# Homework 4 Hash tables

1. The abstract data types (ADT) covered include lists, stacks, queues, hash tables, and dictionaries.

Complete the table to show the most suitable ADT in each case:

|  |  |
| --- | --- |
| **Application** | **ADT** |
| Storing a large data set that is going to be searched frequently |  |
| Controlling items to be printed |  |
| Storing data that is going to be processed from beginning to end |  |
| Holding parameters and return addresses from subroutines |  |

[4]

2. A hash table of size 11 has been created using the hashing function:

**address = key mod (table size)**

(a) Show in Table 1 at which addresses the values 37, 44, 92, 76, 87, 22 would be held. [3]

**Slots**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|  |  |  |  |  |  |  |  |  |  |  |

*Table 1*

(b) Explain how the items 37 and 22 would be located in the table. [2]

(c) A procedure **findItem(x)** to find an item returns **False** if the item cannot be found. Explain how the procedure will be able to ascertain that an item is not in the hash table. [2]

(e) Explain what would need to be done to prevent the procedure **findItem(x)** from returning **False** when the item is in fact in the table. Assume some items have been deleted from the table. [2]

(f) Explain, with the aid of an example, what is meant by the term “load factor” in connection with the hash table. Why is it advisable to avoid having a load factor close to 100%? [3]

3. Internal telephone extension numbers in a large organisation are held in a dictionary data structure. Sample entries are:

{“Jones, A”: 352; “Arnot, G”: 101, “Harrison, M”:56, …}

(i) What value will be returned by a lookup operation using the key “Arnot, G”? [1]

(ii) Explain why the dictionary entries are not held in alphabetical order. [2]

(iii) Some employees and departments have more than one phone number to be stored in the dictionary. Show with the aid of an example how this can be achieved. [1]

Total 20 marks