Problem Solving Contest for Aspiring Engineers - Version 2

Welcome to Problem solving contest for aspiring engineers, version 2. In the first version we discussed on the responsibility of Engineers and how they can make a difference in people's lives… Submissions of students were evaluated and result of previous version was announced. Now we open the second version.

The contest

This contest is organized for students, to give them an opportunity to (i) sharpen their skills (ii) showcase their talent and (iii) achieve their true potential. Submission guidelines are given at the end. All GCET students are welcome to participate.

Problem Scenarios

Interesting problems are given below. Students are expected to read and understand the problems before attempting to develop solutions. There may be non-unique solutions to a problem and students are expected to select and implement the most efficient solution to each problem.

1. Goldbach Conjecture

The Goldbach Conjecture states that every even integer greater than two is the sum of two prime numbers. For example,

6 = 3 + 3

8 = 3 + 5

10 = 3 + 7

12 = 5 + 7

14 = 3 + 11 = 7 + 7

…

…

Task -Develop a program that accepts an even number greater than 2 and finds two prime numbers, the sum of which is equal to the even number.

Recommendation – You may restrict the even number up to 100. Display the even number and the prime numbers.

Efficiency – Point out any optimizations done in your program.

2. Check if number is **positive or negative** without using **comparison** operators

Develop a program to check if a number is less than or greater than zero without using comparison operators (<, >, <=, >=, ==)
Constraint –Comparison Operators should not be used for getting the output.
Recommendation – (a) If user enters zero as input then display an error message. In other cases print an appropriate message. (b) It is not necessary to use Bit operations to solve this problem.

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3. Swapping four variables

Suppose we have four variables **a, b, c, d** and we want to perform **swapping** of these variables in the following manner
a = b, b = c, c = d, d = a
without using a **fifth or temporary variable**
Constraint – an extra variable should not be used
Task – Develop a program for this problem.
Efficiency – not a priority in this problem.

4. Sum of non-primes

Display all the non-prime numbers between 4 and 100. Calculate and print the sum at the end. You may like to store the prime numbers less than 100 in an array to solve this problem.
**Constraint –** No specific constraint.
Task – Develop a program for this problem.
Recommendation – It is recommended to **minimize** the number of *if statements* that you use in this program. Can you guess how this improves the quality of your program?

5. Digital circuit's implementation

Develop a program that takes two signals (*0* or *1*) followed by a gate (*AND, OR, NOT, XOR, NAND*) as inputs and displays appropriate output signal e.g. for input *1, 0, OR* the output should be *1*
Extend the program to implement a **Half Adder** for which the logic circuit is given below
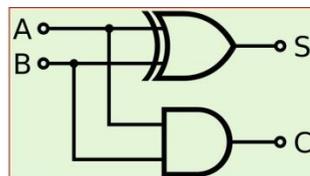
The input signals are *A, B* (*0 or 1*) and outputs *S, C* (sum and carry respectively).

Constraint- Use logical operators (**&&, ||, !**) only. There is no need to use bit operators.

Efficiency is not priority in this situation, only reasonable efficiency is expected.
Recommendation – Check output for all possible inputs.

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Guidelines

a. This is an open contest. Any GCET student can participate.
b. **First three** participants will be appreciated / awarded.
c. Top **50 participants'** Names will be displayed on College **website and GCTC portal.**
d. Students may submit solution(s) to **One or More** of the given problems. Points will be awarded accordingly.
e. **Last problem** is **Optional** for Students of **First year, Mechanical and Civil Engineering.** They will be evaluated separately. However, if they are able to solve the last problem, bonus points will be awarded.
f. There is No negative marking.
g. Last date for submission is 16th Dec., 2018.
h. **Submission method is simple** - Email your solution to finishing.school.contest@gmail.com
The *Name, Year, Section, Branch and Roll Number* of the student should be written on the top of the mail
OR
Submit hand written solution to the undersigned.

Prof. K R Rao/Prof Ashok Sharma,
Staff Room-2, CSE Department,
IIIrd Floor, Block 1.

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