Homework Assignment 2

Note: For the problems that require writing code assume the following (unless stated otherwise):

- The inputs given to your functions will be correct. So do not worry about error handling.
- Do not write a full-fledged program, just the needed function only.
- Do not call other functions or libraries. Your function must be self-contained.

1. [5 points] Write a C function, called `compare()`, (no need to write a full-fledged program, just the function) that takes two integers as arguments and returns 1 if the two numbers are equal and 0 if they are not. However, you must not use any comparison operators.

2. [5 points] Write a C function, called `set_bits()`, (no need to write a full-fledged program, just the function) that takes three arguments: an unsigned int `x`, and unsigned int `l`, and an unsigned int `r`. The function sets the bits from `l` to `r` (inclusive) in `x` to 1. Remember that an integer is 32 bits, starting from the bit 0 (in the right) till bit 31 (in the left).

3. [2 points] What does the following function do (i.e. what does the value of `x` represents at the end)?

```c
unsigned strange(unsigned int k)
{
    unsigned int x = 0;
    while(k)
    {
        k = k & (k-1);
        x++;
    }
    return x;
}
```

4. [3 points] Suppose you have 3 N-bit unsigned integers: `a`, `b`, and `c`. What is the minimum number of bits required to present: `a*b+c`?
5. [9 points] Suppose we have a 5-bit floating point number where 1 bit is used for the sign, 3 bits for exponent, and 1 bit for fraction. The same rules of normalized, denormalized, and special values numbers in IEEE 754 standard are applied.
   a) What will be the bias? How did you get it?
   b) What is the smallest non-zero positive number that can be presented (in decimal)? Show all the steps.
   c) What is the largest positive number than can be presented (in decimal)? Show all the steps.

6. [6 points] Given the unsigned int x, using only shifting left and write, add, and subtract, write the statements to calculate the following (each problem below is independent from the others). Try to optimize as much as possible.
   a) \( y = 7 \times x \);
   b) \( y = 27 \times x \);
   c) \( y = 67 \times x \);