The University of New South Wales

SENG2011: Workshop on Reasoning about Programs

Sample Mini-Exam 1

(mock-exam from 2020)

- Two questions: total time allowed: 60 minutes

ex1.dfy   0 marks

Write a Dafny <u>predicate</u> *acheck* that, given an array *a* of integers, and an integer $n \geq 1$, is true if the following properties are satisfied (and false otherwise):

- the length of the array is even

- if the <u>**index**</u> of an element in the array is divisible by n then the element is 0

You are not allowed to write any other predicates or methods.
So, for example, if the array *a* is [0,42,0,42,0,42] then *acheck(a, 2)* is true.
If the array *a* is [0,1,2,3], or even just [], then *acheck(a, 5)* is true.
If the array *a* is [0,4,2,0], [0,0,0] or [1,2] then *acheck(a, 2)* is false.

Limit the time you spend on each exercise.

Submission: **give se2011 sample1 ex1.dfy** (command will not work before the exam)

ex2.dfy   0 marks

Write a Dafny method that has signature:

```
method Deli(a: array<char>, i: nat)
```

which deletes the character at index *i* of an array, where $0 \leq i < a.Length$, by shuffling all the characters from index $i + 1$ up to the end of the array each down 1 place in the array. (hence the element that was at index *i* is over-written). A '.' is put at the last index in the array. The integer *i* is required to be an index in the array. The array cannot be empty as *i* has minimum value 0.

For example, if the array *a* is ['b','r','o','o','m'], then calling *deli(a, 1)* will delete the character at index 1 by shuffling the 3 letters 'o', 'o' and 'm' down 1 place, and putting '.' at the last index. The result is the array ['b','o','o','m','.'].

An example of calling the method, with verification, is the following fragment of code:

```
var z := new char[]['b','r','o','o','m'];
Deli(z, 1);
assert z[..] == "boom.";
```

You will find a copy of a more complete checker, called `DeliCheck`, on the course website for your convenience, under the *Practice & Play* link.

Conditions:

- You are not allowed to call or write any other predicates, functions or methods.

- You are not allowed to use an *executable-forall* statement in this exercise.

Limit the time you spend on each exercise.

Submission: **give se2011 sample1 ex2.dfy** (command will not work before the exam)

End of Short Sample Examination