SC1007 Data Structures and Algorithms

Tutorial 5: Hash Table and Graph Representation

Q1 The type of a hash table H under closed addressing is an array of list references, and under open addressing is an array of keys. Assume a key requires one "word" of memory and a linked list node requires two words, one for the key and one for a list reference. Consider each of these load factors for closed addressing: 0.5, 1.0, 2.0.

Estimate the total space requirement, including space for lists, under closed addressing, and then, assuming that the same amount of space is used for an open addressing hash table, what are the corresponding load factors under open addressing?

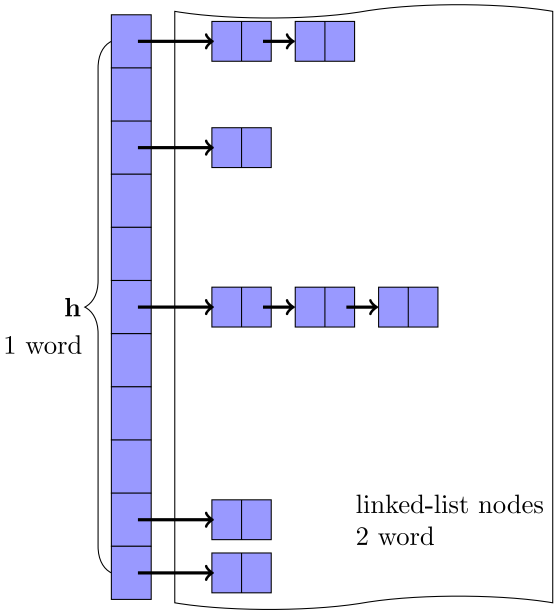

Figure 5.1: Closed Addressing Hash Table

Q2 Consider a hash table of size n using open address hashing and linear probing. Suppose that the hash table has a load factor of 0.5, describe with a diagram of the hash table, the best-case and the worst-case scenarios for the key distribution in the table.

For each of the two scenario, compute the average-case time complexity in terms of the number

of key comparisons when inserting a new key. You may assume equal probability for the new key to be hashed into each of the n slots.
[**Note: Checking if a slot is empty is not a key comparison.**]

Q3 Manually execute breadth-first search on the undirected graph in Figure 5.2, starting from vertex s. Then, use it as an example to illustrate the following properties:

(a) The results of breadth-first search may depend on the order in which the neighbours of a given vertex are visited.

(b) With different orders of visiting the neighbours, although the BFS tree may be different, the distance from starting vertex s to each vertex will be the same.

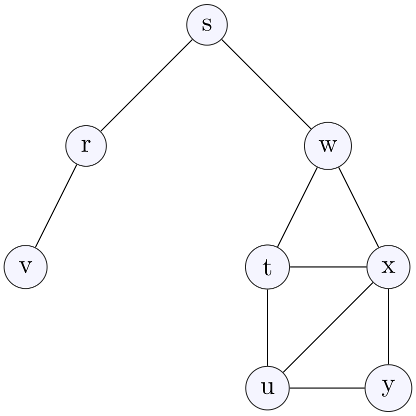

Figure 5.2: The Graph for Q3