Hash Tables

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CSC220 Programming II – Spring 2022

Implementations of Map

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- 2-3 Tree (BTree): add, find, and remove in O(log n) time.

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- When you look up a name, it is nice to be able to go forward or back a few names in case you misspelled it.
- If you want Milenkovic in a hash table, you better not look for Milenkovich because it will be far far away.

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public int hashCode()
Returns a hash code for this string. The hash code for a
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 s[0]*31^(n-1) + s[1]*31^(n-2) + ... + s[n-1]

 using int arithmetic, where s[i] is the ith character of the
 string, n is the length of the string, and ^ indicates
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WHAT???

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for (int i = 0; i < name.length(); i++) {
  char c = name.charAt(i);
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An int can only hold integers in the range from -2147483648 to 2147483647.

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- Using powers of 31 makes these all different.

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```
int hashIndex (String name, int m) {
  int code = name.hashCode();
  int index = code % m;
  if (index < 0)
    index += m;
  return index;
}
```

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- Entries in the same list in the first table will be in different lists in the second table.

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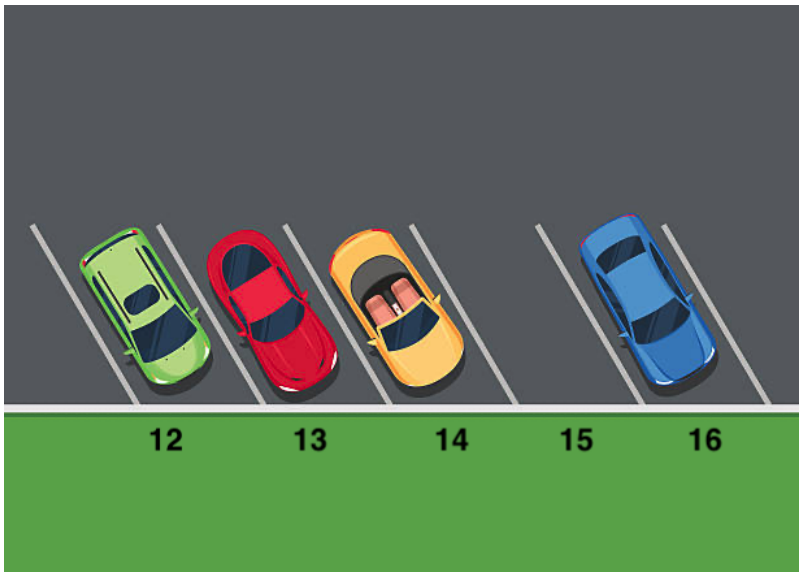
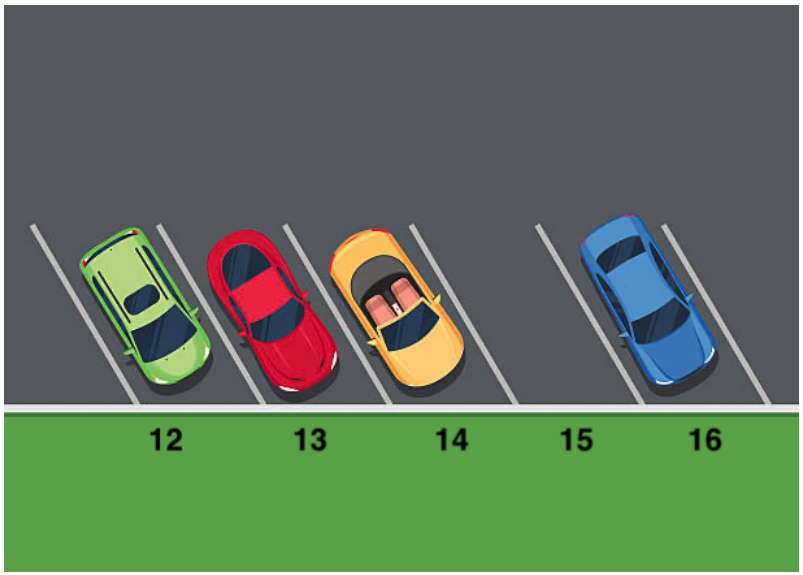
- If you reach the end of the lot, you go back to the beginning.

Add



Add



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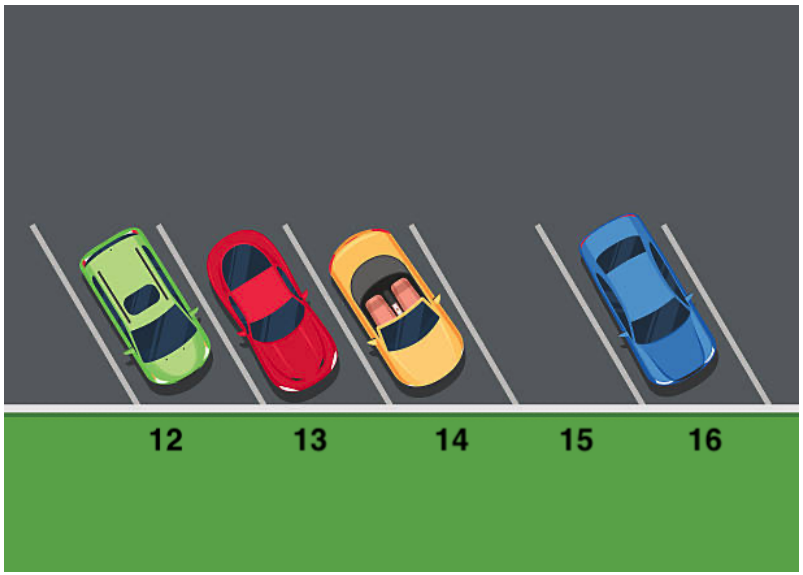

Here is how to add.

