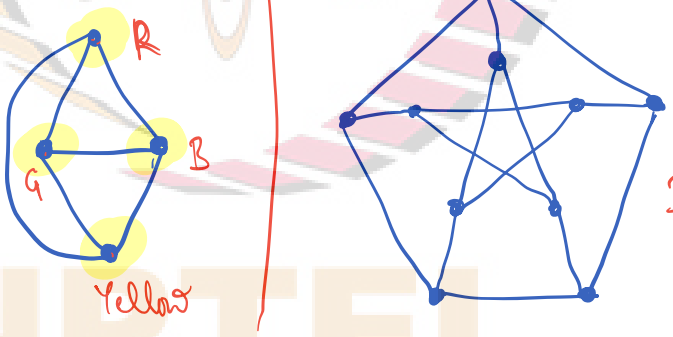
# Theory of Computation

One of the most fundamental courses which is part of CSE curriculum (UG curriculum).

**Problem 1:** I have a computer program and an input x. Will the program terminate when input x is fed?

**Problem 2:** I have a graph G. Can G be coloured using 3 colors (say Red, Green, Blue)




Requires 4 colors!

3-colorable!

**Problem 3:** I want to drive from home to Office What is the shortest route?

For a computer: one of these is "easy", one of these is "hard" and one is "impossible".

How can we make such conclusions? ] GOAL

First, we need to understand what computation is. In this course, we will try to explore: What are the fundamental capabilities and limitations of computers?

Computers have evolved significantly throughout the years. But the theory of computation has remained applicable and relevant throughout.

Modern digital computers were developed around World War II. The theoretical basis for this was provided by Alan Turing in 1936.

"On Computable Numbers, with an Application to the Entscheidungsproblem."

→ Automata Theory: Some simple

models of computation.

→ Computability Theory: Trying to model computers as we know it.

→ Introduction to Complexity Theory: How fast / efficiently can we solve a problem?

Expectation: Basic UG course. Should be familiar with discrete maths and proof techniques. Familiarity with algorithms will be helpful.

Text: Michael Sipser: Introduction to the Theory of Computation

Before next lecture, read Chapter 0 from textbook: Sipser. Brush up basics like Sets, Functions, Relations, Graphs, Logic, Theorem, Proofs etc. Try

out simple exercises.