ICS Homework Week 8

October 18, 2022

1 Arithmetic Operations

Assume x and y are both 4 bit signed integers. Fill the following table. Truncate all the results to 4 bits with 2's complement and write their value in decimal.

	$x+y$	$x-y$	$x*y$	$-y$
$x=\ \ 4, y=7$	-5	-3	-4	-7
$x=-6, y=-8$	2	2	0	-8
$x=\ \ 5, y=-1$	4	6	-5	1
$x=-3, y=6$	3	7	-2	-6

2 Function Naming

1) Here are two poorly named functions written by ICS TAs. Please give the proper function names according to their functionalities. What arithmetic operations do they do?

```
int f1 (int x, int y) {
    return ((x&y) + ((x^y)>>1));
}
```

```
int f2 (int x, int y) {
    int z = x - y;
    int k = (z >> 31) & 1;
    int m = x - k * z;
    return m;
}
```

Name of f1: average

Name of f2: max

2) Do the functions above provide their intended functionalities for all valid parameters? Why? Please explain with concrete examples.

f1 calculates the average of parameter x and y correctly. For example, f1 (-1,-1)=-1, f1(2147483647,1)=1073741824.

f2 does not return maximum one of parameter x and y when (x-y) is overflow. For example, f2(2147483647,-1)=-1.

3 Find the Mole

Given an array of integers, inside which every element appears twice except for one. Find that single element.

For example, given array `{1,3,4,1,2,4,3}`, you need to return `2`.

Can you do this by using only **ONE int variable** and with **ONE traversal**?

```
int single_element(int array[], int length) {
    // fill in your codes...
    int rst = 0;
    for (int i = 0; i < length; i++) {
        rst = rst ^ array[i];
    }
    return rst;
}
```