- Suppose my assigned number is 12.

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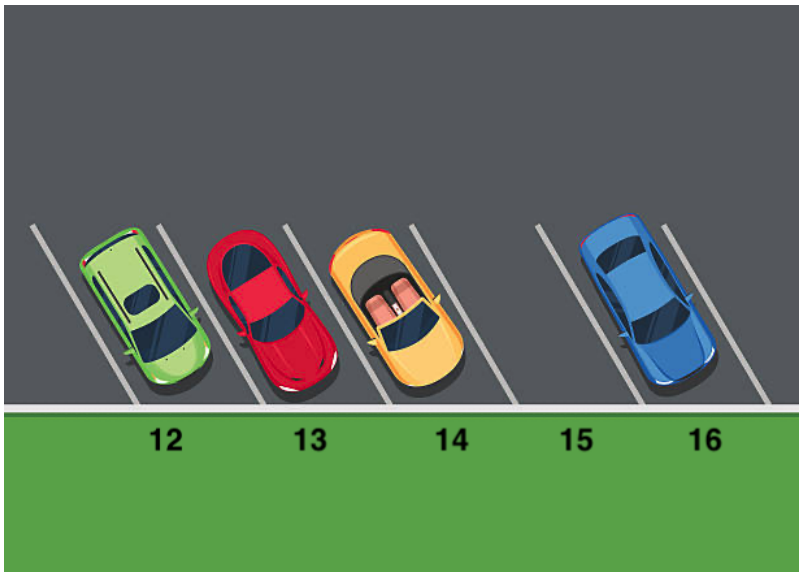

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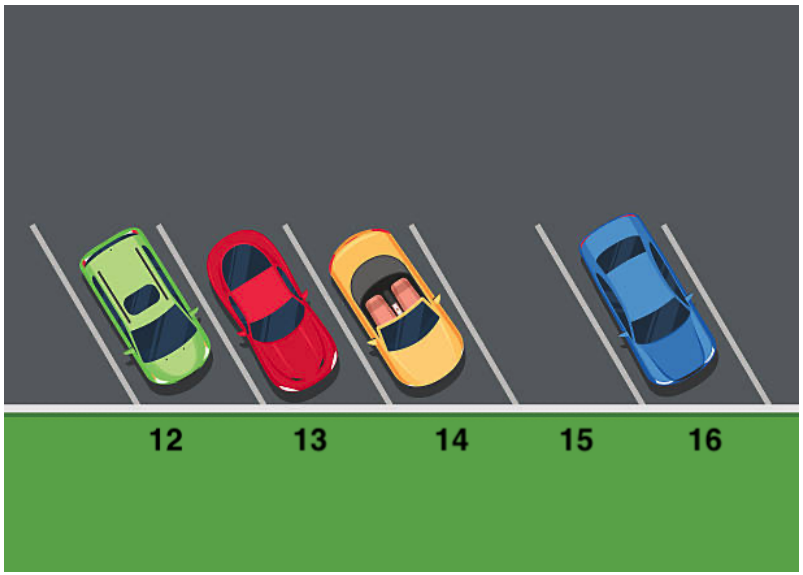

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- So are 13 and 14.

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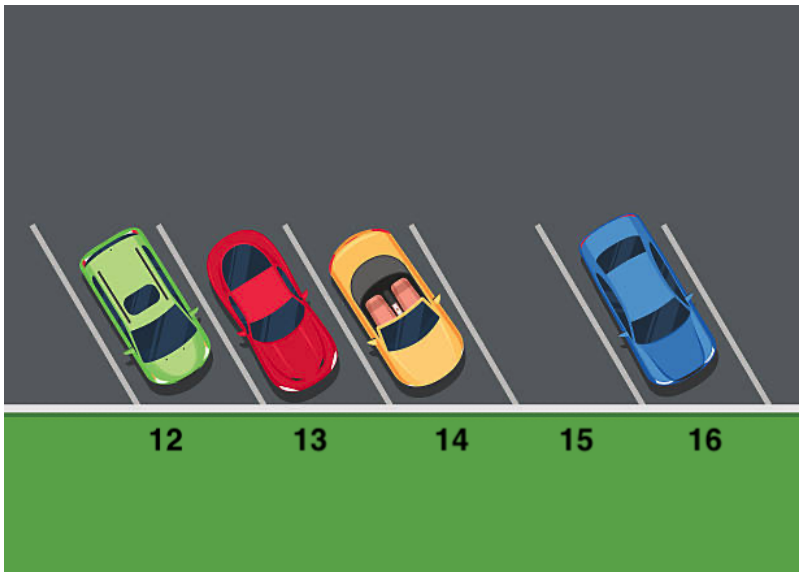
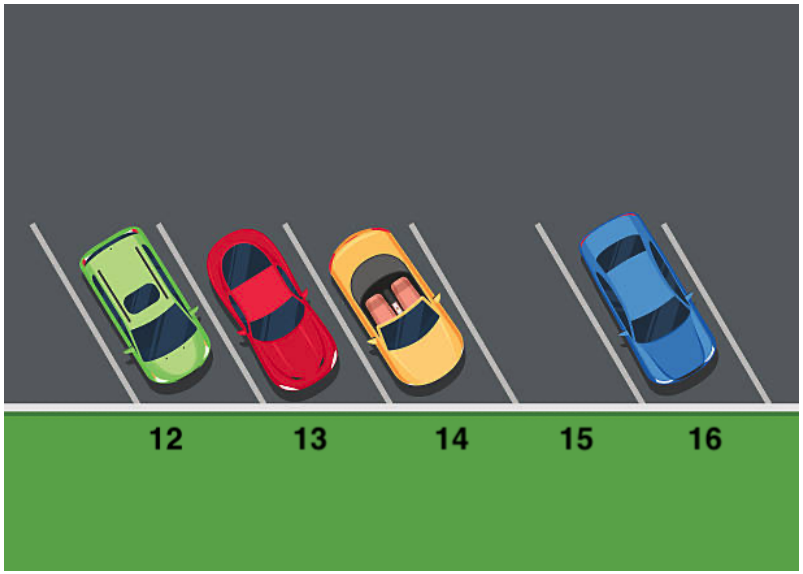


Here is how to add.

