Determining the Complexity of Parallel Circuits: A Proposal

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Abstract

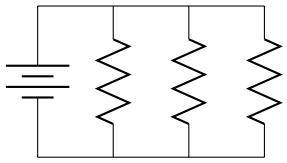
The goal of the experiment is to determine if Parallel Circuits are NP-Complete or P-Complete. For this purpose, parallel circuits will be augmented with switches, which will be modelled in a computer program's logic flow. To start, three parallel circuits are to be constructed, consisting of 1,2, and 3 resistors respectively. From there, induction will be utilized to attempt to prove that the number of resistors can go up to infinity. The experiment is a form of inquiry into the prospect of modelling circuits using computers, which has numerous potential applications. It will also attempt to speculate, depending on the results, if $P = NP$.

1 Introduction

1.1 Parallel Circuits

A **Parallel Circuit** is a variation of circuit that, in its most elemental version, separates I_{net} into separate branches, dedicating a resistor for each branch. The general idea behind a parallel circuit is that each resistor recieves an independent supply of I, such that if one resistor loses I, the other resistors maintain I. The following relationships are derivable using Olm's Law ($V = IR$):

$$V_{net} = V_1 = V_2 = ... = V_n$$
$$I_{net} = \Sigma I_n$$
$$\frac{1}{R_{net}} = \Sigma \frac{1}{R_n}$$



Several unique properties emerge if V, I, and R values are tracked over changes made to the circuit, such as removing/adding a resistor, changing V, etc. Those systematic changes will become central to the experiment.

1.2 Computational Complexity Theory

References