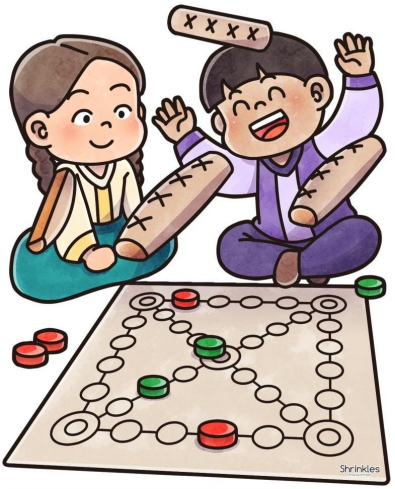
Overview

- Goal: Make a console Yunnori game
  - Two types of game

<Basic Yunnori>

2, 3, or 4 normal players

- **w/ 2, 3, or 4 pieces**
- **Typical Yunnori**



<Advanced Yunnori>

2, 3, or 4 Animal players

- **w/ 4 pieces**
- **Each player has special skills**

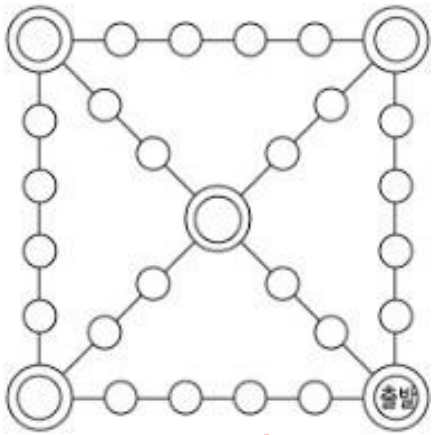
\+ Login

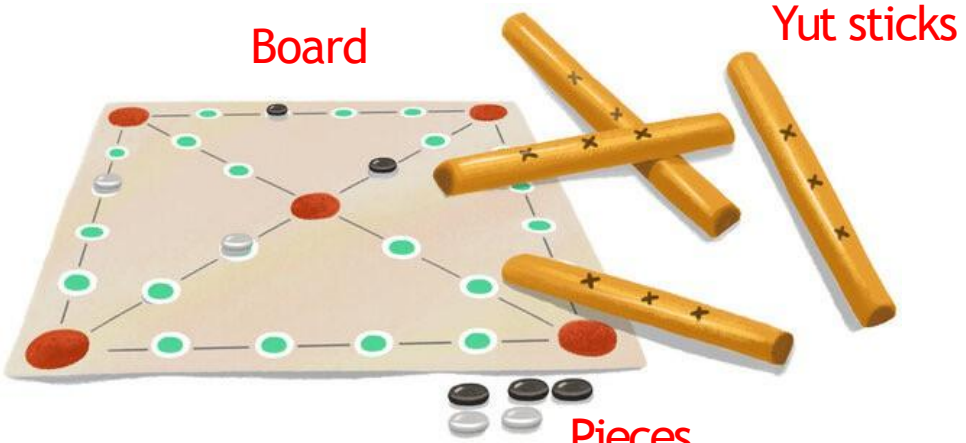
\+ Pausing, saving, and loading games

Introduction to the gameplay

- Game components
  - Game board
  - Game pieces for each player
  - Yut sticks

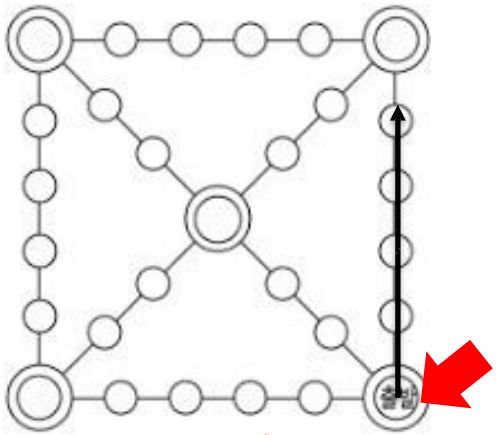
    Pieces are moved based on the results from throwing 4 Yut sticks.

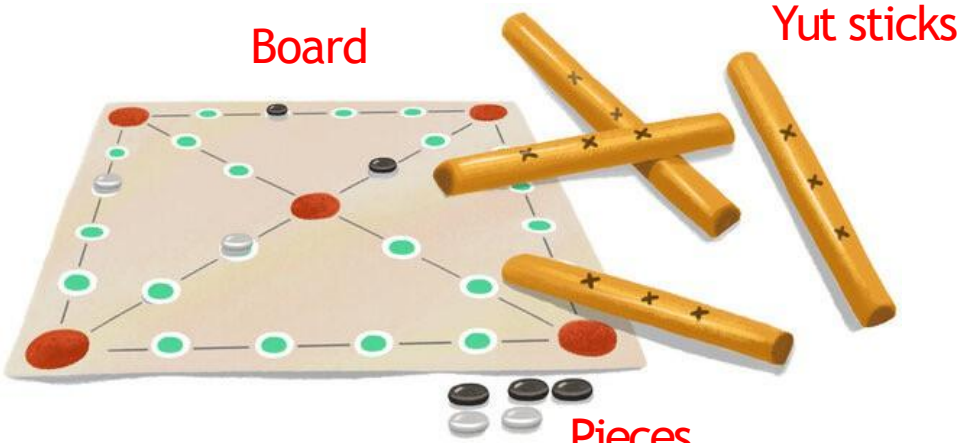




Introduction to the gameplay

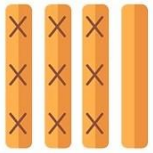
- Game-end condition
  - Piece arrival = a piece has traveled around the board and **passed through** the ending point
  - If all the player's pieces arrive, that player wins the game and the game ends.



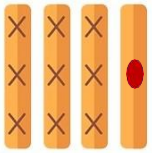


Introduction to the gameplay

- Rules of throwing Yut sticks

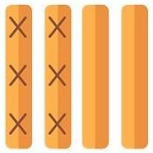


do: move one space.

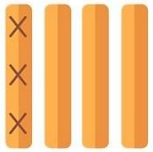


back-do: move one space back.

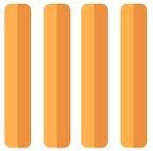
Only one of the four yut sticks is marked.



gae : move two spaces.



geol : move three spaces.



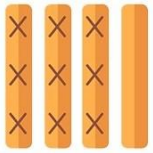
yut : move four spaces and throw again.

mo : move five spaces and throw again.

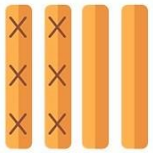
* Assume that the stick is equally likely to come up front or back.

Introduction to the gameplay

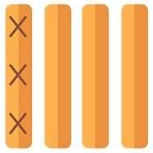
- For clarity, the probabilities of each yut result are



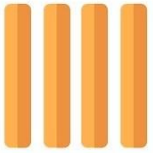
do: $\frac{3}{16}$



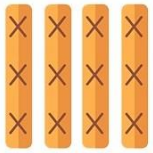
gae : $\frac{3}{8}$



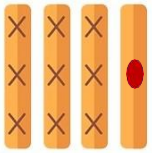
geol : $\frac{1}{4}$



yut : $\frac{1}{16}$



mo : $\frac{1}{16}$



back-do: $\frac{1}{16}$

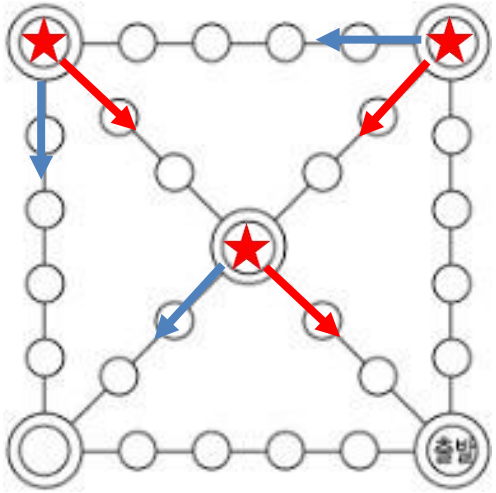
Only one of the four yut sticks is marked.

