CS 5722, Fall 2014 **Homework 4**
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1(a)

We need a binary string of length 5 for this problem. As we learned in class, a binary string of length n can be used to represent integers from 0 to $2^n - 1$. Here we need to represent the numbers from 0 to 31, so if we plug in $n = 5$ we see that a binary string of length five can be used for the integer range $[0, 31]$.

(b)

I would define my neighborhood as all binary strings with a single bit changed. Since there are 5 bits that we can flip in our binary string, this means that our neighborhood has 5 members. All the neighbors are guaranteed to be valid options because every binary string of length 5 maps to an base 10 integer between 0 and 31.

2(a)

The decision vector will be represented as an integer vector of length 10. The i-th bit in the vector will represent the chip that the i-th cell is in. For instance, consider the vector: $[1, 1, 1, 1, 1, 2, 2, 2, 2, 2]$. Cells 1-5 are on the first chip, and cells 6-10 are on the second chip.

(b)

The neighborhood for a given decision vector will be the set of vectors where one pair of different-valued elements are swapped. Example neighbors:
$[2, 1, 1, 1, 1, 2, 2, 2, 2, 1]$ (swap cell 1 with cell 10)
$[1, 1, 2, 1, 1, 2, 2, 1, 2, 2]$ (swap cell 3 with cell 8)

There are exactly $5 * 5 = 25$ neighbors because each of the 5 cells on chip 1 can be swapped with each of the 5 cells on chip 2.

(c)

Iteration 1 (initial) : $[1, 1, 1, 1, 1, 2, 2, 2, 2, 2]$

Iteration 2 : $[1, 1, 2, 1, 1, 1, 2, 2, 2, 2]$ (swap cell 3 with cell 6)

Iteration 3 : $[2, 1, 2, 1, 1, 1, 2, 2, 1, 2]$ (swap cell 1 with cell 9)

Tabu Neighbors for Iteration 4:
$[2, 1, 1, 1, 1, 2, 2, 2, 1, 2]$ (cannot swap cells 3 and 6)
$[1, 1, 2, 1, 1, 1, 2, 2, 2, 2]$ (cannot swap cells 2 and 9)