INTRODUCTION TO ALGORITHMS (CELEN086)
EXTRA PRACTICE PROBLEMS

TOPIC: *Basic programming, Conditionals*

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Note: ALL algorithms must come with proper headings!!

1. In digital electronics, a NAND gate (negative-AND) is a logic gate which produces an output which is false only if all its inputs are true. Draw up the truth table for **NAND(P,Q)** and then write an algorithm that implements NAND.

2. The exclusive OR gate (XOR) is a special case of OR such that it is True only if one of the arguments are True. Write an algorithm to implement **XOR(P,Q)**.

3. Write an algorithm that takes a 3-digit integer and returns a new integer with reversed digits. For example if your input is 973 then your algorithm should return 379. Your algorithm should first check that the last digit of your input is not 0; if so, your algorithm should halt and return a string message '*not possible'*.

4. The annual income tax in some American state is shown in the table below:

Annual Income	**$1 - $10000**	**$10001 – $25000**	**$25001 – $45000**	**$45001 – $65000**	**$65001 – $90000**
Tax Rate (%)	**5%**	**7.5%**	**11%**	**15%**	**17.5%**

The tax rate on each bracket (income interval) is applied to the difference from previous bracket. For Example if your annual income is $68'000.00 then your tax will be calculated as following:
$68'000.00 = $10'000 + $15'000 + $20'000 + $20'000 + $3'000
TAX = 10000 x 0.05 + 15000 x 0.075 + 20000 x 0.11 + 20000 x 0.15 + 3000 x 0.175
= $500 + $1125 + $2200 + $3000 + $525 = **$7350.**

Write an algorithm called **`taxCalc()`** that takes a number between $1 and $90001 and returns the annual tax value. If the income is greater than $90000, your algorithm should return '**Go to your tax office.**'

5. Write an algorithm called **`swap(a,b)`** that takes two numbers and returns them in swapped order. For example calling **`swap(5,3)`** returns **`(3,5)`.**

6. Write an algorithm **`isTriangle(a,b,c)`** that takes three numbers and returns TRUE if we can form a triangle with lengths **`a,b,c;`** otherwise FALSE.

7. Write an algorithm called **`isUnique()`** that takes three numbers x, y and z and returns 1 if all the numbers are equal and returns -1 when two of the numbers are the same, otherwise returns zero.

8. A leap year is a year that has one extra day (366 days). Leap years occur when the year is divisible by 4 but not divisible by 100 or the year is divisible by 400. Write an algorithm **`isLeap(year)`** that takes a number for year and decides if the year is leap or not.