CS 2102 - DMT1 - Spring 2020 — Luther Tychonievich
Administered in class friday february 28, 2020

Quiz 06

PROBLEM 1 *Convert to prose*

Convert the following symbolic proof that $f(x) = (x)(x+1)$ to prose.

1. ```
let f(x) be computed as
    if x <= 0 then return 0
    else return 2*x + f(x-1)
```

*Symbolic Proof.*

1 | $f(0) = 0 = (0)(0+1)$                                           definition

2 |
    | 2 | $f(x-1) = (x-1)(x)$    assumption
    | 3 | $f(x) = 2x + f(x-1)$    definition
    | 4 | $f(x) = 2x + (x-1)(x)$    combine line 2 and 3
    | 5 | $f(x) = 2x + (x^2 - x)$    algebra on line 4
    | 6 | $f(x) = x^2 + x$    algebra on line 5
    | 7 | $f(x) = (x)(x+1)$    simplify line 6

3 | $\forall x \geq 0 . f(x) = (x)(x+1)$                            principle of induction on lines 1 and 2

*Proof.*

PROBLEM 2  *Code termination*

Prove by induction that each of the following function terminates given any natural number argument.

2. ```
let f(x) be computed as
    if x == 0 then return 1
    otherwise return 2*f(x-1)
```
   Proof.