- Suppose my assigned number is 12.
- But 12 is full.
- So are 13 and 14.
- So I park in 15.

Find



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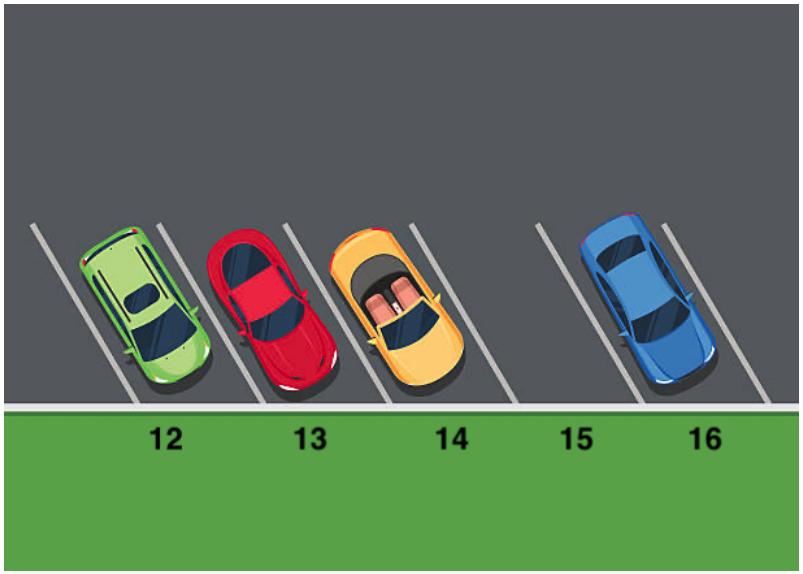

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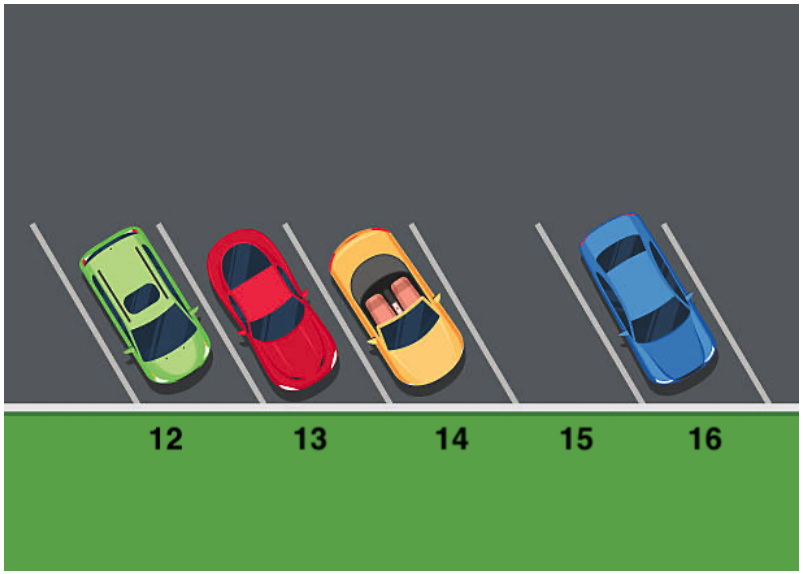

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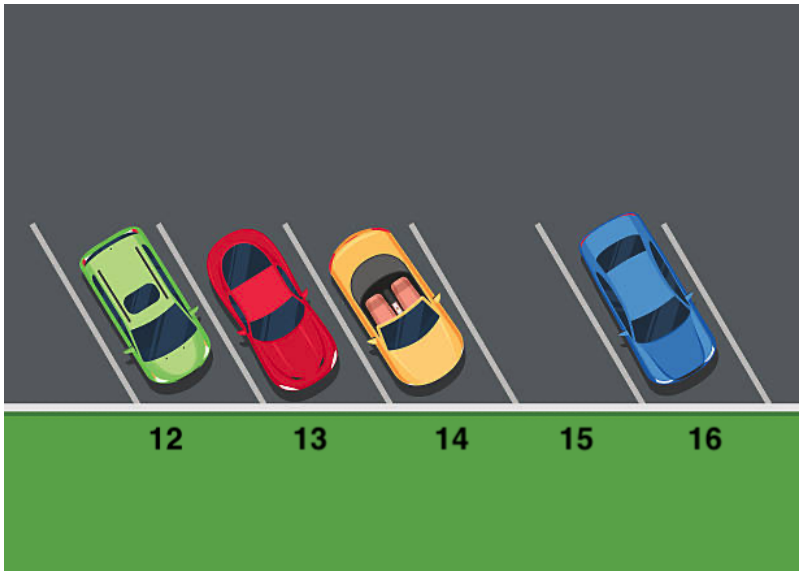

Here is how to find Victor.

- You know my assigned number (hash index of Victor) is 12.
- But I am not in 12 (assume everyone has their name on their license plate).

