

CS 124 W05 Tutorial 2: ADTs with Solutions

1 ADTs

1.1 Properties of ADTs

- Data space - A set of values that the ADT can take on.
- Operations - A set of methods that take the ADT to a different state or reveal information about the state.
- No Implementation - ADTs are abstract and free of implementation. None may be suggested or implied.

1.2 Am I an ADT?

1. (a) A book.
(b) A book that can be read.
(c) A book that can store stories on specific pages.
(d) A book that can store stories and the stories can be read.
(e) A book that can store stories and the stories can be read, but the stories are on A4 pages made with B.C. timber, and reading must involve the use of eyeglasses.
2. (a) A person.
(b) A person that can be in different places.
(c) A person that can walk.
(d) A person that can be in different places and can walk.
(e) A person that can be in different places and can walk, but the places must be designated by green labels in all caps, and the walking must be in a drunken manner by means of muscle contraction.
3. (a) A basketball player.
(b) A basketball player who dunks.
(c) A basketball player who dunks with two hands.
(d) A basketball player who plays for an NBA team and can shoot.
(e) A basketball player who plays for an NBA team because he is listed on an online roster. He also can shoot.
4. (a) A priority queue.
(b) A priority queue that stores a finite set of comparable elements.
(c) A priority queue that can find the smallest element of a given list, but stores nothing itself.
(d) A priority queue that stores comparable elements in contiguous memory, and to which you can add elements and remove the smallest element by “bubbling” the elements through the memory in a specified way.

- (e) A priority queue that stores comparable elements and allows you to add arbitrary elements and remove the smallest.
5. (a) A database.
- (b) A database that stores tables of relations.
 - (c) A database that allows queries.
 - (d) A database that allows queries of the relations it stores.
 - (e) A database that stores tables of relations using a B-tree and a extendible hashtable for the secondary key and must support queries in $O(\log^k n)$ time.

Solutions:

- 1 (d)
- 2 (d)
- 3 None of the above. (d) is closest, however the operation (shooting) does not operate on the data space (NBA team).
- 4 (e)
- 5 (d)

1.3 Make your own ADTs

- 1. Cell phone

Dataspace Power (on/off), and stored phone numbers
 Operations Turn on/off, add/remove/lookup phone numbers

- 2. Airplane

Dataspace Direction, altitude, landing gear (up/down)
 Operations Take off, land, change course, adjust landing gear