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Data Structures
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HW4

1. 1. [4] Given the ordered input {34, 56, 23, 22, 121, 2} and a hash function h(x) = x mod 11
   where the tablesize is 11 show the resulting hash table when the following collision resolution strategies are applied.
   1. Separate chaining

      V[0] = 121, 22

      V[1] =23, 56, 34

      V[2] =2

   2. Linear probing (will be showing all the steps but look at last one for correct answer)

      Null, 34, Null, Null, Null, Null, Null, Null, Null, Null, Null

      Null, 34, 56, Null, Null, Null, Null, Null, Null, Null, Null

      Null, 34, 56, 23, Null, Null, Null, Null, Null, Null, Null

      22, 34, 56, 23, Null, Null, Null, Null, Null, Null, Null

      22, 34, 56, 23, 121, Null, Null, Null, Null, Null, Null

      22, 34, 56, 23, 121, 2, Null, Null, Null, Null, Null

   3. Quadratic probing (will be showing all the steps but look at last one for correct answer)

      Null, 34, Null, Null, Null, Null, Null, Null, Null, Null, Null

      Null, 34, 56, Null, Null, Null, Null, Null, Null, Null, Null

      Null, 34, 56, Null, Null, 23, Null, Null, Null, Null, Null

      22, 34, 56, Null, Null, 23, Null, Null, Null, Null, Null

      22, 34, 56, Null, 121, 23, Null, Null, Null, Null, Null

      22, 34, 56, 2, 121, 23, Null, Null, Null, Null, Null

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4. Double Hashing

Null, 34, Null, Null, Null, Null, Null, Null, Null, Null, Null

56 mod 11 +(7 – 56 mod 7) mod 11

1 +7 =8 mod 11 = 8

Null, 34, Null, Null, Null, Null, Null, Null, 56, Null, Null

23 mod 11 + (7 – 23 mod 7) mod 11

1 + (7 – 2) = 6 mod 11

Null, 34, Null, Null, Null, Null, 23, Null, 56, Null, Null

22, 34, Null, Null, Null, Null, 23, Null, 56, Null, Null

121 mod 11+ (7-121 mod 7) mod 11

0 +(7-2) = 5 mod 11 = 5

22, 34, Null, Null, Null, 121, 23, Null, 56, Null, Null

22, 34, 2, Null, Null, 121, 23, Null, 56, Null, Null

2.[4] Given the hash function `h(x) = x mod 11.` Assume `x = 12` and four collisions occur. That is, assume that the next key to insert is x = 12. However, when attempting to store the object with key 12, the first hash of 12 results in a collision, then the next probing sequence of 12 results in another collision (i.e. 2 collisions occur), then the next probing sequence results in a collision (i.e. a 3rd collision occurs), then the next probing sequence results in a collision (i.e. a 4th collision occurs). What are the locations/hashes of these four collisions?

Before we start the question 12 mod 11 = 1 so it would be in the 1 spot

Separate Chaining wouldn't have four collisions I am fairly certain because wouldn't it just add it to the front of the linked list and push everything else in that list back?

Linear Probing it would occur when there are numbers located in the 1st, 2nd,3rd, and 4th away from zero just so we are clear it would look something like Null, Full, Full, Full, Full, … etc

Quadratic Probing it would occur when there are numbers located in the 1st, 2nd,5th,11th Positions because its 1,4, and 9 spots away from the original spot. For an example it may look like Null, Full, Full, Null, Null, Full, Null, Null, Null, Null, Full

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Double hashing it would occur when there are numbers located in the 1st, 3rd, 5th, 7th position are full.

1 + (7-(12 mod 7) mod 11

1+(7-5) = 3 mode 11 would be 3

3 +2 = 5 mod 11 = 5

5+ 2 = 7 mod 11 = 7

3. These questions pertain to hashing and lazy deletion.

1. What is lazy deletion?
2. Does separate chaining require lazy deletion? Why/why not?
3. Do open addressing (a.k.a. closed hashing) techniques require lazy deletion? Why/why not?

1. Lazy deletion happens in open addressing and It means rather than deleting the whole number from the hash table we would only mark it as deleted so when searching for an item our hash table isn't messed up.
2. does separate chaining need lazy deletion? – No because our has table it made out of many linked lists and we can just use the way we delete an item from a linked list and continue.
3. Do open addressing (a.k.a. closed hashing) techniques require lazy deletion? As stated before yes it does require lazy deletion to allow us to search for items inside of our hash table if we didn't have lazy deletion we may not be able to find every item in our table using our original hashing function.

4.

Key A is in table 2 position 4

Key B is in table 1 position 3

Key C is in table 2 position 2

Key D is in table 1 position 4

Key E is in table 2 position 1

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