The Monks with Red Eyes

Solution

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If there are n red-eyed monks, all n leave on the nth midnight after the announcement.

The monks all reason perfectly, know that the others do too, hear the same truthful announcement, and observe who has left after each midnight. These shared facts matter.

One red-eyed monk. This monk sees no red eyes. On hearing that at least one monk has red eyes, they immediately know the announcement must refer to them. They leave at the first midnight.

Two red-eyed monks. Each sees one red-eyed monk and thinks: "If my eyes are blue, that other monk sees no red eyes and will leave tonight." Nobody leaves the first night. Each therefore rules out having blue eyes and leaves the second night.

Three red-eyed monks. Each sees two red-eyed monks. If their own eyes were blue, those two would be in the preceding case and would leave on the second night. When they do not, all three infer that their own eyes are red. They leave on the third night.

Continue the same reasoning. With n red-eyed monks, each sees $n-1$ others and waits to see whether those others leave on night $n-1$. When they do not, each knows they must be the additional red-eyed monk.

What did the announcement add?

With two or more red-eyed monks, everyone already sees at least one red-eyed monk. But that is not the whole issue. They need to reason about what others know, what others know that others know, and so on.

The public announcement supplies a shared starting point for this chain of reasoning. It is *common knowledge*: everyone knows it, everyone knows that everyone knows it, and this continues to every depth. The passing nights then supply new public evidence.

The puzzle is not claiming that a previously unseen red eye was revealed. It is about publicly shared knowledge and deductions from the absence of departures.

History and sources: companion history PDF.