* Assume that the stick is equally likely to come up front or back.

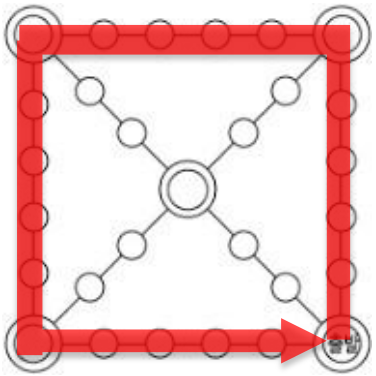
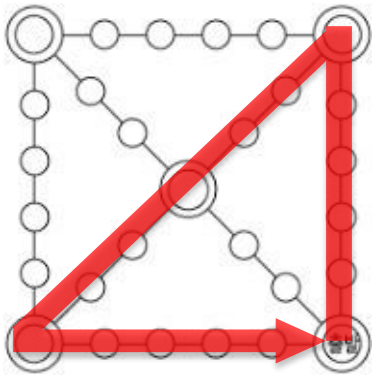
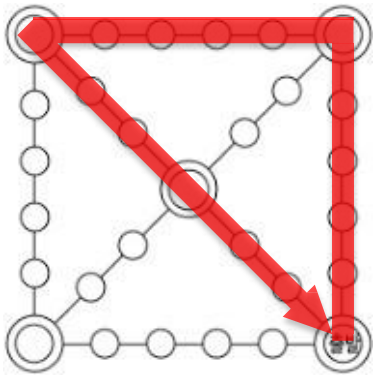
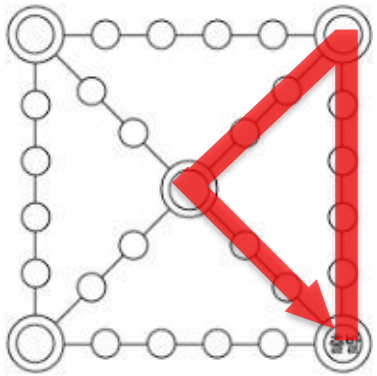
Introduction to the gameplay

- Gameplay mechanics
  - Movement

If the piece stops exactly at ★ ,
it must move in the direction of → . Otherwise,
it must move in the direction of → .

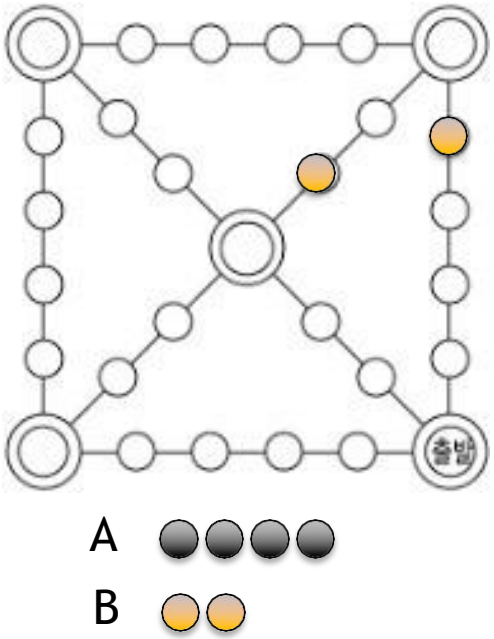


There are 4 possible directions to move. (without considering back-do)

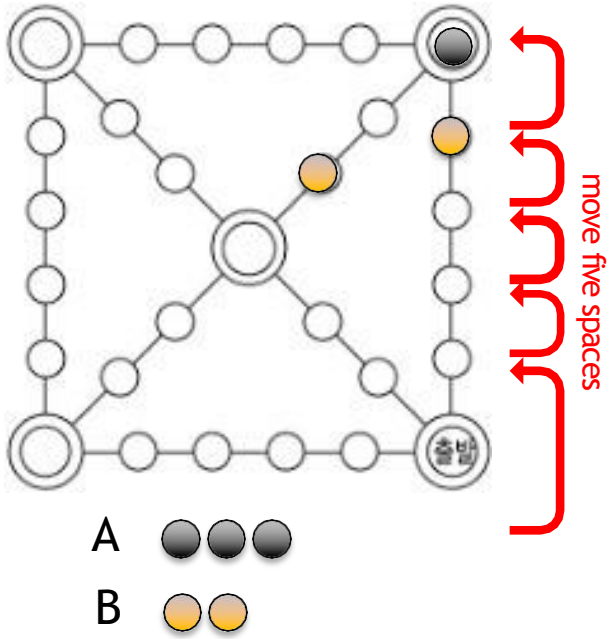
Introduction to the gameplay

- For example,
  - It's player A's turn, and the pieces haven't departed yet.



Introduction to the gameplay

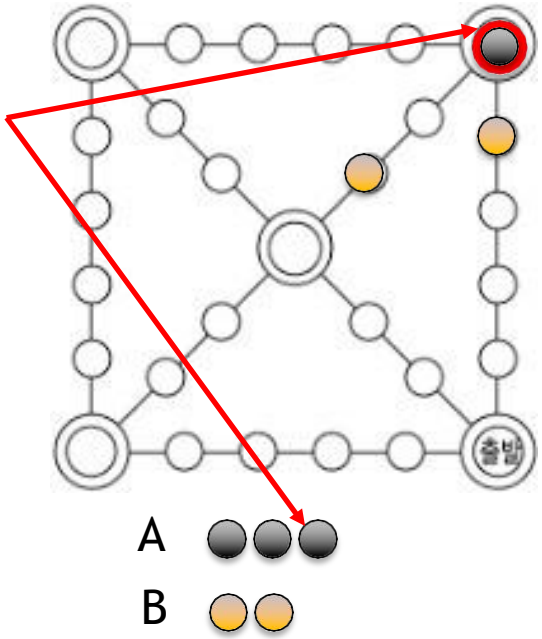
- For example,
  - It's player A's turn, and the pieces haven't departed yet.
  - Player A throws the yut sticks and the result is mo.



Introduction to the gameplay

- For example,
  - It's player A's turn, and the pieces haven't departed yet.
  - Player A throws the yut sticks and the result is mo.
  - Player A throws the yut sticks again (b/c the previous result is mo) and the result is geol.

