

## Homework 1 (Rubric)

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**Problem 3 [10 points]**

- [4 points] for determining whether each procedure is correct (1 per procedure)
- [3 points] for counterexamples with explanation for each incorrect procedure (1 per incorrect procedure)
- [3 points] for proving correctness for GCD4
  - Partial correctness/termination strategy
    - \* [1 point] for showing partial correctness
    - \* [2 points] for showing termination
  - Structural induction strategy
    - \* [1 point] for choosing an appropriate potential function to induct on
    - \* [1 point] for showing that  $\gcd(a, b) = \gcd(b, a(b + 1))$
    - \* [1 point] for a correct induction step

The vast majority of submissions attempted to prove partial correctness and termination over using structural induction.

A number of submissions failed to prove that  $\gcd(a, b) = \gcd(b, a(b + 1))$ . One common mistake here was only showing that if  $d$  divides  $a$  and  $b$ , then  $d$  divides  $b$  and  $a(b + 1)$ , when you need the reverse implication (if  $d$  divides  $b$  and  $a(b + 1)$ , then  $d$  divides  $a$  and  $b$ ) as well.

A number of submissions included counterexamples for each of the first three procedures, but failed to explain them. A counterexample without explanation was worth a half point for GCD1 (since the only bad inputs are those with  $a = b$ ), but no points for GCD2 and GCD3 (since almost any input will cause these procedures to fail).