

# What is wrong with this proof?

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This fallacious argument was proposed by George Prolya (1887-1985) to demonstrate improper usage of mathematical induction.

*Claim:* All horses have the same colouring.

*Proof.* Firstly, we examine a set of one horse. It has one colouring. This is our base case.

Next, we assume that any set of  $n$  horses all have the same colouring. This is our induction hypothesis.

Lastly, we examine a set of  $n + 1$  horses. In any subset of  $n$  horses, every horse has the same colouring by our induction hypothesis. Therefore, by looking at two such sets, we can see that all  $n + 1$  horses have the same colouring.  $\square$

Hint: We can rephrase the Claim to say: "Any two horses have the same colouring."