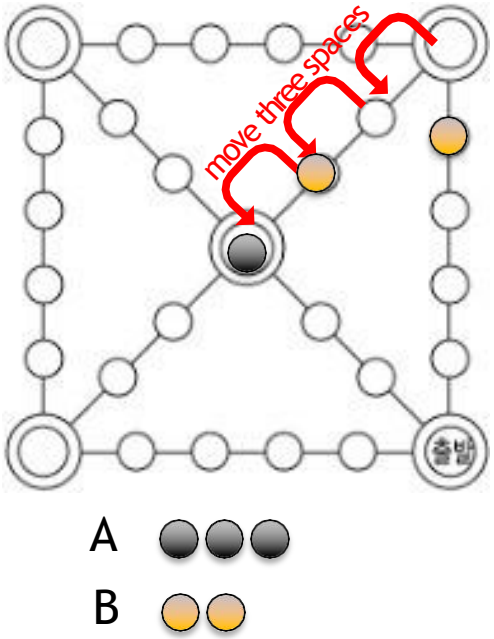
Player A choose a piece to move



Introduction to the gameplay

- For example,
  - It's player A's turn, and the pieces haven't departed yet.
  - Player A throws the yut sticks and the result is mo.
  - Player A throws the yut sticks again (b/c the previous result is mo) and the result is geol.

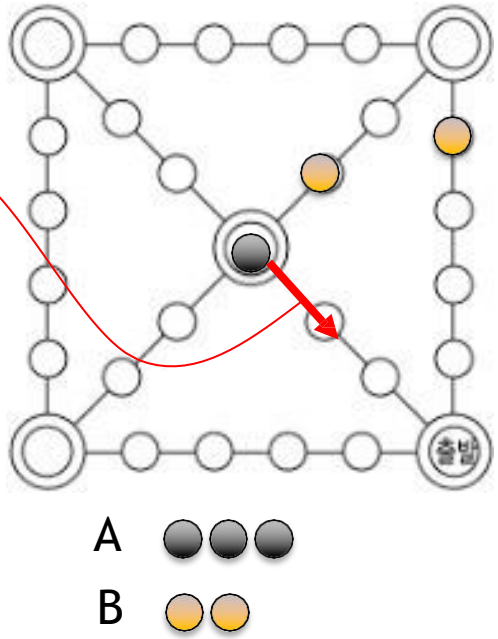
    Player A choose a piece to move



Introduction to the gameplay

- For example,
  - It's player A's turn, and the pieces haven't departed yet.
  - Player A throws the yut sticks and the result is mo.
  - Player A throws the yut sticks again (b/c the previous result is mo) and the result is geol.
  - Player A's turn is over.

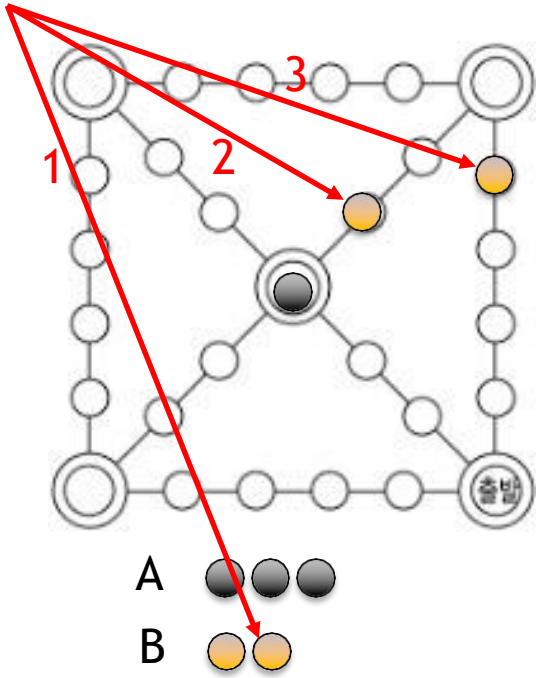
player A must move in this direction on his next turn.



Introduction to the gameplay

- For example,
  - It's player B's turn, and the two pieces haven't departed yet.
  - Player B throws the yut sticks and the result is geol.

Player B choose a piece to move



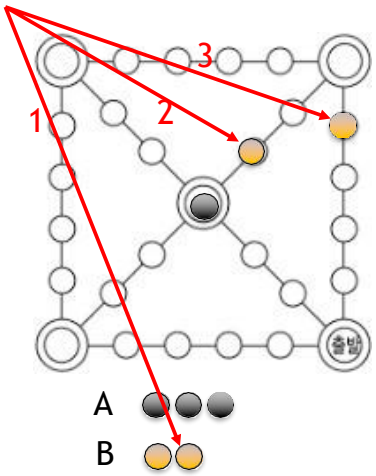
Introduction to the gameplay

- For example,
  - It's player B's turn, and the two pieces haven't departed yet.
  - Player B throws the yut sticks and the result is geol.

Player B choose a piece to move

- If B choose piece 1

<before>



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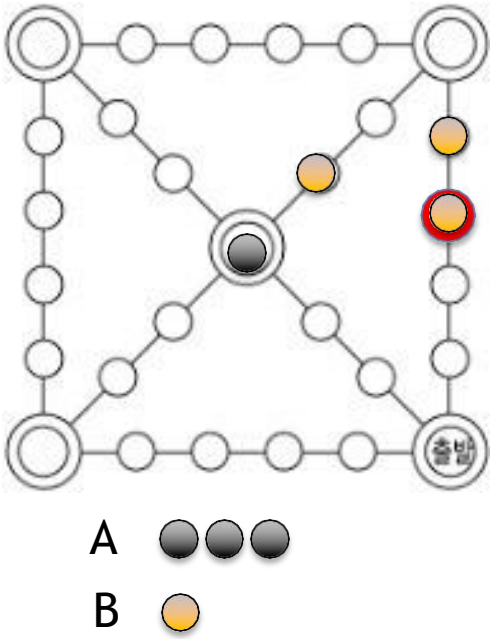

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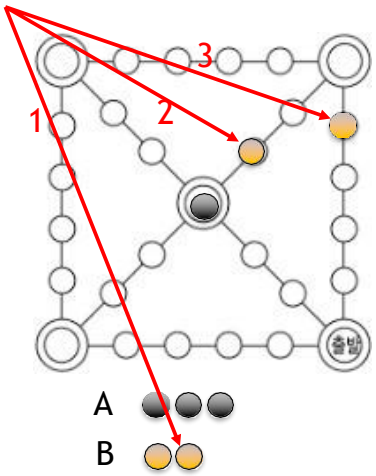
Introduction to the gameplay

- For example,
  - It's player B's turn, and the two pieces haven't departed yet.
  - Player B throws the yut sticks and the result is geol.

Player B choose a piece to move

- If B choose piece 2

<before>



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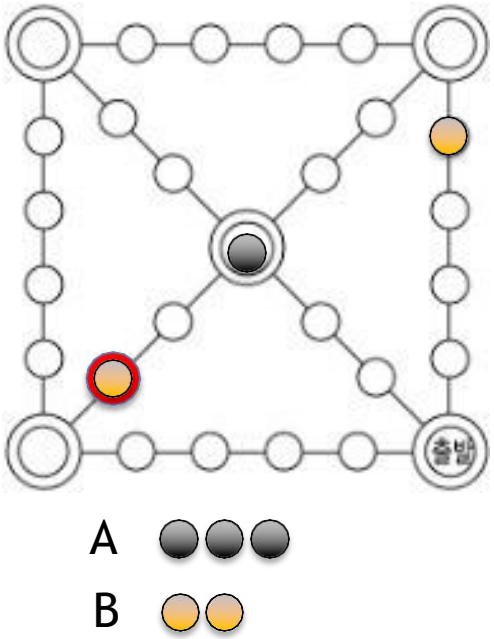

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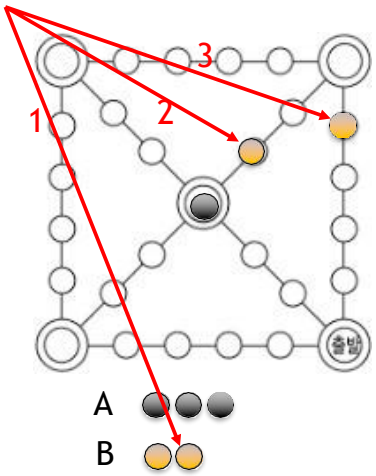
Introduction to the gameplay

- For example,
  - It's player B's turn, and the two pieces haven't departed yet.
  - Player B throws the yut sticks and the result is geol.

