

1st Test (Theoretical Computer Science) (MIEI, FCT UNL)

April 9, 2014

Consider the cloud dropbox system. The goal of this exercise is to model a simplified version of the system with a structure. The system maintains a global finite collection of folders and a finite collection of clients.

Each folder has a name and a finite collection of files. Each file has a name and a content, the content is represented by an element of set *TEXT* (do not worry about the definition of *TEXT*).

Each client (user) keeps a name (the userid of the client) and a finite collection of local folders. The local folders are supposed to be local copies of the global folders, but not always, since the local state of a client may be outdated (there are operations that allows users to update their local data from the dropbox and to update the dropbox with their local data, as you will see below).

1. Define the set *FILE* of all files.
2. Define the set *FOLDER* of all folders.
3. Define the set *CLIENT* of all possible client states.
4. Define the set *SDROP* of all possible dropbox system states.
5. Consider the set of all dropbox states you defined in 4. Is it finite or infinite? Is it countable ?
6. Define a function **hasuser** $\in SDROP \times STRING \rightarrow BOOL$ that checks if a user exists in a dropbox system.
7. Define a function **addclient** $\in SDROP \times STRING \rightarrow SDROP$ that creates a new client in a dropbox system given its name. When the client is created its name cannot exist yet in the system, so the operation is undefined if it does. The set of local folders is empty after creation.
8. Define a function **createfolder** that creates a new local folder in a given user client. The operation requires the user name and the folder name. When the folder is created it cannot exist yet in the system, so the operation is undefined if it does exist. The operation is also undefined if the user does not exist. The local folder is empty after creation.
9. Define a function **createfile** that creates a new local file in a given client folder in a dropbox system. The operation requires the user name, the folder name, and the file name. When the file is created it cannot exist yet in the folder, so the operation is undefined if it does exist. The operation is also undefined if the user and folder do not exist.
10. Define a function **upload** that models the upload of the contents of a user local folder to the dropbox. The effect of this operation is to replace the global copy with the new contents, this operation also creates a new global folder, if it does not exist. The operation requires the user name and the name of the local folder to be uploaded.
11. Define a function **download** that models the update of the contents of a user local folder from the global dropbox store. The effect of this operation is to replace the content of the local folder with the contents of the corresponding folder in the global store. The operation requires the user name and the name of the local folder to be updated.