

Manual for Pinochle for Prolog

Bug Report

Bugs encountered with AI meld and chase card suggestion during demo. I tried to fix the bugs and AI seems to work better from what I have observed

Feature Report:

Missing features:

All features have been implemented

Extra features:

No extra features were implemented

Description of Data Structures:

Hand: Contains the list of all the hands of a player in a round of pinochle. Is simply a list of all the cards that the player possesses. Each card is represented as an integer ranging from 0 to 47

CapturePile: Contains the list of all the capture pile cards of a player in a round of pinochle. Is simply a list of all the cards that the player possesses in his capture pile. Each card is represented as an integer ranging from 0 to 47

Meld: Stores all the melds played by a player. The meld is a list of lists of lists. The outer most list consists of 9 lists (9 standing for the total number of meld types in Pinochle). Each of these 9 lists stands for one meld type. Each of these 9 lists contains melds of its own type. These melds are also lists that are comprise of lists of cards that are used to form the meld.

Log

-Nov 29, 2020

- Came up with the general design for the program

Total: 4 hours

-Nov 30, 2020

- Created all the clauses that interpret the card rank and suit based on card id
- Created facts that determine a rank's or a suit's string representation and index
- Created clauses to get card string given id
- Created clauses to create and shuffle a deck for the game

Total: 3 hours

-Dec 1, 2020

- implemented clauses to start the game, prompt user for 'new' or 'load' game
- Implement beginning a new game of pinochle and setting up a new round of pinochle
- added clauses to print a list of cards (for printing capture pile and hands)

Total: 4 hours

-Dec 2, 2020

- implemented round loop and round logic, including determining which card wins in a round, who goes next, what the next move will be
- implemented prompting user for next move

Total: 3 hours

-Dec 3, 2020

- Debugged the clause related to round loop and setting up new round .
- Added clause that makes computer play a lead card and prompts human to play a lead card
- Added clause that makes the computer play a chase card and prompts human to play a case card
- Added basic meld-related facts and rules that generate meld points

Total: 4.5 hours

-Dec 4, 2020

- Added the clauses that for the logic of suggesting lead card
- Added the clauses for logic of suggesting chase card
- Added clause for determining what cards, when thrown preserve the best melds

Total: 4 hour

-Dec 6, 2020

- Created clauses for logic of recommending meld to play
- Created clauses for accepting user input for melds to play
- Added clause for determining what melds can be played from the current hand
- Debugged clauses for suggesting cards that had to do with backtracking issues

Total: 11 hours

-Dec 7, 2020

- Added clauses to prompt player for melds to play
- Tested and ran the a game of Pinochle
- Fixed multiple bugs relating to AI logic.
- Fixed clauses that prompt player for melds to play
- Fixed bugs in the round_loop clause

Total: 11 hours

-Dec 8, 2020

-Implement saving and loading games, although not in the format specified in project description.

Total: 3 hours

Dec 9, 2020

- Implemented saving and loading games in the specified format

Total: 10 hours

Dec 11, 2020

- Fixed bugs in AI logic that suggested incorrect melds and non-ideal lead and chase cards

Total: 3 hours

How to Run

- 1) In terminal, navigate into the src directory
- 2) Enter “swipl” into the terminal and press enter
- 3) Enter “[pinochle].” into the terminal and press enter
- 4) Enter “start_game.” to start the game

Screenshots

1. Starting a game

```
src — hadoop@ip-172-31-29-179:~ — swipl — 121x31

SWI-Prolog comes with ABSOLUTELY NO WARRANTY. This is free software.
Please run ?- license. for legal details.

For online help and background, visit https://www.swi-prolog.org
For built-in help, use ?- help(Topic). or ?- apropos(Word).

?- [pinochle].
true.

?- start_game.
Welcome to Pinochle!
Would you like to (1) start a new game or (2) load a previous game? Enter 'new' or 'load':
|: |: |:
```

2. Starting a new game

```
src — hadoop@ip-172-31-29-179:~ — swipl — 171x39

?- start_game.
Welcome to Pinochle!
Would you like to (1) start a new game or (2) load a previous game? Enter 'new' or 'load':
|: new
*****
Beginning a new game of Pinochle.

-----
Starting round 1...
-----

Distributing cards:

Giving human four cards...
Human hand so far: JH XC 9C QC

Giving computer four cards...
Computer hand so far: KH QS 9D AD

Giving human four cards...
Human hand so far: JH XC 9C QC QS 9C XS QD

Giving computer four cards...
Computer hand so far: KH QS 9D AD JD KH QH AD KD XD JS

Giving human four cards...
Human hand so far: JH XC 9C QC QS 9C XS QD XH KC AH AH

Giving computer four cards...
Computer hand so far: KH QS 9D AD JD KH QH AD KD XD JS

Done distributing cards.

Picking card from the deck to find out the trump card.
The trump card for this round is JC.

Deciding who goes first based on a coin toss. Enter your prediction (heads/tails):
|: |:
```