Player B choose a piece to move

- If B choose piece 3

<before>



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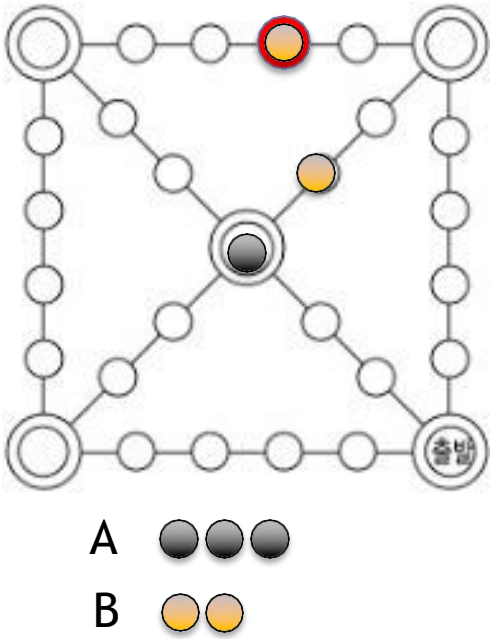

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Introduction to the gameplay

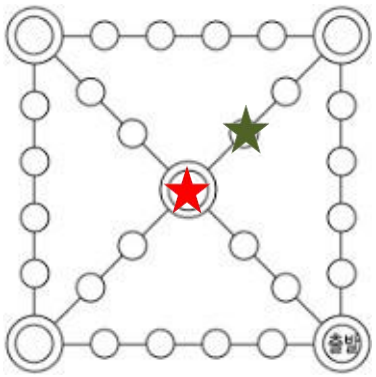
- Gameplay mechanics
  - Movement

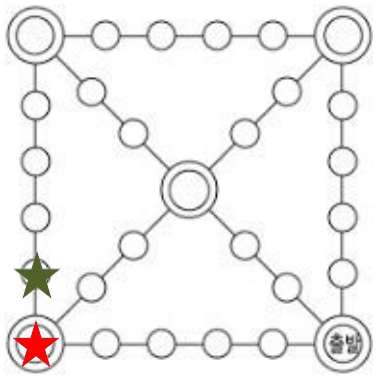
    Back-do: A piece on the board that you choose to move must go back one space.

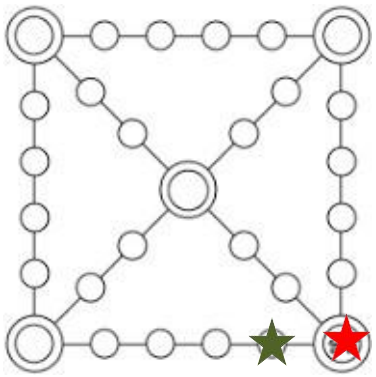
    You cannot put a new token on the board with Back-do.

    Things that may be confusing:

    - If Back-do occurs when a piece is on ★, move it to ★.



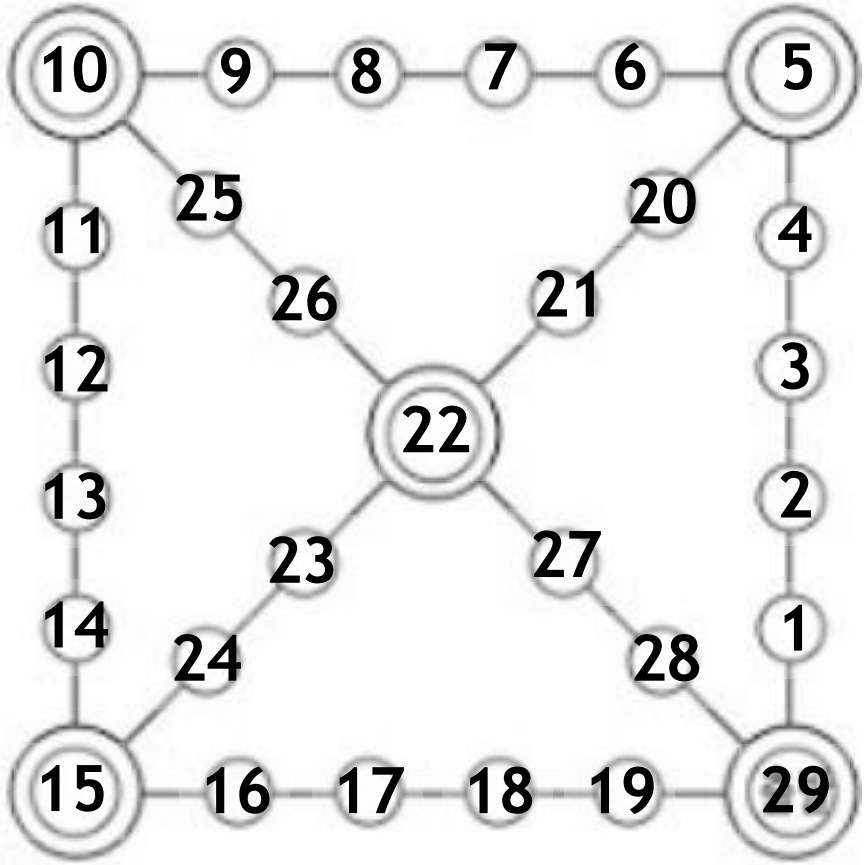




Introduction to the gameplay

These numbers are important because they are directly related to our grading.

- We specify each position of the board.

