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 \( \Theta(\cdot) \) 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.

[Diagram of K-D tree]

(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