3. Coin toss

```
● ● ●
src — hadoop@ip-172-31-29-179:~ — swipl — 171x39

Picking card from the deck to find out the trump card.
The trump card for this round is JC.

Deciding who goes first based on a coin toss. Enter your prediction (heads/tails):
|: heads
The toss resulted in a tails.
The computer player goes first.

-----
Current Round Table:

Round: 1

Computer
Score: 0 / 0
Hand: KH(0) QS(1) 9D(2) AD(3) JD(4) KH(5) QH(6) AD(7) KD(8) KD(9) XD(10) JS(11)
Capture Pile:
Melds:

Human
Score: 0 / 0
Hand: JH(0) XC(1) 9C(2) QC(3) QS(4) 9C(5) XS(6) QD(7) XH(8) KC(9) AH(10) AH(11)
Capture Pile:
Melds:

Trump Card: JC
Stock: AS KC XD JC QH KS 9D AS 9S JD 9H XC QC QD XS JS 9H 9S XH JH KS AC AC

Next Player: Computer

-----
It is the computer's turn to play a card. What would you like to do?
Pick an action:
1. Ask computer to make a move
2. Quit the game

Enter [1] or [2]:
|: 
```

4. Asking computer to make a move

```
● ● ●
src — hadoop@ip-172-31-29-179:~ — swipl — 171x39

Round: 1

Computer
Score: 0 / 0
Hand: KH(0) QS(1) 9D(2) AD(3) JD(4) KH(5) QH(6) AD(7) KD(8) KD(9) XD(10) JS(11)
Capture Pile:
Melds:

Human
Score: 0 / 0
Hand: JH(0) XC(1) 9C(2) QC(3) QS(4) 9C(5) XS(6) QD(7) XH(8) KC(9) AH(10) AH(11)
Capture Pile:
Melds:

Trump Card: JC
Stock: AS KC XD JC QH KS 9D AS 9S JD 9H XC QC QD XS JS 9H 9S XH JH KS AC AC

Next Player: Computer

-----
It is the computer's turn to play a card. What would you like to do?
Pick an action:
1. Ask computer to make a move
2. Quit the game

Enter [1] or [2]:
|: 1

The computer chose to play AD as its lead card because throwing this card would preserve the most favorable hand (meld-wise) and it would increase the chance of winning because it has a high rank..

It is your turn to play a card. What would you like to do?
Pick an action:
1. Make a move
2. Ask for help
3. Quit the game

Enter [1], [2], or [3]:
|: 
```

5. Asking for help throwing a lead card

6. Asking for help throwing a chase card

```
src — hadoop@ip-172-31-29-179:~ — swipl — 171x39
Score: 0 / 0
Hand: JH(8) XC(1) 9C(2) QC(3) QS(4) 9C(5) XS(6) QD(7) XH(8) KC(9) AH(10) AH(11)
Capture Pile:
Melds:

Trump Card: JC
Stock: AS KC XD JC QH KS 9D AS 9S JD 9H XC QC QD XS JS 9H 9S XH JH KS AC AC

Next Player: Computer

It is the computer's turn to play a card. What would you like to do?
Pick an action:
1. Ask computer to make a move
2. Quit the game

Enter [1] or [2]:
|: 1

The computer chose to play AD as its lead card because throwing this card would preserve the most favorable hand (meld-wise) and it would increase the chance of winning because it has a high rank..

It is your turn to play a card. What would you like to do?
Pick an action:
1. Make a move
2. Ask for help
3. Quit the game

Enter [1], [2], or [3]:
|: 2

It is recommended that you play XC(1) as your chase card because this card is the least ranked trump-suit card that can beat the opponent's non-trump-suit card while also preserving the best melds in hand as far as possible.

The computer chose to play AD as its lead card.
What card do you want to throw?
Enter the card position (first card has position 0):
|: 1
```

7. Human making a move and Computer Winning a turn

```
src — hadoop@ip-172-31-29-179:~ — swipl — 171x39

The computer chose to play AD as its lead card because throwing this card would preserve the most favorable hand (meld-wise) and it would increase the chance of winning because it has a high rank..

It is your turn to play a card. What would you like to do?
Pick an action:
1. Make a move
2. Ask for help
3. Quit the game

Enter [1], [2], or [3]:
|: 2

It is recommended that you play XC(1) as your chase card because this card is the least ranked trump-suit card that can beat the opponent's non-trump-suit card while also preserving the best melds in hand as far as possible.

The computer chose to play AD as its lead card.
What card do you want to throw?
Enter the card position (first card has position 0):
|: 0

You chose to play JH as your chase card.

The computer's lead card has beaten your chase card. The computer wins this turn.
The computer won 13 points.

The computer takes both cards for its capture pile.
The computer won this turn, so it can create a meld.

The computer chose to play a Pinochle as its meld because playing this meld will yield the highest possible points.
The computer won 48 points for playing the meld.

The computer picks a card from the stock first.
Then you pick a card from the stock.

Would you like to save your progress so far? (yes/no):
|: 0
```

