

ICS Homework Week 8

October 30, 2020

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?

```
1 int f1 (int x, int y) {
2     return ((x&y) + ((x^y)>>1));
3 }
```

```
1 int f2 (int x, int y) {
2     int z = x - y;
3     int k = (z >> 31) & 1;
4     int m = x - k * z;
5     return m;
6 }
```

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?

```
1  int single_element(int array[], int length) {
2      // fill in your codes...
3      int rst = 0;
4      for (int i = 0; i < length; i++) {
5          rst = rst ^ array[i];
6      }
7      return rst;
8  }
```