QuickCheck 05: A hashing good time with K-D trees

Due: 8:00 am on Thursday, Feb 06, 2020

QuickChecks must be scanned and submitted online via Gradescope. If you have a smartphone, you can follow these steps to scan using an app: https://www.gradescope.com/help#help-center-item-student-scanning. Otherwise, there are scanners located at various libraries on campus which can be found here: https://finance.uw.edu/c2/printing-copying/dawg-prints-copy-locations. Make sure that the gray border around the edge of this page is visible in your scanned document.

1. Separate Chaining

For parts (a) and (b), consider a hash table of size 10 using separate chaining with a hash function of $h(x) = x$. Assume that each bucket is a linked list where new elements are added to the front of the list.

(a) Insert 5, 13, and 101 into the hash table. A following call of insert(3) will be placed at index: ☐

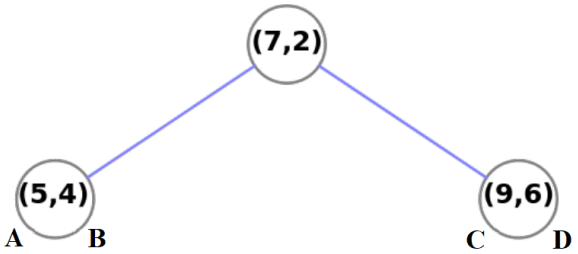
(b) Insert 7, 17, and 27 into the hash table. Give the size of the bucket at index 7: ☐

(c) True or False: We are guaranteed $\Theta(1)$ runtime with a hash table's find()
◯ True ◯ False

(d) Give the worst case $\Theta(.)$ run bound for contains() with a hash table of size n. ☐

2. K-D Trees

For this question, use the following 2-D tree, where A corresponds to the left child of node $(5, 4)$ and B the right child. Similarly, C and D correspond to the left and right children of node $(9, 6)$ respectively.



(a) Suppose we insert the point $(8, 1)$ into our tree. At what position will it be added?
◯ A ◯ B ◯ C ◯ D

(b) Suppose we insert the point $(4, 7)$ into our tree. At what position will it be added?
◯ A ◯ B ◯ C ◯ D