

Build Search Engine

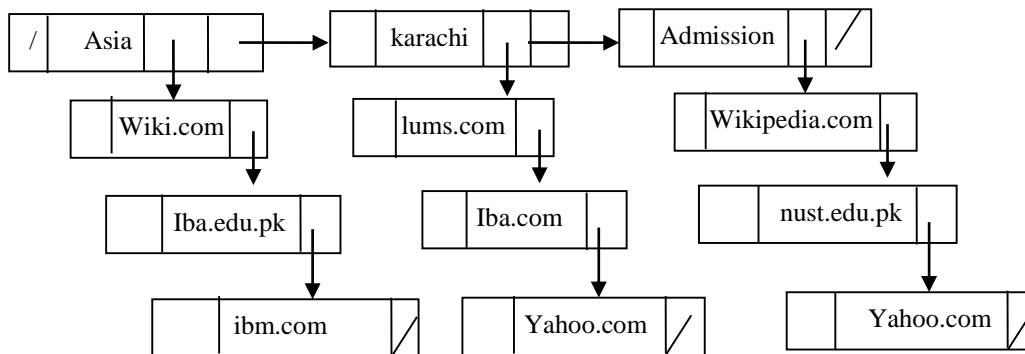
This question helps you to understand how to design data structure to build a search engine. In typical search engines, users provide keywords where the search engine returned a list of URLs based on these keywords. To build a search engine, you have to design a list data structure to organize words and URLs.

The idea is that you have to store the words corresponding to URLs in a list so that users can get relevant URLs efficiently. You have to create two kinds of the linked list then linked them together. One is a Linked list of WORDs and another one is linked list of URLs.

Procedure:

- A. Create a linked list of words, where each node consists of four information:
 - i. address of previous word node
 - ii. WORD
 - iii. head of URLs list
 - iv. address of next word node
- B. Create a linked list of URLs consists of three information
 - i. address of previous URL node
 - ii. URL
 - iii. address of next URL node

Consider the diagram below to design the data structure of nested linked list to build a search engine.



For example,

The word Asia is found on three web pages and URLs are wiki.com, iba.edu.pk, ibm.com similarly next word is Karachi and so on.

You have to implement the following methods to build a search engine and understand the Big Oh of each method:

- insert(String word, String url)
- search(String word) → return list of urls corresponding to the word
- delete(String word)
- toString() → display all words with list of URLs

3. Modified search engine

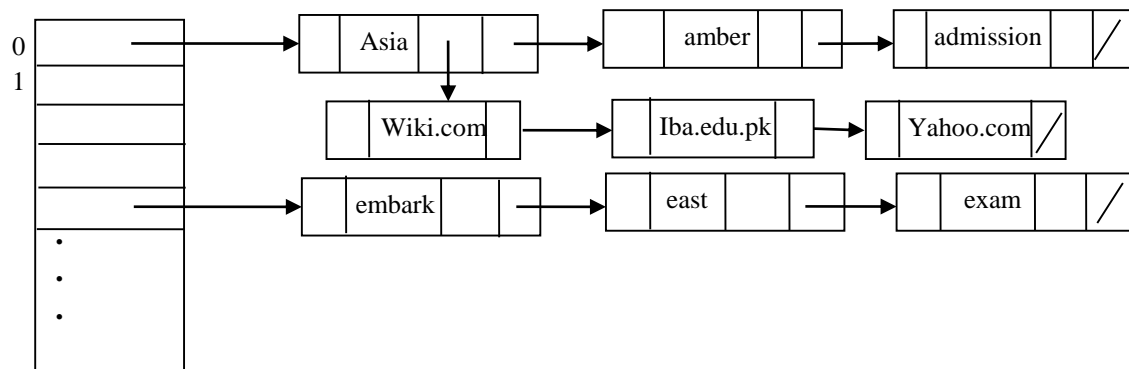
Modify the design of search engine as you did in above question by adding array to enable direct access to some nodes of the linked List. For example:

0th index of an array refers to wordlist where each word starts with letter A.

1st index of an array refers to wordlist where each word starts with letter B.

and so on.

If the input word is **Asia** then you have to direct access to linked list of words which is referred by 0th index. In this way you can avoid searching to the whole list of words and improve the performance.



You have to implement the following methods to build a search engine and understand the bigOh of each method:

- `insert(String word, String url)`
- `search(String word) → return list of urls corresponding to the word`
- `delete(String word)`
- `toString() → display all words with list of URLs`