Queen's UNIVERSITY

GRP 17: Euchred?

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Course Modelling Project

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Abstract

This modeling project aims to model whether or not a euchre can occur in the popular card game Euchre. Based on the outcome of the first three tricks in a hand of euchre, and the trump suit, our model will determine the logical steps the team that did not call trump can make to euchre the other team.

Propositions

- Called Trump Q_i: This is true when team X has called trump. Subscript indicates which player called trump
  - $Q_1 \vee Q_2$
- Trick $T_{i,j}$: This is true when player i is on team x and has won the trick j.
  - $C_1, v, n \vee C_3, v, n$
- Win W_t: This is true when team X has won ≥ 3 tricks t.
  - $W_3 \vee W_4 \vee W_5$
- Euchre E: This is true when $W \neq Q$
  - $W_t \wedge \neg Q_i$
- Player P_i: This is true when player i is on team X and holds the winning card for trick T
  - $P_1 \vee P_3$
- Card C_t, v, n: This is true when a card of type t(trump/off suit led/off suit)(1-Trump, 2-off suit led, 3-off suit) and rank(1-6 for off suit 9 through Ace and 1-7 for Trump 9 through right Bauer) v is winning a trick n(4 or 5).
  - Ex. $C_{1,7,4} \vee C_{3,2,4} \vee C_{1,2,4} \vee C_{1,4,4}$
- Lead L_i: This is true when team X won trick 3 or 4, i corresponds to the player, j corresponds to the trick
  - $L_{1,3} \vee L_{3,3}$
- Suit $S_{i,j}$: This is true when a card played is off suit, i corresponds to whether or not it was lead(1 = lead, 2 = not led), j corresponds to whether or not it's the same suit that was led(1 = same, 2 = not).
  - $S_{1,1} \vee S_{2,1} \vee S_{2,2}$
- Trump B: This is true when a card played is of trump.

Constraints

- A euchre can only take place if a team wins a round and also did not call trump:
  - $(W \wedge \neg Q) \vee (\neg W \wedge Q)$
- A team can only win a round if they win ≥ 3 tricks T_i:
  - $(t_1 \wedge t_2 \wedge t_3) \vee (t_1 \wedge t_2 \wedge t_4) \vee (t_1 \wedge t_2 \wedge t_3 \wedge t_4 \wedge t_5) \vee ...etc$
- A team can only win a trick if their player holds the winning card:
  - $(P_1 \vee P_3) \vee (P_2 \vee P_4)$
- A card is only winning if it is the possible highest trump or the Highest suited card if no trump is played
  - $C_{1,v} \vee (\neg C_{1,v} \vee c_{2,v})$
- Only a player who leads can determine the Suit:
  - $L_{i,j}$ Player i leads trick j

Model Exploration

Our initial interpretation for modelling the game of euchre was to examine the state of the game after a hand had been played, with conditions for who called trump, played each card to determine who had won a hand that already happened. However we pivoted away from this concept to make it more challenging; we looked at the results of the first 3 tricks, then determined whether or not a euchre can occur based on the information of the hand.

First-Order Extension

Predicate logic could allow for a more dynamic analysis. By using quantifiers, we could potentially model situations that hold for any trick. For example if **there exists** a player on the non trump calling team who has won 3 tricks, a euchre has already occurred. Or if **there exists** a player on the non trump calling team who has won two tricks, a euchre can occur.

Useful Notation

Feel free to copy/paste the symbols here and remove this section before submitting.

$$\wedge \quad \vee \quad \neg \quad \rightarrow \quad \forall \quad \exists$$