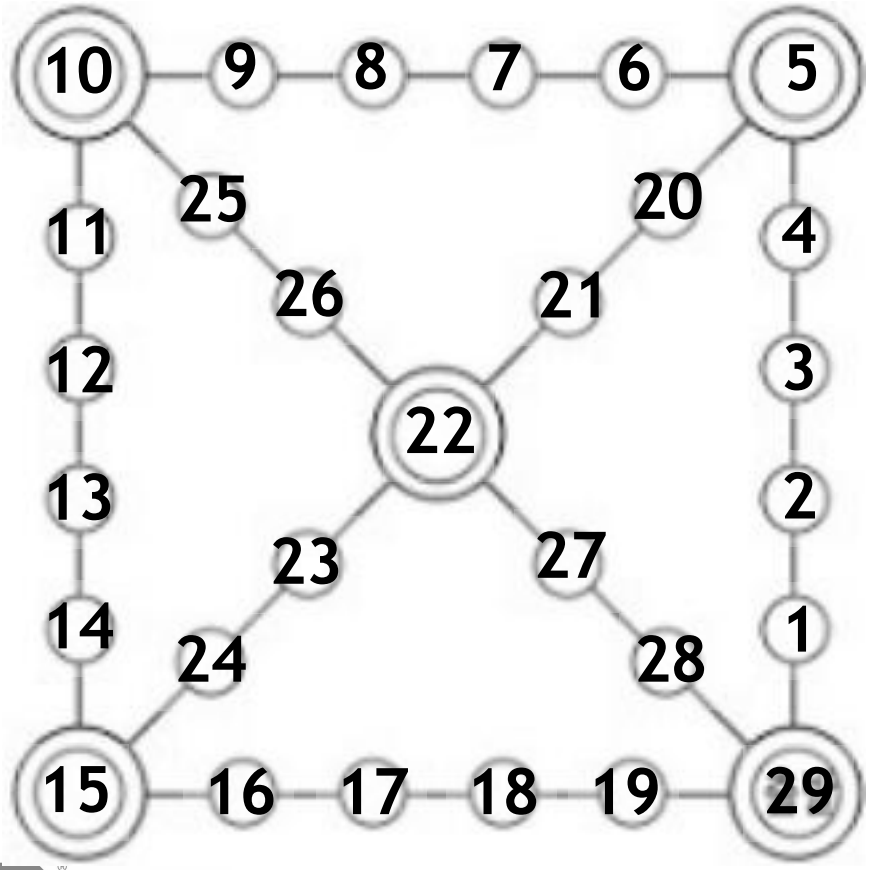


Position 0
:not yet departed

Position 29
:The piece needs to go at least one more space from 29
to be considered arrived.

Introduction to the gameplay

- To clarify back-do movement



Position 0 cannot move
Position 1 29
Position 29 19
Position 15 14
Position 22 21

Otherwise, for example,
Position 10 9
Position 19 18
Position 26 25
Position 23 22

…

Introduction to the gameplay

- Gameplay mechanics
  - "Catching"

    when a player lands on a space occupied by a piece of one of his opponents.

    [results]
    - The opponent's piece is eliminated from the board (position becomes 0) and it should start over.
    - The player throws again.

  - "Stacking"

    when a player lands on a space occupied by his pieces.

    [results]
    - The player should stack their pieces to move together as one unit.

Introduction to the gameplay

- Gameplay mechanics
  - "Throwing again"

when a player gets yut or mo.

[results]

- The player throws again and moves his pieces with the stick results.
  *It doesn't matter what order the stick results are applied.

For example,

player A's turn:

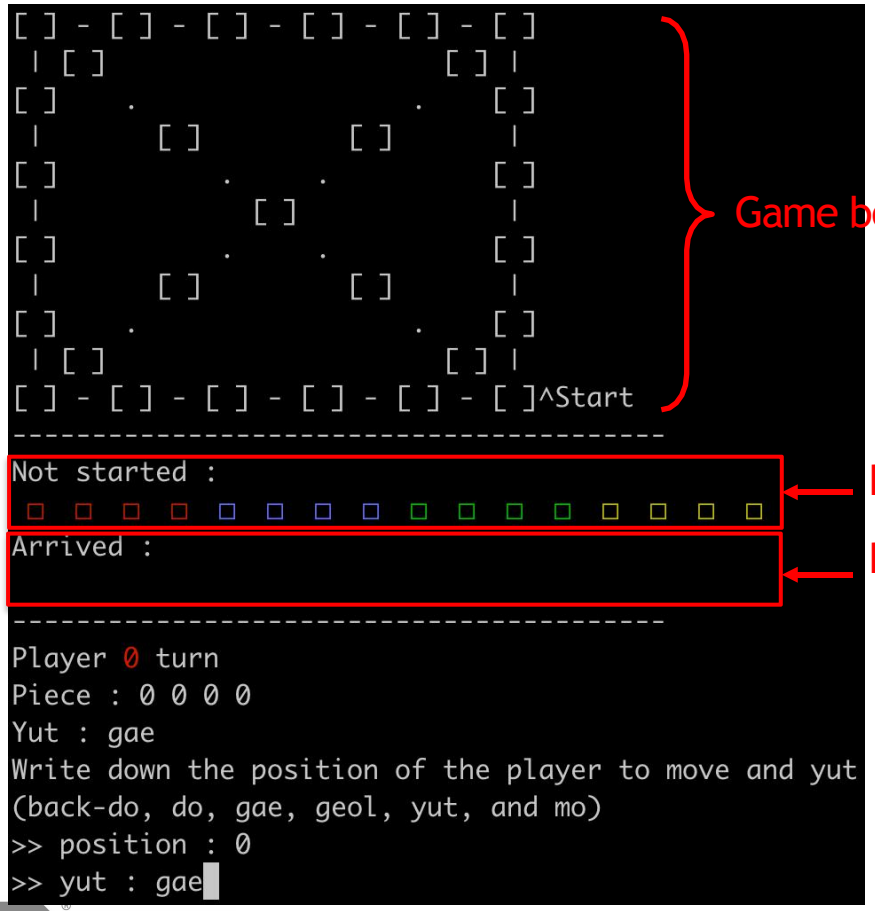
1st throwing result is Yut → 2nd throwing result is Mo → 3rd throwing result is Goel

➡ player A chooses and moves his tokens based on the stick results (Yut, Mo, and Geol).

The order of application of Yut, Mo, and Goel doesn't matter.

