HW 07

Elizabeth Hunt (A02364151)

November 4, 2023

1 Problem One

```
1. [A1] Y  <- Y  - 1
2.      IF Y  != 0 GOTO A
3. [B1] IF X1 != 0 GOTO C
4.      GOTO E
5. [C1] X1 <- X1 - 1
6.      Y  <- Y  + 1
7.      Y  <- Y  + 1
8.      Y  <- Y  + 1
9.      GOTO B1
```

2 Problem Two

1. $(1, \sigma)|\sigma = \{X_1 = 2, Y = 0, Z_1 = 0\}$
2. $(4, \sigma)|\sigma = \{X_1 = 2, Y = 0, Z_1 = 0\}$
3. $(5, \sigma)|\sigma = \{X_1 = 1, Y = 0, Z_1 = 0\}$
4. $(6, \sigma)|\sigma = \{X_1 = 1, Y = 1, Z_1 = 0\}$
5. $(7, \sigma)|\sigma = \{X_1 = 1, Y = 1, Z_1 = 1\}$
6. $(1, \sigma)|\sigma = \{X_1 = 1, Y = 1, Z_1 = 1\}$
7. $(4, \sigma)|\sigma = \{X_1 = 1, Y = 1, Z_1 = 1\}$
8. $(5, \sigma)|\sigma = \{X_1 = 0, Y = 1, Z_1 = 1\}$
9. $(6, \sigma)|\sigma = \{X_1 = 0, Y = 2, Z_1 = 1\}$
10. $(7, \sigma)|\sigma = \{X_1 = 0, Y = 2, Z_1 = 2\}$
11. $(1, \sigma)|\sigma = \{X_1 = 0, Y = 2, Z_1 = 2\}$
12. $(2, \sigma)|\sigma = \{X_1 = 0, Y = 2, Z_1 = 2\}$
13. $(3, \sigma)|\sigma = \{X_1 = 0, Y = 2, Z_1 = 3\}$
14. $(8, \sigma)|\sigma = \{X_1 = 0, Y = 2, Z_1 = 3\}$

3 Problem Three

```
1. [A1] Y  <- Y
2.      Y  <- Y
3.      Y  <- Y
4.      Y  <- Y
5.      Y  <- Y
6.      GOTO E
```

4 Problem Four

Let P be a program in L that computes $g(x_1, x_2, \cdots, x_n)$; a list of instructions $[I_1, I_2, \cdots, I_k]$, where I_1 is the first instruction and I_k the last.

Then, define $P^i | i \in N$ to be a new program such that each instruction I_n replaces I_{n+i} (when $n = 0$ we perform no operation), appending to the end of the instruction list if necessary. We then replace the sublist $[I_1, \cdots, I_i]$ with $[Y \leftarrow Y]^i$ in the program P. As $Y \leftarrow Y$ produces no side effects then P^i still computes g.

Finally, for all $i \in N$ the length of P^i is greater than k and thus there are countably infinitely many L -programs to compute g.