

University of Toronto - Department of Computer Science

CSC410, Fall 2016

Homework 1

This homework is worth 3% of your final mark

Due: Sunday, 25 September 2016 at 23:59

Instructions:

The homework is to be done individually. You can write the answers on a sheet of paper or using an editor. Handwritten answers must be legible; otherwise, it will affect the mark. Write clearly which problem you are answering.

To submit, either scan your solutions or save your document as a PDF file and upload it to MarkUs.

Note that while all of the material is relevant for the midterm and final, only some problems may be marked.

Questions? Ask them on Piazza (folder hw1).

At the beginning of the homework include and complete the following header :

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CSC410, Fall 2016 - Homework 1

Name: _____

Student Number: _____

Lecture: ☐ Monday ☐ Tuesday

I am the sole author of this homework.

Signature: _____

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Problem 1 (Understanding JML assertions)

[2 Marks per assertion]

Given the following function, write for each assertion (in bold) whether it holds, and if it doesn't, explain why:

```
void problem1(/*@ non_null */ int a[]) {
    //@ assume a.length > 0;
    //@ a//@ assert a[0] <= 1000000;
    for (int i=0; i<a.length; ++i){
```

```

        //b)//@ assert i == 0;
        //c)//@ assert i <= a.length;
        a[i] = 0;
    }
    //d)//@ assert (\forall int j; j>=0 && j<a.length && a[j] == 0);
    //e)//@ assert a[0] <= 1000000;
    //f)//@ assert a[a.length-1] != '0';
    //g)//@ assert (\forall int j; j>=1 && j<a.length ==> a[0] > a[j])
}

```

Problem 2 (Writing JML assertions)

[3 Marks per assertion]

Assume that the following variables are available (*a* and *b* are not null and have length ≥ 1):

```

int a[];
char b[];
int x, y, i;

```

Translate the following assertions expressed in English into JML:

- x* equals the maximum integer lower or equal to the square root of *y*
 - The first character of *b* is an uppercase letter
 - The last element of *a* is greater than 1000
 - The value of *x* has been doubled (with respect to its previous value)
 - The return value is the index of *a*'s maximum value (it can be assumed that exists only one)
 - All the even places of *a* contain odd numbers
 - All the elements of *b* are lowercase letters
 - All the elements of *a* until (excluding) position *i* are sorted in an ascending order
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Problem 3 (Bonus: Writing JML assertions)

[2 Marks per assertion]

To get these bonus points, all the answers in **Problem 2** have to be correct.

The description of the problem is the same as in Problem 2.

Translate the following assertions expressed in English into JML:

- Every element of *a* was in the original version of *a*
- The return value is the sum of all values in the even indices of *a*