Gameplay examples

- Game visualization



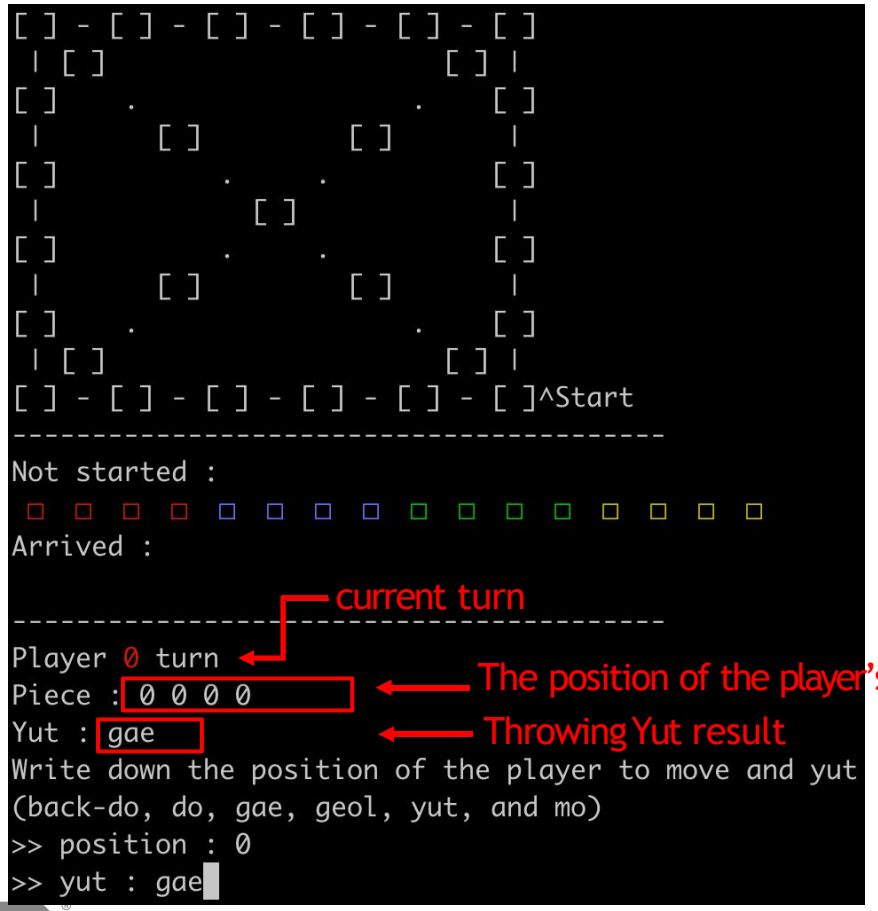
Game board

Players' pieces that have not yet departed

Players' pieces that have arrived

Gameplay examples

- Game visualization



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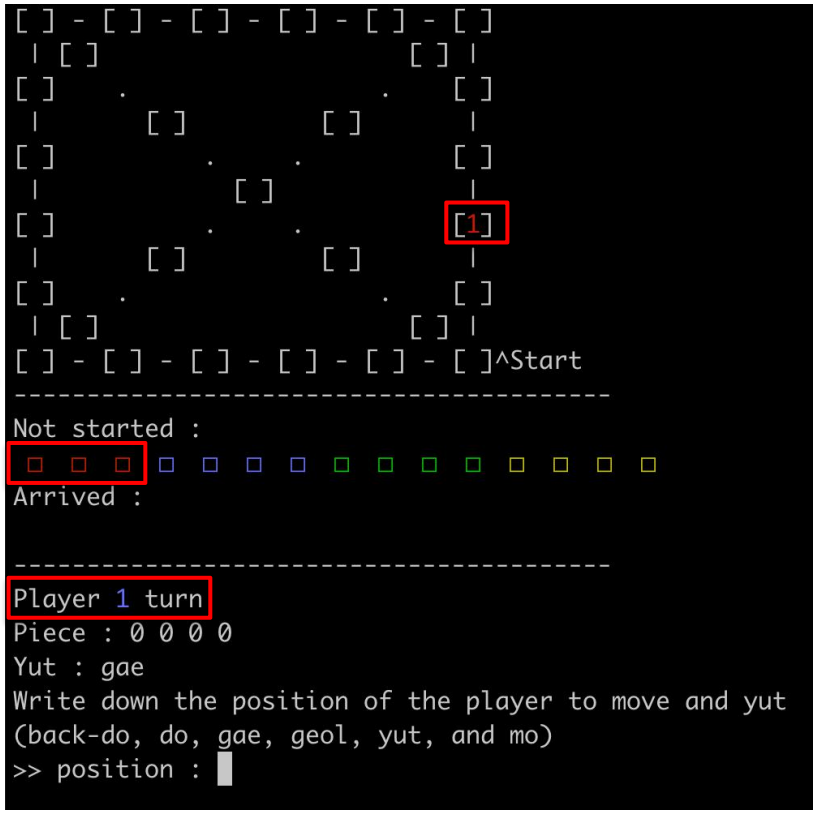
Gameplay examples

- Game visualization

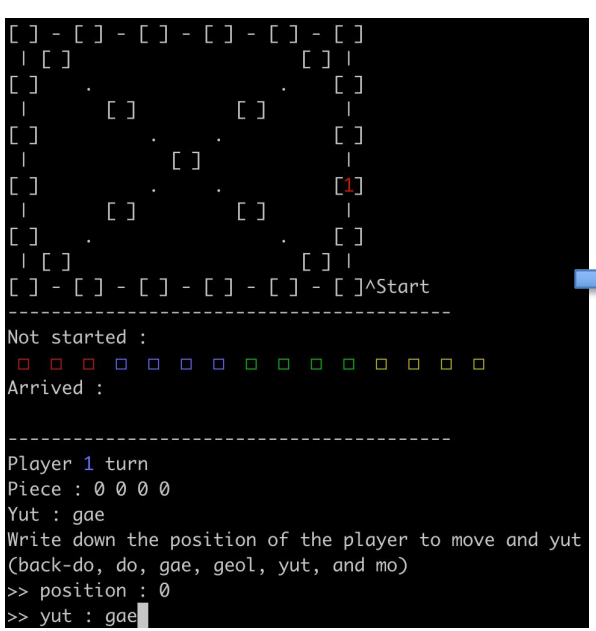
Gameplay examples

- Game visualization (ex 1)
  - player 0 moves with gae



Gameplay examples

- Game visualization (ex 2)
  - player 1 moves with gae catches player 0
    throws yut sticks again moves with geol



Gameplay examples

- Game visualization (ex 3)
  - player 2 throws yut sticks and the result is yut
    throws again and
  - the result is gae
    moves a new piece with gae
  - (stacking happens)

Throw until
no yut or mo comes up, and print a list of the yut results at once
Printing rule: Print in the order of back-do, do, gae, geol, yut, mo

Gameplay examples

- Game visualization (ex 3)
  - player 2 throws yut sticks
    and the result is yut
    throws again and
  - the result is gae
    moves a new piece with gae
  - (stacking happens)
    moves pieces at 2 with yut

Piece: 0 0 2 2

(two pieces that haven't departed yet,
two pieces at position 2)

Gameplay examples

- Game visualization (ex 3)
  - player 2 throws yut sticks
    and the result is yut
    throws again and
  - the result is gae
    moves a new piece with gae
  - (stacking happens)
    moves pieces at 2 with yut
    Next player's turn

Gameplay examples

- Game visualization (ex 4)
  - player 0 throws yut sticks and the result is back-do.

    Since player 0's all pieces have not departed yet, the pieces cannot move.

Gameplay examples

- Game visualization (ex 4)
  - player 0 throws yut sticks and the result is back-do.

    Since player 0's all pieces have not departed yet, the pieces cannot move.
  - Nothing happens and it is the next player's turn.

Basic version rules

- The number of players and pieces per player is selectable.
  - 2, 3, or 4

Advanced version rules

- Additional functionalities
  1. Different skills per player
  2. Login
  3. Pausing and saving games
  4. Loading the saved game

- The number of pieces per player is always 4.

- Otherwise, the rules are the same as in the basic version.

Advanced version rules

- Different skills per player
  - Players should choose one of the following animals

    pig, dog, sheep, or cow

  - Pig

    If someone else (player A) catches you, A ends his turn immediately.
  - Dog

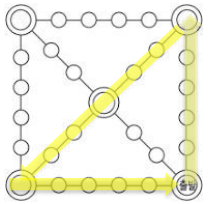
    Even if the stick result is geol, you should throw again.
  - Sheep

    If you catch someone else,
    you have two chances to throw again.

Obviously, if you get yut or mo, throw again as basic version rules!
(ex1) 1. do / 2. gae
(ex2) 1. gae / 2. yut mo geol
(ex3) 1. mo do / 2. yut gae

  - Cow

    You can only move along the yellow path.



Advanced version rules

- Different skills per player
  - Players should choose one of the following animals:

    pig, dog, sheep, or cow

  - P

    ely.

  - D

  - Sheep

    you have two chances to throw again.

    If you catch someone else,

  - Cow

    You can only move along the yellow path.

Caution!!

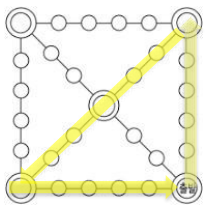
What happens if **Sheep** catches **Pig**?

Pig is stronger than Sheep.

So Sheep cannot use its skill and his turn ends immediately.

