



Coláiste na Tríonóide, Baile Átha Cliath
Trinity College Dublin

Ollscoil Átha Cliath | The University of Dublin

Faculty of Engineering, Mathematics and Science

School of Computer Science and Statistics

Senior Freshman Integrated Computer Science
Senior Freshman Computer Science Joint Honours

Michaelmas Term 2022

Systems Programming

13th December 2022

Online Exam

09.30 – 11.20

Dr David Gregg

Instructions to Candidates:

- ☐ Answer 1 out of the 2 questions
- ☐ All questions are marked out of 100
- ☐ All program code should be commented, indented and use good programming style
- ☐ Answers to the questions should be completed by completing corresponding assignments that can be found on the CSU22014 Blackboard page.

Materials permitted for this examination:

1. 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 `mystring` that represents a string as a linked list of characters. Your ADT should have functions to do the following:

- a) Create a new empty string [10 marks]
- b) Take a normal null-terminated array C string as a parameter, and return a new linked list-based string of type `mystring`. [10 marks]
- c) A string copy function that takes a `mystring` as a parameter, and returns a newly created `mystring` that is a copy of the original string. [10 marks]
- d) A string concatenate function, that takes two `mystrings` as a parameter and returns a new `mystring` that consists of the concatenation of the first and second string. [16 marks]
- e) A string reverse function that takes a `mystring` as a parameter, and returns a new string that contains the same characters as the original string, but in reverse order. [16 marks]
- f) A 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. [26 marks]
- g) A free function that frees the memory used by the string. [12 marks]

Your functions should operate directly on the linked list data structure that represents the string. You should not convert the linked list to an array or other data structure for processing.

Your string abstract data type should be implemented in the related files in the assignment for the exam on Blackboard.