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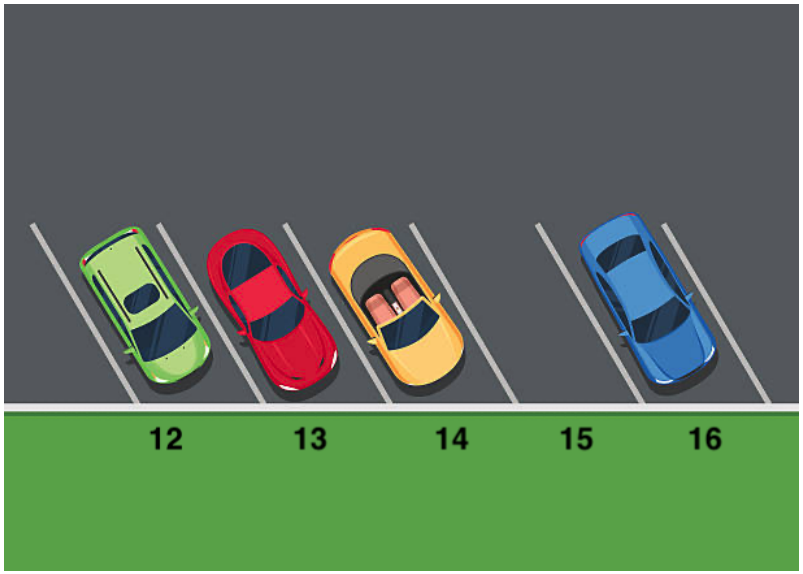

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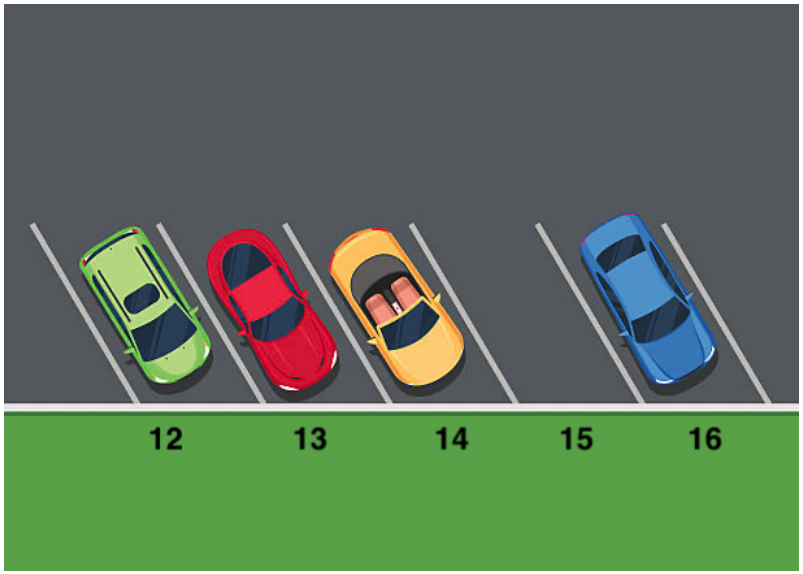

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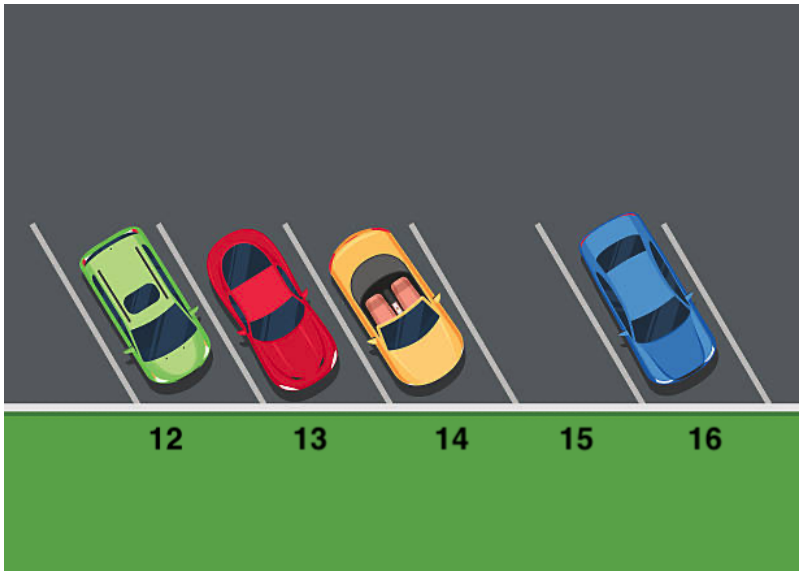

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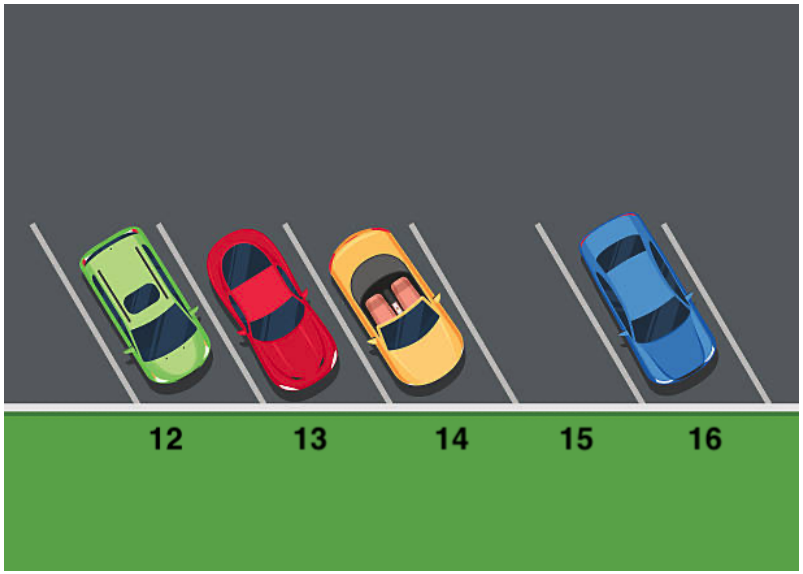

