

How many colours are required to colour the tree of real numbers of the unit hold]

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Every path in a complete infinite tree represents a real number of the unit interval between 0 and 1. (Some rational numbers have two representations.) Assume that you have a can of red paint and that you can colour an infinite path of the tree with one can. Assume further that you get another can of red paint for every node that you are colouring for the first time. Then you will first accumulate an infinity of cans of red paint, but you will nevertheless not be able to colour all paths, since there are uncountably many paths in the tree (and you can win only countably many cans of red paint). So there remain uncountably many paths uncoloured in the first run. Start with another colour, say green. Also with green paint you will not finish. How many different colours will be required?

set-theory

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asked 1 hour ago

 rainbow
1

It sounds like you're painting nodes, in that case you can color all of them red on the first try. If that's not how your painting works, you might want to clarify your question. – François G. Dorais ♦ 1 hour ago

I am colouring all edges and all nodes of one path, say $0.222\dots$ with one can. For every node I get another can, each of which I use for another path, like $0.323232\dots$ or $0.888\dots$. So I am really colouring full infinite paths, as I said. – rainbow 1 hour ago

1 Same problem: there are only countably many edges. – François G. Dorais ♦ 1 hour ago

1 @rainbow You seem to be ignoring the fact that, after you have colored a countable family of paths, say $\{P_0, P_1, \dots, P_n, \dots\}$, there may be other paths Q that are not on this countable list but have, nevertheless, had all their nodes and edges colored. Perhaps the first node and edge of Q were also in P_1 , the second node and edge of Q were in P_2 , etc. As Francois points out, by choosing the sequence of P_n 's intelligently, you can, in fact, ensure that this sort of thing happens for every path Q .

– Andreas Blass 1 hour ago

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