Matt Muldowney
Homework 2 due 2/12

Written Problems

Problem 1

Suppose the numeral for the number n is $b_7b_6b_5b_4b_3b_2b_1b_0$.

(a) What is the the numeral for n/2?

/ 2 entails shifting bits one position to the left:

n / 2 = $\mathbf{0b_7b_6b_5b_4b_3b_2b_1}$

(b) What is the numeral for 2n?

* 2 entails shifting bits one position to the right:

2n = $\mathbf{b_6b_5b_4b_3b_2b_1b_00}$

(c) What number is represented by $b_7b_6b_5b_4b_3b_2b_10$?

$b_7b_6b_5b_4b_3b_2b_10$ = **(n / 2) * 2**

(d) What number is represented by $b_7b_6b_5b_4b_3b_2b_11$?

$b_7b_6b_5b_4b_3b_2b_11$ = (n / 2) * 2 + 2^0 = **(n / 2) * 2 + 1**

Problem 2

Describe the evolution of the state for the entire execution of Figure 1.

1. After line 1, the state is S{ i-->? } because variable *i* is declared.
2. After line 2, the state is S{ i-->?; x-->? } because variable *x* is declared.
3. After line 4, the state is S{ i-->4; x-->? } because *4* is assigned to *i*.
4. After line 5, the state is S{ i-->4; x-->3 } because *3* is assigned to *x*.
5. After line 6, the while loop is executed because *i = 4 < 7*.
6. After line 7, the state is S{ i-->4; x-->7 } because *4 + 3 = 7* and *7* is assigned to x.
7. After line 8, the state is S{ i-->6; x-->7 } because *4 + 2 = 6* and *6* is assigned to *i.* The while loop is again executed because *i = 6 < 7*.
8. After line 7, the state is S{ i-->6; x-->13 } because *6 + 7 = 13* and *13* is assigned to x.
9. After line 8, the state is S{ i-->8; x-->7 } because *6 + 2 = 8* and *8* is assigned to *i.* The while loop is not executed again because *i = 8 > 7*.
10. The final state is S{ i-->8; x-->7 }.

Matt Muldowney
Homework 2 due 2/12

Problem 3

Two lower case alphabet letters mapped to letter 20 places later, then encoded using ISO-8859-1. What is the original plaintext of 01101000 01101001?

01101000 = $2^6 + 2^5 + 2^3 = 64 + 32 + 8 = 104$ --> h

01101001 = $2^6 + 2^5 + 2^3 + 2^0 = 64 + 32 + 8 + 1 = 105$ --> i

h is in the 7^{th} spot of the alphabet; i is in the 8^{th} spot of the alphabet.

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

a b c d e f g h i j k l m **n** **o** p q r s t u v w x y z

u v w x y z a b c d e f g **h** **i** j k l m n o p q r s t

The original plaintext is **no**.