

Bit String Flicking

ICT Officers- Based on Mihir Patel's Lecture

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1 Introduction

Bit flicking, as the name implies is moving around bits given a set of commands.

2 Commands

- NOT: Takes in 1 bit, flips 1 to 0 and vice-versa
- AND: Takes in 2 bits, if both are 1 then output is 1
- OR: Takes in 2 bits, if either one is 1 then output is 1
- XOR: Takes in 2 bits, if either is 1 then output is 1 but if both are 1 or 0 then output is 0
- (L/R)SHIFT: moves the bits a specific amount in a direction (left or right) and fills in new spaces with 0
 - LSHIFT-1 11011 = 10110
 - LSHIFT-3 11100 = 00000
 - RSHIFT-2 11111 = 00111
- (L/R)CIRC: cycles the bits a specific amount in a direction (left or right)
 - LCIRC-3 11100 = 00111
 - RCIRC-2 00101 = 01001
 - RCIRC-4 11110 = 11101
- Order of Operations: NOT, SHIFT / CIRC, AND, XOR, OR

3 Variable Problems

Often, you will be given a situation where a bit is given as a variable and you must solve for what it can be. You should treat this as an algebra question and simplify to solve for a specific side. The easiest way to think about it is to treat the variable as a set of bits ($X = abcde$). Often, any bit will be possible for a specific location so a star can be used or all solutions can be written.

- $\text{LSHIFT-3 } 11001 = \text{RCIRC-3 } X$
 1. $\text{LSHIFT-3 } 11001 = \text{RCIRC-3 } abcde$
 2. $01000 = \text{RCIRC-3 } abcde$
 3. $01000 = cdeab$
 4. Therefore, all are 0 except d and $X = 00010$ (put back in original order)
- $11000 = (\text{LSHIFT-2 } X) \text{ AND } (11110)$
 1. $11000 = (\text{LSHIFT-2 } abcde) \text{ AND } 11110$
 2. $11000 = cde00 \text{ AND } 11110$
 3. $11000 = cde00$
 4. Therefore, $c = d = 1$ and $e = 0$ so $X = **110$

4 Practice

1. $X = (\text{RCIRC-2 } 11100) \text{ XOR } (\text{LSHIFT-1 } 10110)$
2. $\text{RCIRC-3 } (00111 \text{ AND } 11100 \text{ OR } 11011 \text{ XOR } (\text{NOT } 11100))$
3. $\text{LSHIFT-1 } (\text{RCIRC-2 } (11100 \text{ AND } \text{LSHIFT-2}(11000) \text{ OR } 11111)) = \text{RCIRC-2 } ((\text{LSHIFT-1 } X) \text{ OR } 00000 \text{ AND } 11111)$
4. $\text{LCIRC-3 } (abcde \text{ OR } 10101) = \text{RCIRC-4 } (\text{LCIRC-3 } (\text{RCIRC-31 } 10101))$