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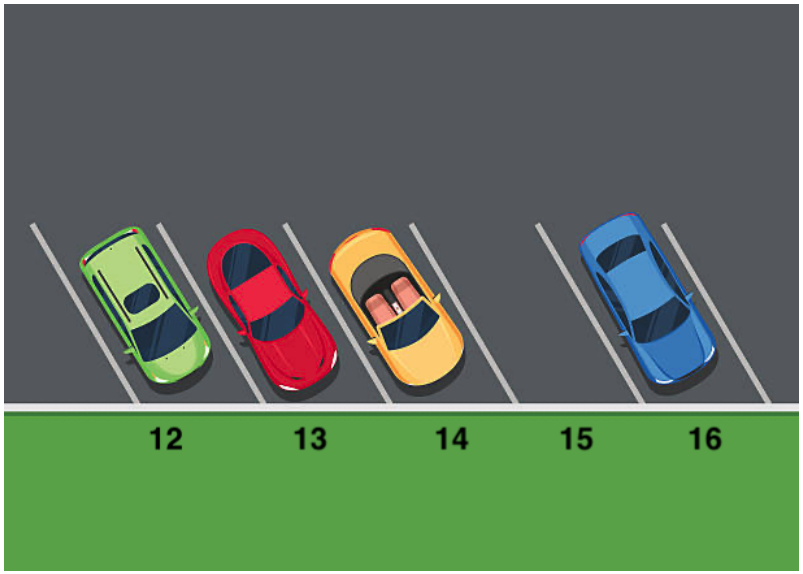

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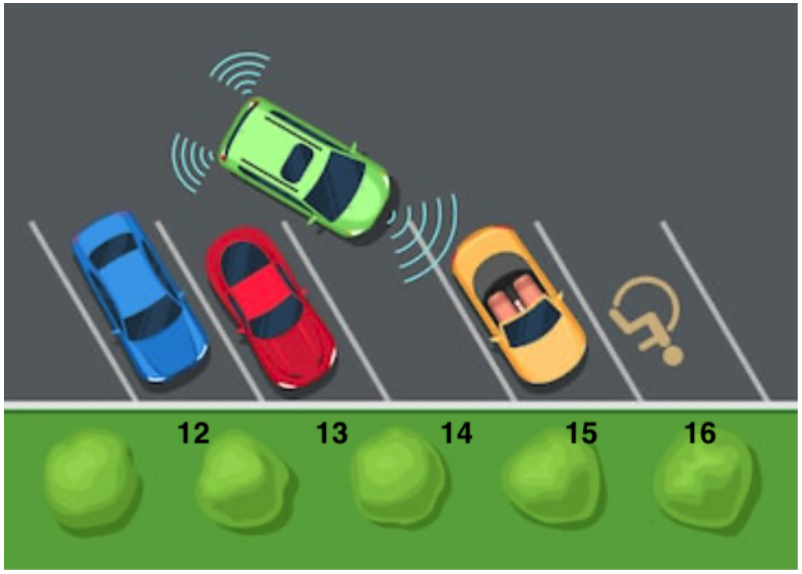

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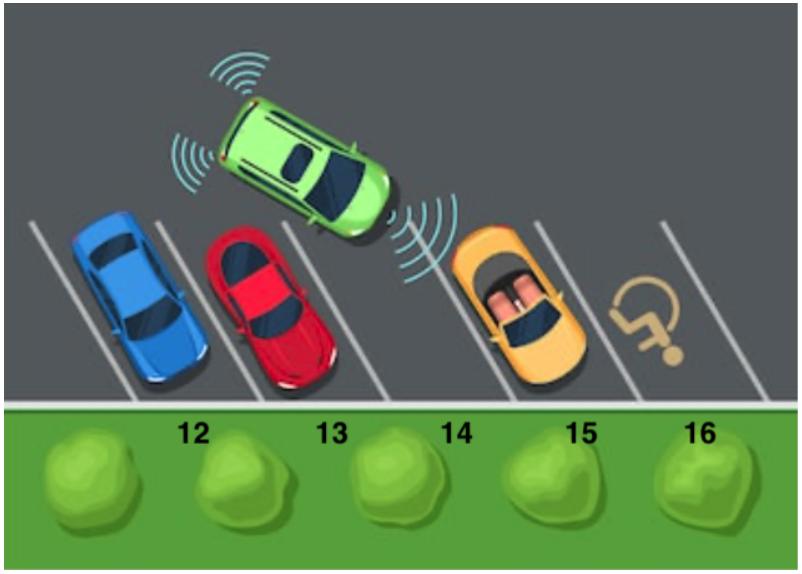

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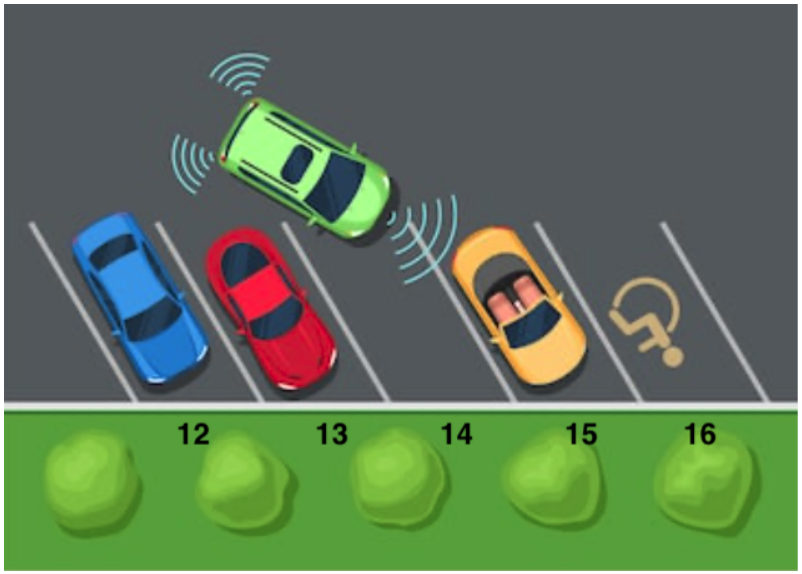