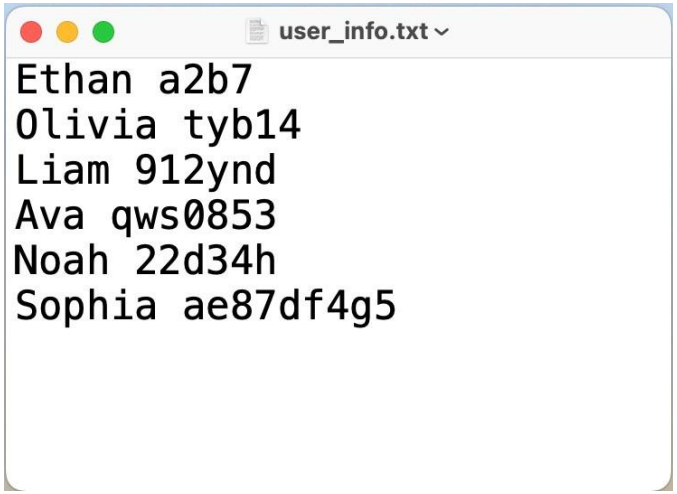
Obviously, if you get yut or mo, throw again as basic version rules!
(ex1) 1. do /2. gae

(ex2) 1. gae /2. yut mo geol
(ex3) 1. mo do /2. yut gae



Advanced version rules

- Login
  - ID and password information exists in user_info.txt
    - ID, password information for one player per line
    - ID is English and the password is a mix of alphanumeric characters.



Advanced version rules

- Login
  - More than one person should login to start the game.

```
**********************************************************
**********************    Menu    **************************
**********************************************************
Logged-in ID List : No player is logged in
1. game start
2. login
3. end program
Select the function you want : 1
More than 1 player is needed to start the game
```

```
**********************************************************
**********************    Menu    **************************
**********************************************************
Logged-in ID List : Noah Liam
1. game start
2. login
3. end program
Select the function you want :
```

Logged-in IDs

We assume that players who are already logged in will not attempt to login again.

  - Cases of "Login Failed!"

    1. ID does not exist in the user_info.txt / 2. The password is incorrect.

```
**********************************************************
**********************    Menu    **************************
**********************************************************
Logged-in ID List : No player is logged in
1. game start
2. login
3. end program
Select the function you want : 2
ID : Noah
PASSWORD : 22d34h
Login Succeed!
```

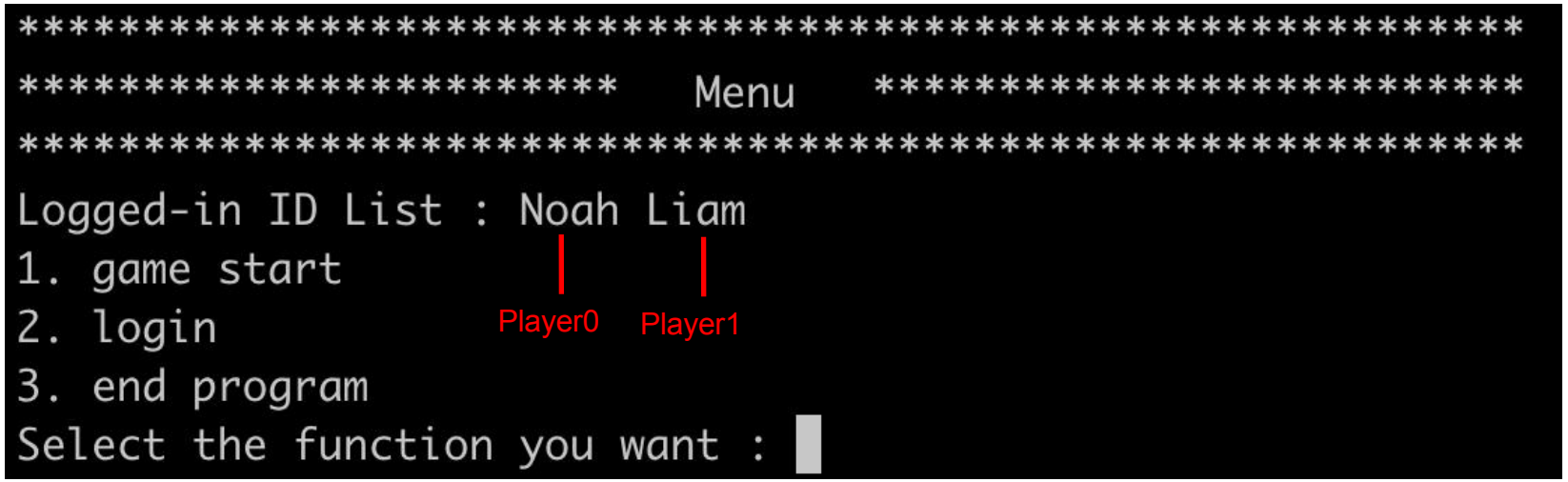
Login succeed

```
**********************************************************
**********************    Menu    **************************
**********************************************************
Logged-in ID List : Noah
1. game start
2. login
3. end program
Select the function you want : 2
ID : Jack
PASSWORD : adfv
Login Failed!
```

Login failed

Advanced version rules

- Login
  - Player number order (Player 0, Player 1, Player 2, Player 3) is the same as login order



If there exists a saved game with player order Liam(Player0) Noah(Player1), then Liam will be Player0, Noah will be Player1.
You can understand what this means after you read the subsequent slides. (p52)

Advanced version rules

- Pausing and saving games
  - If you want to save the current game information and stop in the middle of a game,
    Save game information in game_info.txt

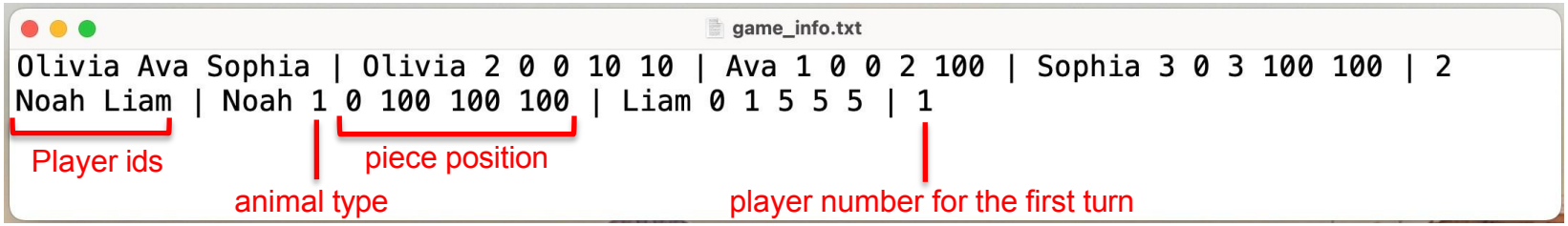
It should be asked between players' turns.

After saving, go back to the beginning of the game.
(Initial screen with no one logged in).

