COMS12200 problem set #2

Within this problem slot, the idea is that you attempt to solve the set of pencil-and-paper, exam-style questions presented below; in doing so, you can (optionally) use an interactive system to anonymously register your solutions. More concretely, optionally start by installing the Socrative client, e.g.,

- for Chrome

  http://chrome.google.com/webstore/detail/socrative-student/nblhpecglllndfihipmpdoikimcmgkha

- for Android

  http://play.google.com/store/apps/details?id=com.socrative.student

- for iOS

  http://itunes.apple.com/gb/app/socrative-student/id477618130

or using the web-based application at

http://www.socrative.com,

then entering the 9-character "room name" which should be displayed top-center on the projector screen. Then, we will alternate as follows:

1. solve the current question, and optionally register your solution using Socrative,
2. wait until everyone is finished (or say ∼ 5 minutes elapse), at which point we will discuss the questions and solutions using any collated Socrative results as a starting point.

Q1. We studied representation of unsigned integers using a base-b positional number system. Which of the following literals

A: 10101
B: 11111
C: 11120
D: 12200
E: 12345

represents the unsigned decimal integer $123_{(10)}$ in base-3 (or ternary, digits in which are termed trits).

Q2. Imagine that two signed, 8-bit integers x and y are represented using two's-complement and sign-magnitude respectively, and both of which have the decimal value $51_{(10)}$. If the most-significant bit of both x and y is set to 1, what are their new (decimal) values?

A: $-77_{(10)}$ and $179_{(10)}$
B: $-77_{(10)}$ and $-51_{(10)}$
C: $-51_{(10)}$ and $-77_{(10)}$
D: $179_{(10)}$ and $179_{(10)}$
E: $179_{(10)}$ and $-51_{(10)}$

Q3. Imagine that two signed, 16-bit integers x and y are represented using two's-complement; their product $r = x \cdot y$ is a signed, 32-bit integer also represented using two's-complement. What is the largest (i.e., whose magnitude is greatest) negative value of r possible?

A: −0
B: −32768
C: −65535
D: −1073709056
E: −2147483648

Q4. Imagine you write a C program that defines signed, 16-bit integer variables `x` and `y` (of type `short`) and then assigns them the decimal values $256_{(10)}$ and $4852_{(10)}$ respectively. If `x` and `y` are then cast into signed, 8-bit integers (of type `char`), which of the following

`A:` 0 and 12
`B:` 0 and −12
`C:` −1 and 256
`D:` −1 and −52
`E:` 0 and 52

identifies their decimal value? Or, put another way, which are the result of evaluating the two expressions `( char )( x )` and `( char )( y )`?

Q5. Consider two signed, 8-bit integer variables `x` and `r` (of type `char`) used in a C program. If `x` has the decimal value $9_{(10)}$ and an assignment

```
r = ( ~x << 4 ) | 0x97
```

is executed, what is the decimal value of `r` afterwards?

`A:` $-9_{(10)}$
`B:` $-1_{(10)}$
`C:` $0_{(10)}$
`D:` $1_{(10)}$
`E:` $9_{(10)}$

Q6. In general, some x is a fixed point of a function f if $f(x)$ equals x, i.e., if f maps x to itself. Consider the following function

```
int8_t abs( int8_t x ) {
  int8_t r;

  if( x >= 0 ) {
    r =  x;
  }
  else {
    r = -x;
  }

  return r;
}
```

implemented in C: `abs` was written in an attempt to compute the absolute value of `x`, a signed, 8-bit integer representing using two's-complement. How many of the $2^8 = 256$ possible values of `x` are fixed points of `abs`?

`A:` 0
`B:` 127
`C:` 128
`D:` 129
`E:` 256