

# The Bored Assassins Problem

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## 1 Introduction

The game of assassins is one commonly played across a number of universities, as well as being a common format for a game to target regardless of the motif placed on top of it.

In essence, a list of players enrol, and are each assigned targets. After through some method eliminating their targets they are assigned new ones.

The Bored Assassin is a desired set of invariants that it would be ideal to hold across any given target assignment.

1. All assassins have  $k$  targets.
2. All assassins are targeted by  $k$  other assassins.
3. Assassins should not have their targets changed, only added or killed.

## 2 Mathematical Definitions

The Assassins  $A$  are a mutable set of living assassins.  $T_a$  is the set of targets of a person  $a$ , where  $a \in A$ .

$\forall a \in A$	for each assassin
$T_a \subset A$	their targets are assassins
$a \notin T_a$	they do not target themselves
$ T_a  = k$	they have $k$ targets
$ Q \text{ where } \forall q \in Q, q \in A, a \in T_q  = k$	$k$ assassins target them

We can define a function,  $K(A, a \in A, t \in A)$  such that we can say that  $a$  has killed  $t$ . This function must maintain the invariants until  $|A| = k$  while altering  $A$  such that  $t \notin A$ . Finding a valid form for this function at any value of  $k$  is the bored assassins problem.