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The Diagonal Argument Revisited

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THE DIAGONAL ARGUMENT REVISITED

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Recently a somewhat odd proof came up in the Techniques of Mathematical Proofs class: we had to show that the set of all real numbers from 0 to 1 is infinite. The diagonal argument proof of this theorem, instead of being accepted as usual, gave rise to another problem. It is usually taken for granted that one irrational number is greater than another, but, at the moment we did not have an algorithm of determining whether it is true or not. We did find such algorithm, but it was based on the fact that a subset of natural numbers necessarily has a least element. The proof of this theorem, in turn, gave a rise to another one. To complete the whole argument, we had to show that given a subset S of natural numbers with the following properties: 1) 1 is in S, 2) for any n in natural numbers, n* is (where n*={1, 2, ..., n}) a subset of S implies that n+1 is in S, would mean that S= the set of all natural numbers. Having shown this last result, we can now say that the set of all real numbers form 0 to 1 is infinite.