The University of New South Wales

SENG2011: Workshop on Reasoning about Programs

Sample Mini-Examination 2

(taken from 2020 Final Examination)

- Two questions: total time allowed: 60 minutes

ex1.dfy — 0 marks

A well-known property of Number Theory is that $n^2 - n$ is divisible by 2 for $n \geq 0$. For example, if $n = 5$ then $5^2 - 5$ is divisible by 2. Dafny does not 'know' this property.

1. Write a LEVEL-2 proof of this property in a Dafny lemma, called `Div2`, with signature:

   ```
   lemma {:induction false} Div2(n:  nat)
   ```

2. Demonstrate that Dafny has 'learnt' this property by writing a method that checks the general case. *(Do this part only if you have the previous part working.)*

Limit the time you spend on each exercise.

Submission: **give se2011 sample2 ex1.dfy** (command will not work before the exam)

ex2.dfy — 0 marks

A less-well-known property is that $n^3 - n$ is divisible by 6 for natural numbers $n \geq 0$. For example, if $n = 5$ then $5^3 - 5$ is divisible by 6. Dafny does not 'know' this property as well.

1. Write a LEVEL-3 proof of this property in a Dafny lemma, called `Div6`, with signature:

   ```
   lemma {:induction false} Div6(n:  nat)
   ```

   Note this proof must be LEVEL 3. You may find it useful to use lemma `Div2` in this proof.

2. Demonstrate that Dafny has 'learnt' this property by writing a method that checks the general case. *(Do this part only if you have the previous part working.)*

Limit the time you spend on each exercise.

Submission: **give se2011 sample2 ex2.dfy** (command will not work before the exam)

End of Short Sample Examination