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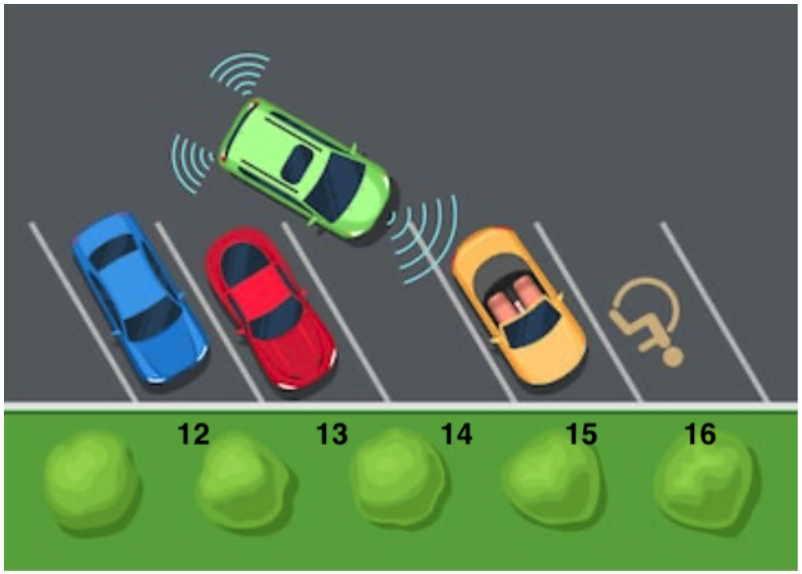

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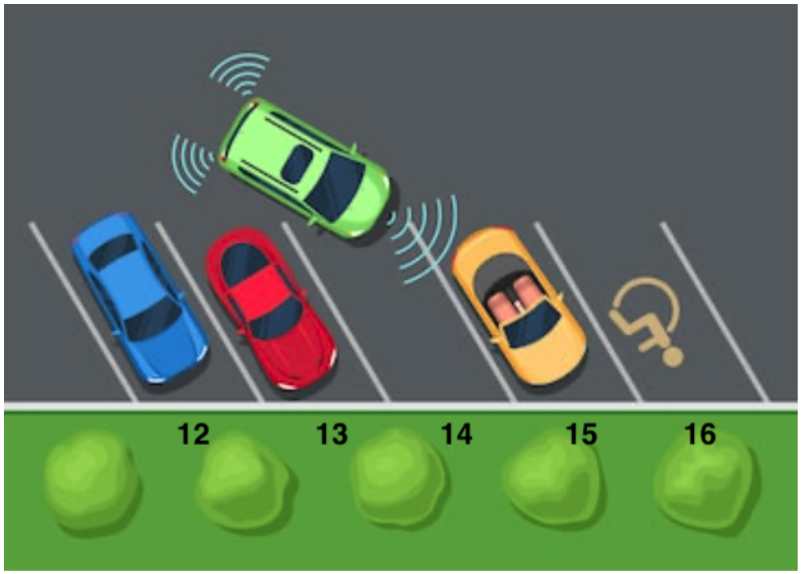

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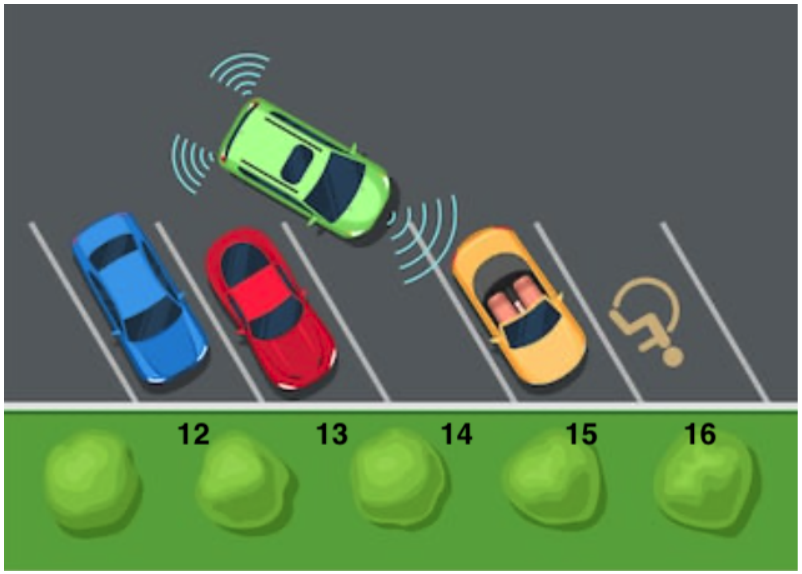

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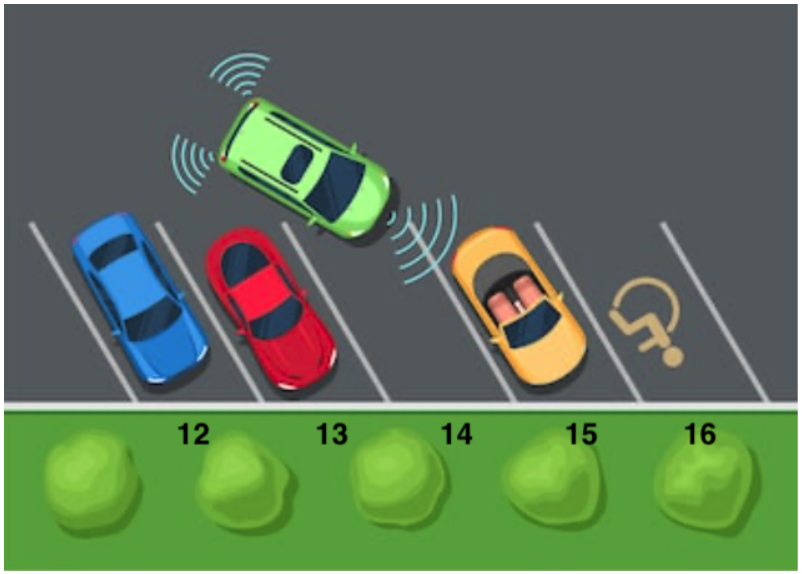

