Assignment 4 CSSE3100/7100 Reasoning about Programs

Due: 4pm on 28 May, 2021

The aim of this assignment is to provide you with experience specifying and verifying programs using objects and data structures.

Instructions: CSSE3100 students submit a single Dafny file with your solution to question (a) to Blackboard by the due date and time.

CSSE7100 students submit a single Dafny file with your solutions to questions (a) and (b) to Blackboard by the due date and time.

A stack is a list of elements in which addition and deletion of elements occurs only at one end, called the *top* of the stack. In other words, a stack is a LIFO (last in, first out) data structure. The Dafny file `Stack.dfy` provides a linked-list implementation of a stack of integers.

(a) Verify the implementation in `Stack.dfy` using the Dafny verifier. To do this, provide specifications for each of the implemented methods in the `Stack` class in terms of a ghost variable `s: seq<T>` representing an abstract view of the stack. You will need a `Valid` invariant to relate the provided implementation to this abstract representation. You will also need to provide specifications for the `Node` class in terms of an abstract variable. Look at the binary tree example in the lectures for ideas.

(b) **(CSSE7100 students only)** Add the following method which moves the top element of the stack to another stack provided as an input parameter.

```
method MoveTop(other: Stack<T>)
{
     var v := Pop();
     other.Push(v);
}
```

Verify the implementation of `MoveTop` using the Dafny verifier by providing a specification in terms of the abstract variable `s`.

Marking

A breakdown of the marks is given below.

(a)	Node specification	4 marks
	Node invariant	1.5 marks
	Node specification-related code	2 marks
	Stack specification	3 marks
	Stack invariant	1.5 marks
	Stack specification-related code	3 marks
(b)	MoveTop specification	3 marks

CSSE7100 students' marks will be divided by 1.2 to get a total mark out of 15. Fractional marks will be rounded to the nearest 0.5 marks.

School Policy on Student Misconduct

This assignment is to be completed individually. You are required to read and understand the School Statement on Misconduct, available on the Schools website at: http://www.itee.uq.edu.au/itee-student-misconduct-including-plagiarism