8. Human winning and being prompted to create a meld

```
cause it has a high rank..  
src — hadoop@ip-172-31-29-179:~ — swipl — 171x39  
It is your turn to play a card. What would you like to do?  
Pick an action:  
1. Make a move  
2. Ask for help  
3. Quit the game  
Enter [1], [2], or [3]:  
|: 2  
It is recommended that you play KC(8) as your chase card because this card is the least ranked trump-suit card that can beat the opponent's non-trump-suit card while also preserving the best melds in hand as far as possible.  
  
The computer chose to play AD as its lead card.  
What card do you want to throw?  
Enter the card position (first card has position 0):  
|: 8  
  
You chose to play KC as your chase card.  
Your chase card has beaten the computer's lead card. You win this turn!  
You won 15 points.  
  
You take both cards for your capture pile.  
You won this turn, so you can create a meld.  
Pick cards from your hand to create a meld:  
  
Hand: XC(8) 9C(1) QC(2) QS(3) 9C(4) XS(5) QD(6) XH(7) AH(8) AH(9) KC(10)  
Trump Suit: C  
Melds Played:  
  
Pick an action:  
1. Play a meld  
2. Ask for help  
|: |
```

9. Asking for help for a meld

```
src — hadoop@ip-172-31-29-179:~ — swipl — 171x39  
3. Quit the game  
Enter [1], [2], or [3]:  
|: 2  
It is recommended that you play KC(8) as your chase card because this card is the least ranked trump-suit card that can beat the opponent's non-trump-suit card while also preserving the best melds in hand as far as possible.  
  
The computer chose to play AD as its lead card.  
What card do you want to throw?  
Enter the card position (first card has position 0):  
|: 8  
  
You chose to play KC as your chase card.  
Your chase card has beaten the computer's lead card. You win this turn!  
You won 15 points.  
  
You take both cards for your capture pile.  
You won this turn, so you can create a meld.  
Pick cards from your hand to create a meld:  
  
Hand: XC(8) 9C(1) QC(2) QS(3) 9C(4) XS(5) QD(6) XH(7) AH(8) AH(9) KC(10)  
Trump Suit: C  
Melds Played:  
  
Pick an action:  
1. Play a meld  
2. Ask for help  
|: 2  
It is recommended that you use the following cards to create a Royal Marriage meld because playing this meld will yield the highest possible points:  
KC(10) QC(2)  
  
Separately enter the positions (pressing enter after each card) of all the cards you would like to play for your meld. Enter a period '.' once you are done entering positions:  
|: |
```

10. Human creating a meld

```
src — hadoop@ip-172-31-29-179:~ — swipl — 171x39
Enter the card position (first card has position 0):
|: 8

You chose to play KC as your chase card.

Your chase card has beaten the computer's lead card. You win this turn!
You won 15 points.

You take both cards for your capture pile.
You won this turn, so you can create a meld.
Pick cards from your hand to create a meld:

Hand: XC(0) 9C(1) QC(2) QS(3) 9C(4) XS(5) QD(6) XH(7) AH(8) AH(9) KC(10)
Trump Suit: C
Melds Played:

-----
Pick an action:
1. Play a meld
2. Ask for help
|: 2
It is recommended that you use the following cards to create a Royal Marriage meld because playing this meld will yield the highest possible points:
KC(10) QC(2)

Separately enter the positions (pressing enter after each card) of all the cards you would like to play for your meld. Enter a period '.' once you are done entering positions:
|: 10
|: 2
|: .

You played a Royal Marriage for your meld.
You won 48 points for playing a Royal Marriage meld.

You pick a card from the stock first.
Then, the computer picks a card from the stock.

Would you like to save your progress so far? (yes/no):
|: 
```

11. Round end and Asking if user wants to play another round

```
src — hadoop@ip-172-31-29-179:~ — swipl — 171x39
2. Ask for help
3. Quit the game

Enter [1], [2], or [3]:
|: 1

The computer chose to play 9H as its lead card.
What card do you want to throw?
Enter the card position (first card has position 0):
|: 0

You chose to play QS as your chase card.

The computer's lead card has beaten your chase card. The computer wins this turn.
The computer won 3 points.

The computer takes both cards for its capture pile.
There are no playable melds in the computer's hand. Moving on to the next turn...

No more cards left in stock. Play until cards in hand are exhausted.

Would you like to save your progress so far? (yes/no):
|: no
Both players have run out of cards to play

Round ended.

-----
Computer's score this round: 129
Your score this round: 118

Computer's total score so far: 129
Your total score so far: 118

The computer won this round.

Would you like to play another round? (Enter 'yes' or 'no'):
|: 
```