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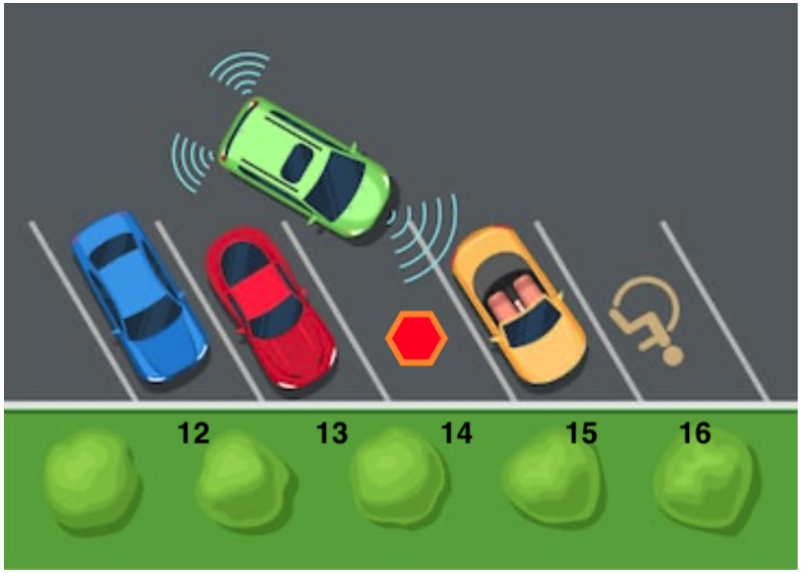

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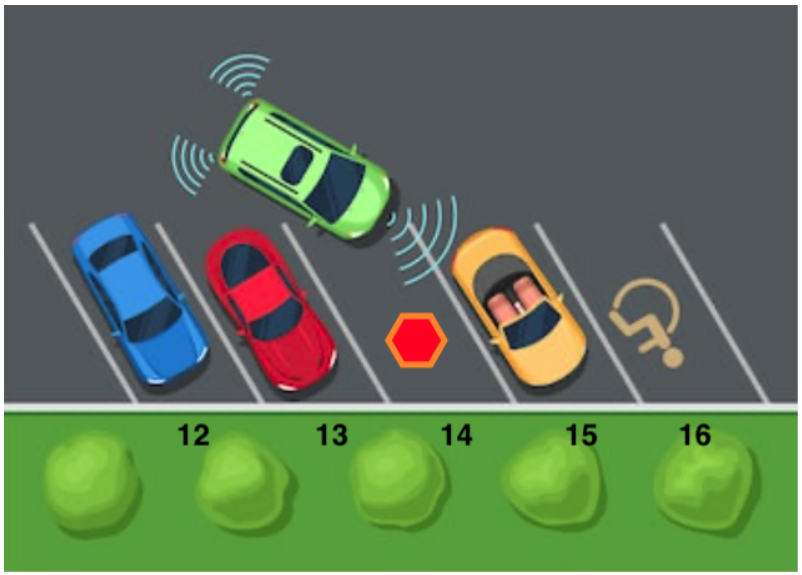

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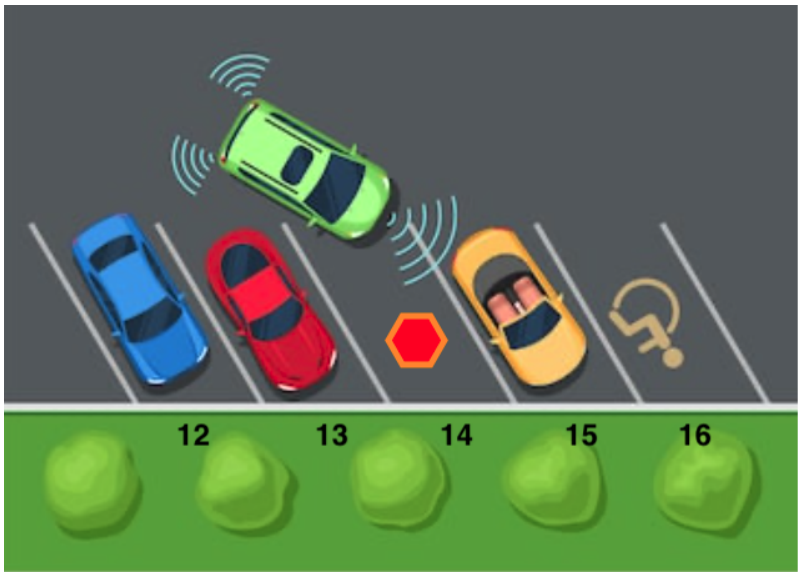

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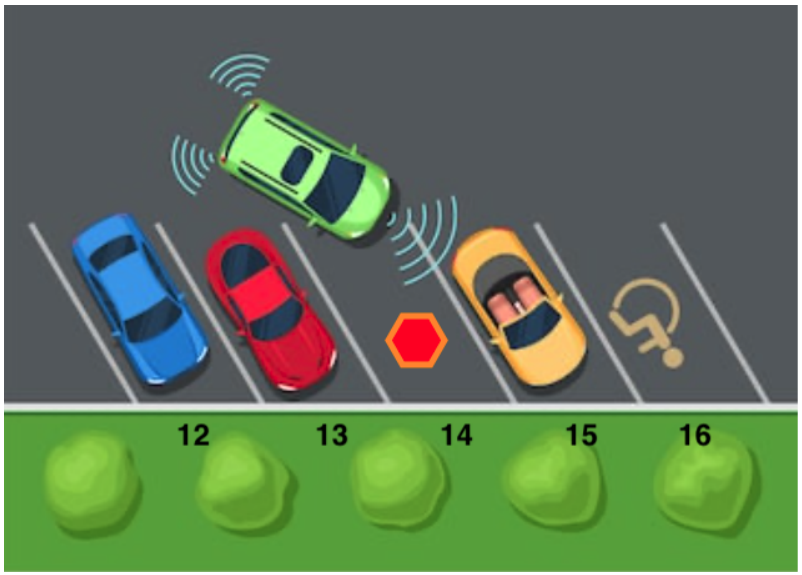

