Bit mask exercises

Exercise 1. Given an integer x, write a function `reverseBytes(`x`)` that returns an integer whose bytes are reversed. For example, `reverseBytes(3628)` = 739115008 because 3628 = `0x00000E2C` and 739115008 = `0x2C0E0000`.

Exercise 2. You are given a set S containing N elements. How many subsets of S contain M or more elements? Constraints: $1 \leq M \leq N \leq 20$

Exercise 3. Write the following functions using bitmasks: `isEven(`x`)`, `evenBitsOnly(`x`)`, `setNthBit(`x`, `N`)`. For example:

- `isEven(5)` returns `false`
- `evenBitsOnly(14)` returns 10
- `setNthBit(11, 2)` returns 15

Complete search exercises

Question: For the following problems, how many operations will your program run in the worst case scenario? About how long will the program run? (Do not write the program.)

Exercise 4. (Perfect square problem) Given an integer N, determine if N is a perfect square, i.e., if $\exists x$ such that $x^2 = N$ and x is an integer. Constraint: $0 < N < 10^6$

Exercise 5. (Use all digits problem) Given a number N, find all pairs of 5-digit numbers that between them use the digits 0 through 9 exactly once and such that $abcde/fghij = N$ (each letter represents a unique digit `[0-9]`). Constraint: $2 < N < 79$

Exercise 6. (Movie seating problem) N friends go to a movie and sit in a row with N consecutive open seats. There are M seating constraints, i.e., two people a and b must sit at least (or at most) c seats apart. How many possible seating configurations are there? Constraints: $0 < N \leq 8$ and $0 \leq M \leq 20$

Input: Each case begins with a line containing two integers N and M, followed by M lines containing a seating constraint, a, b, c. If c is positive, a and b must be at most c seats apart. Otherwise, if c is negative, a and b must be at least $-c$ seats apart.

Sample input	Sample output
2 0 3 1 0 1 1 4 2 0 1 1 0 2 -2	2 4 8

Exercise 7. (Water gates problem) A dam has N water gates to release water from the dam's reservoir if the water level is getting too high. You are given each gate's *flow rate* and *cost of use*. Determine the minimum *total cost of use* for a *total flow rate* of at least F. Constraint: $2 \leq N \leq 20$

Input: Each case begins with a line containing two integers N and F, the number of gates and the total flow rate to achieve. Following are N lines describing a gate which contains a pair of integers r and c, the flow rate and cost of use for the gate. The sum of r and the sum of c will be less than 10^9.

Sample input	Sample output
2 5 5 5 5 8 3 5 2 4 3 7 5 12	5 11