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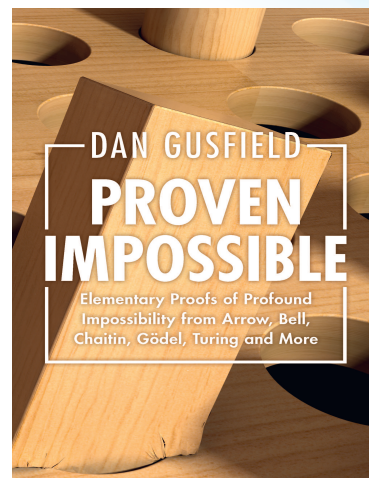
Elementary Proofs of Profound Impossibility from
Arrow, Bell, Chaitin, Gödel, Turing and More

Dan Gusfield

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In mathematics, it simply is not true that 'you can't prove a negative'. Many revolutionary impossibility theorems reveal profound properties of logic, computation, fairness and the universe, and form the mathematical background of new technologies and Nobel prizes. But to fully appreciate these theorems and their impact on mathematics and beyond, you must understand their proofs. This book is the first to present these proofs for a broad, lay audience. It fully develops the simplest rigorous proofs found in the literature, reworked to contain less jargon and notation, and more background, intuition, examples, explanations, and exercises. Amazingly, all of the proofs in this book involve only arithmetic and basic logic – and are elementary, starting only from first principles and definitions. Very little background knowledge is required, and no specialized mathematical training – all you need is the discipline to follow logical arguments and a pen in your hand.

Preface; 1. Yes you can prove a negative!; 2. Bell's impossibility theorem(s); 3. Enjoying Bell magic; 4. Arrow's (and friends') impossibility theorems; 5. Clustering and impossibility; 6. Gödel-ish impossibility; 7. Turing undecidability and incompleteness; 8. Chaitin's theorem: More devastating; 9. Gödel (for real, this time).



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'This unique and lovely book takes us on a grand tour of the limitations of science, mathematics, and of reason itself. To appreciate what is possible we must know the impossible, and such limitations define the boundary between the two. Gusfield offers well-explained gems illustrating various limitations, showing why they arise, giving their historical context, and in contrast to other similar books for a broad audience, presenting rigorous proofs requiring limited background.' **Michael Sipser, MIT**



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