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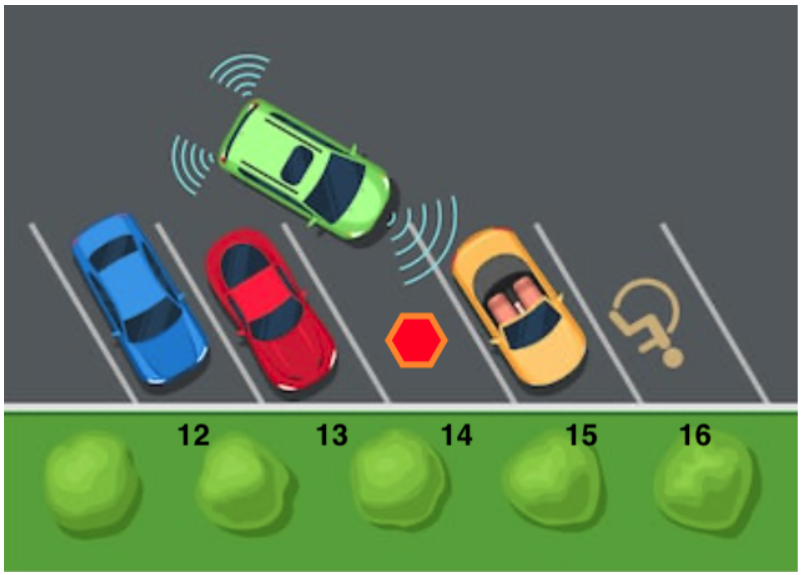

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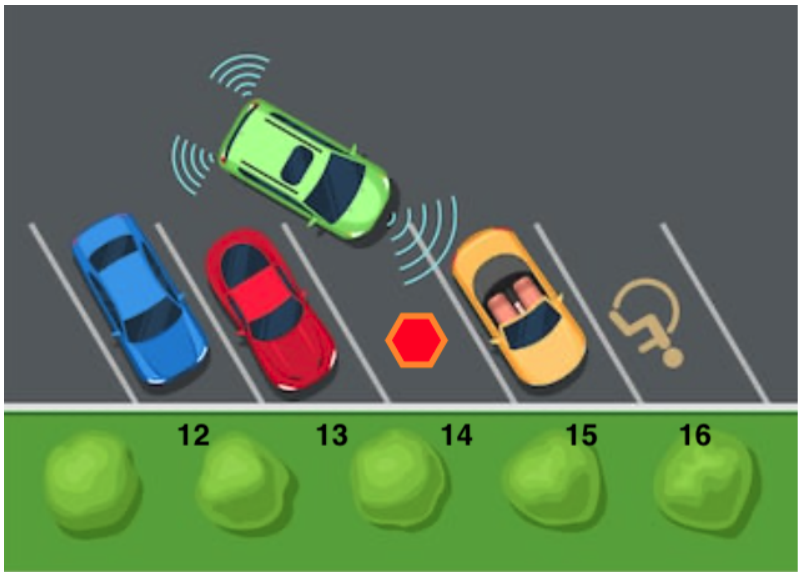

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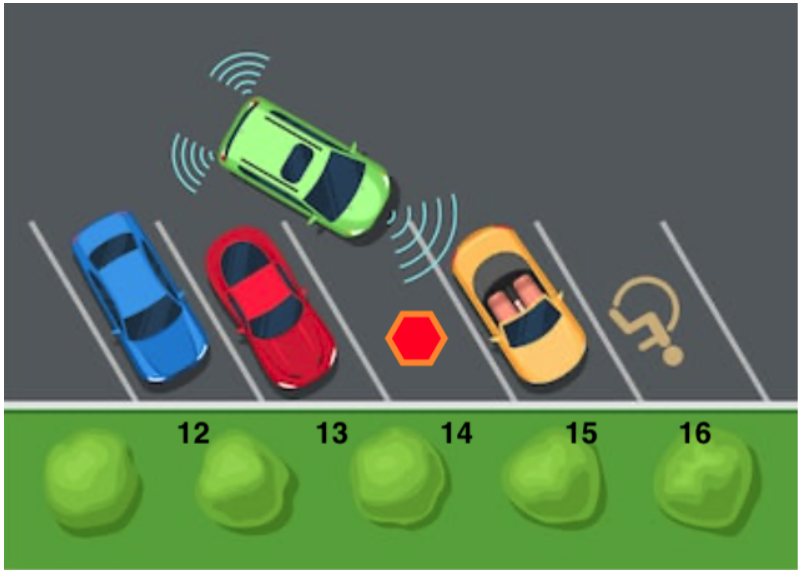

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- Needs to rehash and possibly reallocate when less than m/2 spaces are empty.