Knights and Knaves Puzzle Generation

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Determining Constraints

- Decided to use truth tables in order to search for solutions
- Would be bad for large groups of people, as computation gets too intense
- Decided that a person would only ever say one thing about at most two people
- What are the things that a person can say?

A Person φ and a Person Ψ

- Φ
- Ψ
- ~Φ
- ~Ψ
- Φ ^ Ψ
- ~Φ ^ Ψ
- Φ ^ ~Ψ
- ~Φ ^ ~Ψ

- Φ v Ψ
- ~Φ v Ψ
- ~Φ v ~Ψ
- Φ <-> Ψ
- ~Φ <-> Ψ

The Truth Table

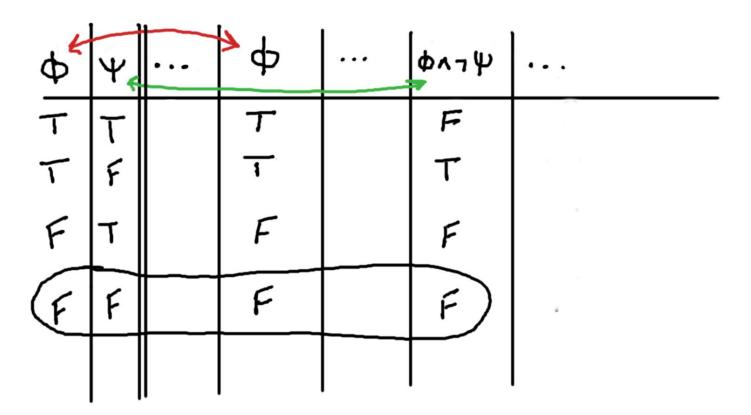| ϕ	ψ	$\neg\phi$	$\neg\psi$	$\phi\wedge\psi$	$\cdots$	$\neg\phi\leftrightarrow\neg\psi$
T	T	F	F	T		F
T	F	F	T	F		T
F	T	T	F	F		T
F	F	T	T	F		F

Finding Solutions

- Have a truth table now, but how do we find a solution?
- Still need to choose what people are saying. This involves two steps

  1. Generate combinations of what people can say from the truth table,　　e. g. Φ and Φ v Ψ, ~Φ v ~Ψ and Φ <-> Ψ, etc.

  2. Generate permutations of how people will say these combinations,　　e. g. Φ says Φ and Ψ says Φ v Ψ.

Finding a Solution Extended Example

Similar Solutions

- Tried to make sure that problems did not have duplicates,
  e.g. Φ says Φ v Ψ vs Φ says Ψ v Φ
- This happened for the most part, except ...
- When two people have the same solution assignment (T and T or F and F), what they say doesn't matter, since both of the statements have the same truth assignment.
- Once people are given names, though logically very similar, the puzzles do seem different.

Example of Similar Solution

Some Results

- The generation only ran up to 4 people.
- 74 solutions involving 2 people.
- 15,540 solutions involving 3 people.
- 6,562,536 solutions involving 4 people.
- To go to higher numbers of people, it is probably necessary to look at the problem differently.
- Maybe to generate a random solution and see if it is a valid puzzle.