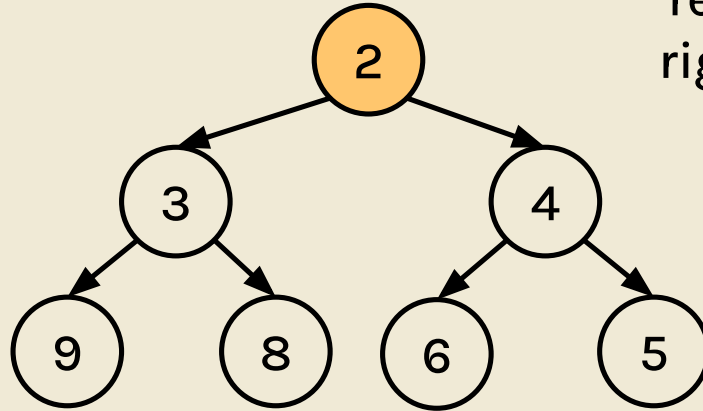
deletion from heaps



deletion from heaps

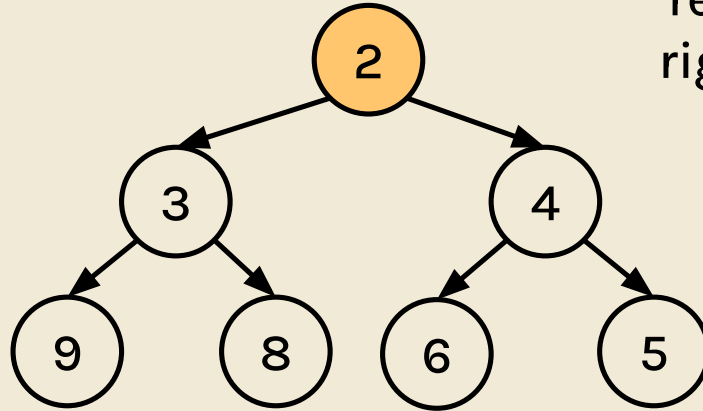


deletion from heaps



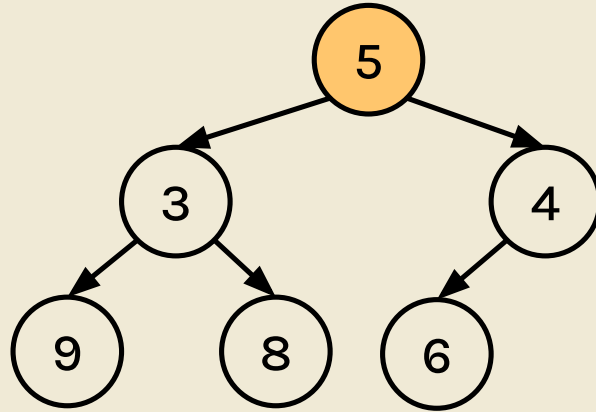
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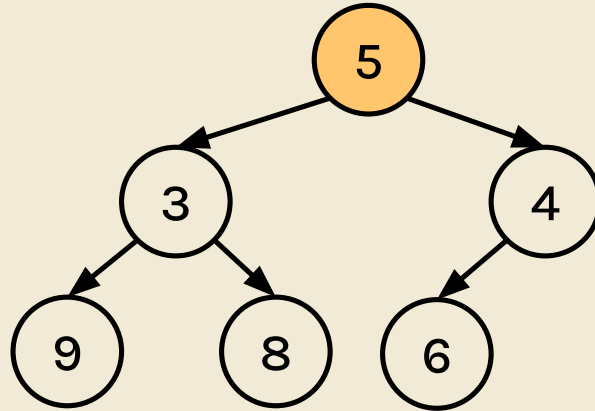