12. Player refusing to play another round and winner declaration

```
src ~ hadoop@ip-172-31-29-179:~ -zsh - 171x39

The computer's lead card has beaten your chase card. The computer wins this turn.
The computer won 3 points.

The computer takes both cards for its capture pile.
There are no playable melds in the computer's hand. Moving on to the next turn...

No more cards left in stock. Play until cards in hand are exhausted.

Would you like to save your progress so far? (yes/no):
|: no
Both players have run out of cards to play

Round ended.

Computer's score this round: 129
Your score this round: 110

Computer's total score so far: 129
Your total score so far: 110

The computer won this round.

Would you like to play another round? (Enter 'yes' or 'no'):
|: no

Game ended.

Computer's score: 129
Your score: 110

The computer won this game.

Thank you for playing Pinochle!
(base) biplobthapamagar@Biplabs-MacBook-Pro src %
```

13. Loading a previous game from a save file

```
src ~ hadoop@ip-172-31-29-179:~ -swipl - 201x49

?- [pinoclie].
true.

?- start_game.
Welcome to Pinochle!
Would you like to (1) start a new game or (2) load a previous game? Enter 'new' or 'load':
|: load

*****+
Loading a game of Pinochle.
Enter the name of the save file:
|: case3.p
Game successfully loaded!

Current Round Table:

Round: 1

Computer
Score: 0 / 187
Hand: QD(0) KS(1) 9H(2)
Capture Pile: 9C JC JH QH KD AD KC AC 9S XS XD JD 9C JC XC QC XC QC QD KD JS AS
Melds:

Human
Score: 0 / 110
Hand: QS(0) JD(1) XH(2)
Capture Pile: 9D XD KC AC XS AS 9H XH KH AH 9S QS 9D AD KH AH JS KS JH QH
Melds:

Trump Card: C
Stock:

Next Player: Human

It is your turn to play a card. What would you like to do?
Pick an action:
1. Make a move
2. Ask for help
3. Quit the game

Enter [1], [2], or [3]:
|: |
```

14. Player quitting in the middle of a game

```
src — hadoop@ip-172-31-29-179:~ — zsh — 130x31

It is the computer's turn to play a card. What would you like to do?
Pick an action:
1. Ask computer to make a move
2. Quit the game

Enter [1] or [2]:
|: 1

The computer chose to play KD as its lead card because throwing this card would preserve the most favorable hand (meld-wise) and it would increase the chance of winning because it is the highest-ranked card with trump suit.

It is your turn to play a card. What would you like to do?
Pick an action:
1. Make a move
2. Ask for help
3. Quit the game

Enter [1], [2], or [3]:
|: 33
Invalid input. You must enter either [1], [2], or [3]. Please try again.
It is your turn to play a card. What would you like to do?
Pick an action:
1. Make a move
2. Ask for help
3. Quit the game

Enter [1], [2], or [3]:
|: 3
Thank you for playing Pinochle! Exiting game...  

(base) biplabthapamagar@Biplabs-MacBook-Pro src %
```

15. Saving a game

```
src — hadoop@ip-172-31-29-179:~ — zsh — 201x49

Capture Pile: 9D XD KC AC XS AS 9H XH KH AH 9S QS 9D AD KH AH JS KS JH QH
Melds:
Trump Card: C
Stock:
Next Player: Human

It is your turn to play a card. What would you like to do?
Pick an action:
1. Make a move
2. Ask for help
3. Quit the game

Enter [1], [2], or [3]:
|: 1
What card do you want to throw?
Enter the card position (first card has position 0):
|: 1
You chose to play JD as your lead card.

It is the computer's turn to play a card. What would you like to do?
Pick an action:
1. Ask computer to make a move
2. Quit the game

Enter [1] or [2]:
|: 1
The computer chose to play QD as its chase card because this card is the least valuable card that would also beat the opponent's lead card, while also preserving the best melds in hand as far as possible.

The computer's chase card has beaten your lead card. The computer wins this turn.
The computer won 5 points.

The computer takes both cards for its capture pile.
There are no playable melds in the computer's hand. Moving on to the next turn...

No more cards left in stock. Play until cards in hand are exhausted.

Would you like to save your progress so far? (yes/no):
|: yes
Enter the name of the save file:
|: savefile.p

Game saved.
(base) biplabthapamagar@Biplabs-MacBook-Pro src %
```