

2. The most common representation of character strings is as an array of characters, but it is also possible to represent strings using linked lists. When strings are represented with a linked list, each character of the string occupies one node of the linked list.

Write a C abstract data type (ADT) called `list_string` that represents a string as a linked list of characters. Your ADT should have functions to do the following:

- a) Take a normal null-terminated array C string as a parameter, and returns a new linked list-based string of type `mystring`. [30 marks]
- b) Take a `list_string` as a parameter, and returns the length of the string. [10 marks]
- c) A string compare function that takes two `mystring` parameters and returns -1 if the first string is lexicographically less than the second, 0 if the two string are equal, and 1 if the first is lexicographically greater than the second. Lexicographic order is similar to alphabetic order, but each character is compared based on its ASCII code, not its alphabetic order. For example, "abC" is less than "abc" because the first two characters are the same, and 'C' < 'c'. The string "abc" is also less than the string "abcd", which share the first three characters, but "abcd" is longer. On the other hand "bbc" is lexicographically greater than "abcd". [30 marks]
- d) A substring search function that takes two `mystrings` as parameters: a piece of text, and a string to search for. The function should search the text string for the search string, and if it finds a sequence of characters within the text that is equal to the characters in the search string it should return 1. Otherwise the function should return 0. [30 marks]

You may not use any standard C string manipulation functions in your solution. You must also manipulate your strings as linked lists. You should not convert your list strings to another data structure, such as C strings or arrays.

You should complete your solution on a computer within files that are available on the CSU22014 Blackboard page. You may define and call additional functions from the two functions (a) and (b). All program code should be commented, indented, and use good programming style.

[Total: 100 marks]