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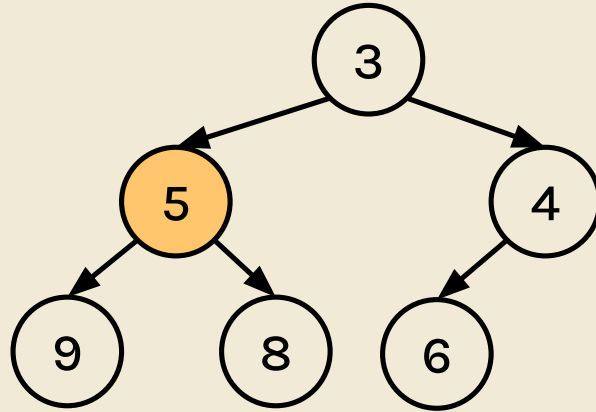


deletion from heaps

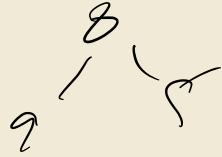
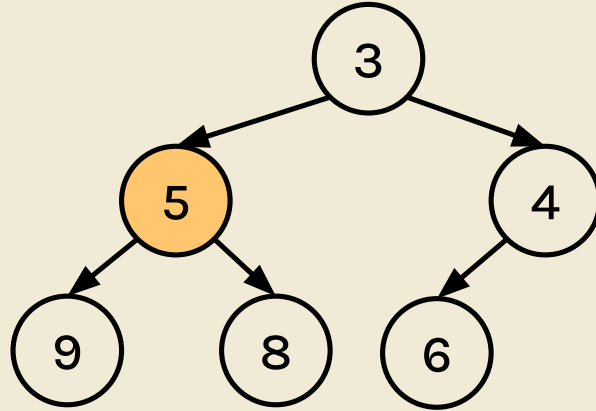


“bubble down”

deletion from heaps

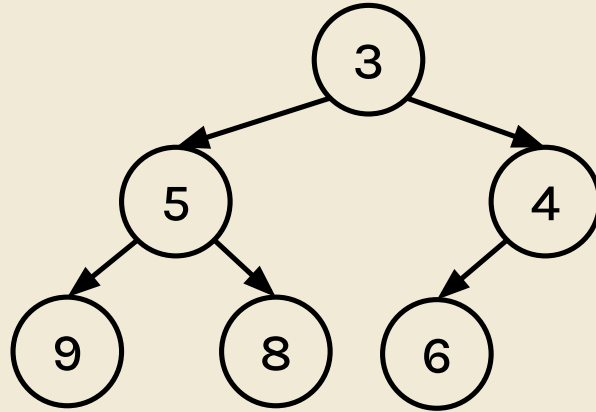


deletion from heaps



bubble down?

deletion from heaps



hashing

hashing

- hash functions represent objects using ints

hashing

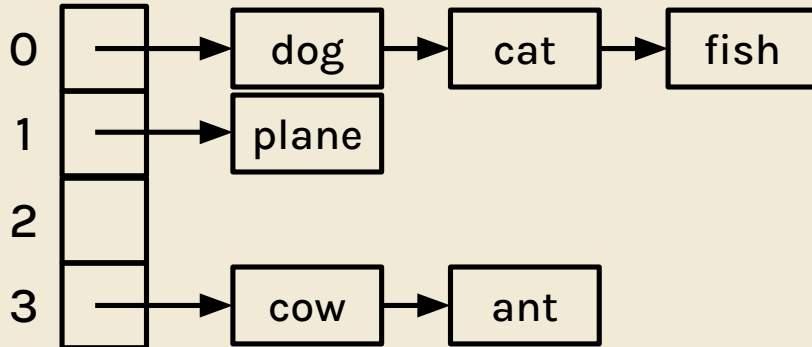
- hash functions represent objects using ints
- figure out which bucket object goes in via
hashcode (mod number of buckets)

hashing

$$O\left(\frac{N}{M}\right)$$

$$\frac{N}{5} \approx 1.5$$

- hash functions represent objects using ints
- figure out which bucket object goes in via hashcode (mod number of buckets)



worksheet

(on 61B website)



attendance

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feedback

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