Advanced version rules

- Pausing and saving games
  - Multiple game information can be stored. (one per line)
  - Saved ID order is the same as player number order

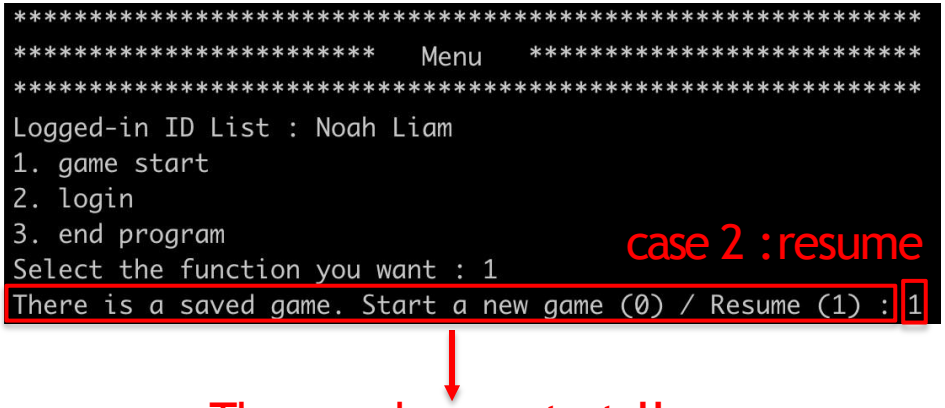
<game_info.txt>



100 means arrived piece

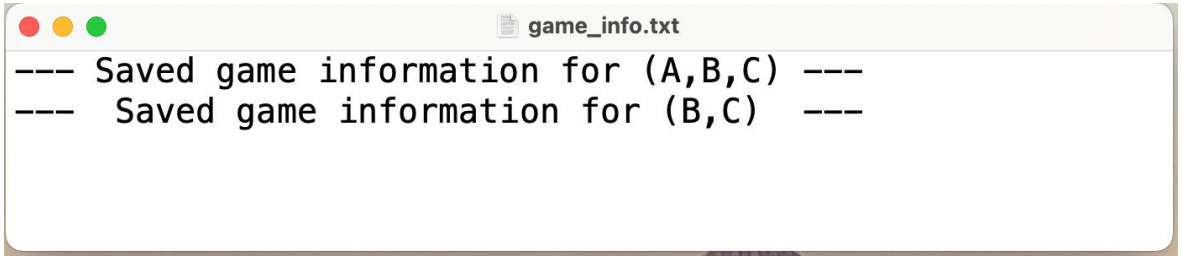
Advanced version rules

- Loading the saved game
  - If logged-in IDs before the game starts are the same as that of a saved games stored in game_info.txt,
    Ask whether to load the saved game



Advanced version rules

- Loading the saved game
  - Only the logged-in ID combination has to match (regardless of login order).
  - The player number order is the same as the saved order.



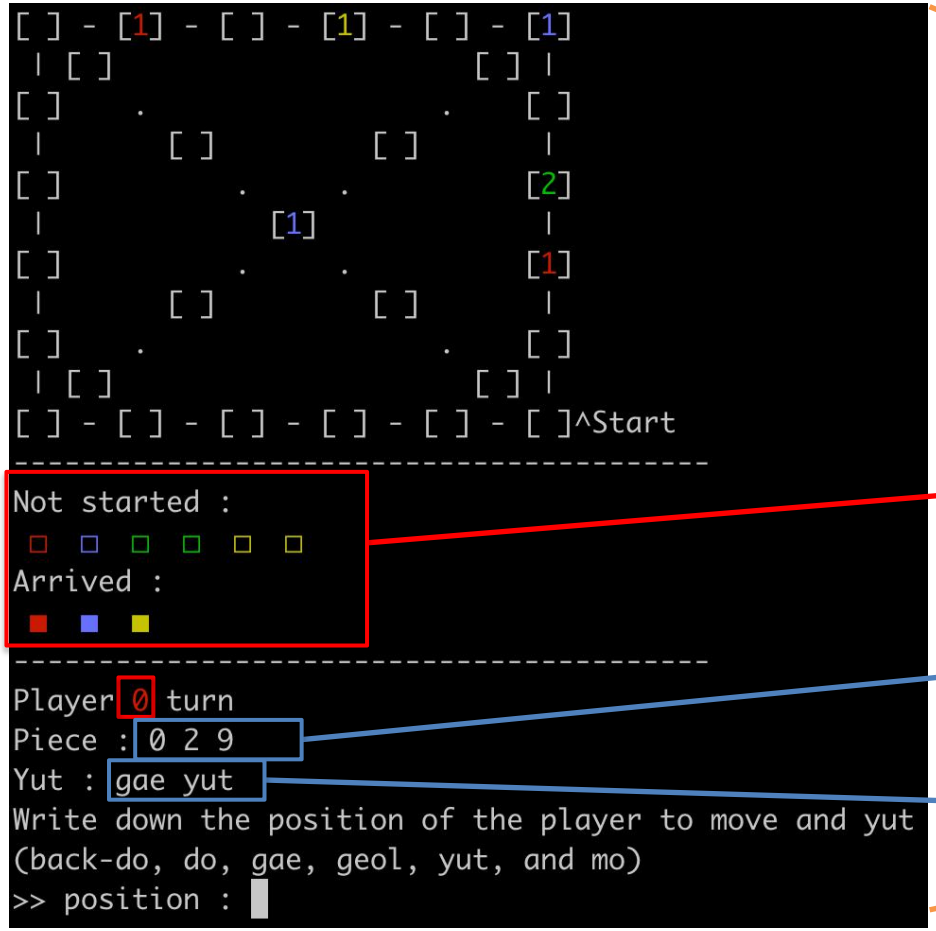
Login ID combinations must be exactly the same.

When B, C, D log in, you should start a new game.

You should play with the saved order, not the newly logged-in ID order.

If logged-in in the order B, A, C and then resuming the saved game, the player number order should be A, B, C.

Visualization rules



There are no blank lines in the output!

Token colours

- player0 : red
- player1 : blue
- player2 : green
- player3 : yellow

Print in ascending order
(exclude arrived pieces)

Print in the order of
back-do, do, gae, geol, yut, mo

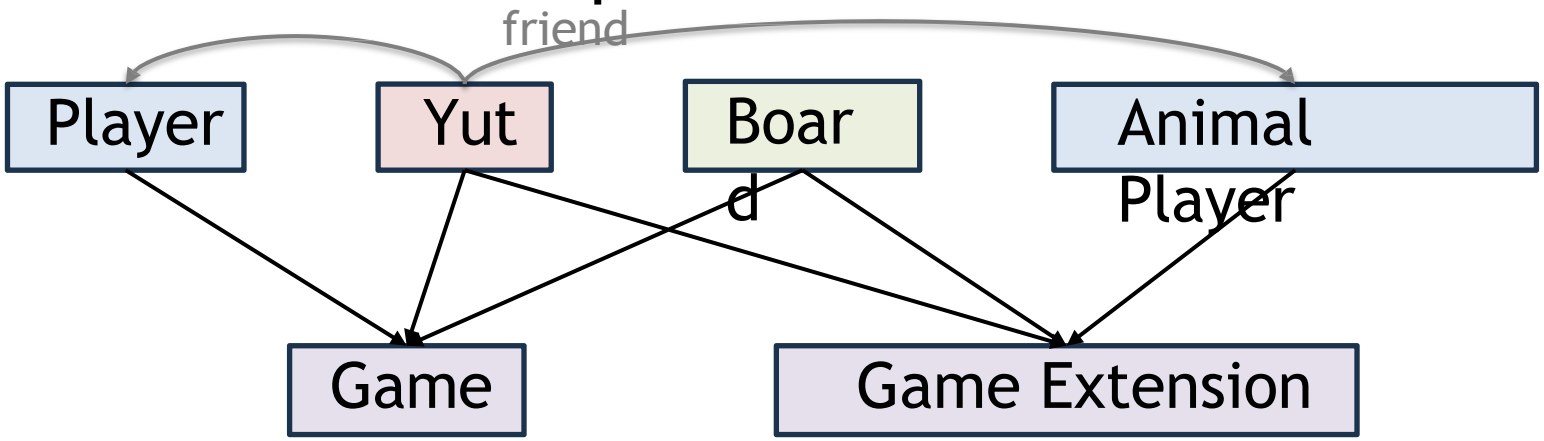
Visualization rules (Advanced version)

Each player's animal type

Code structures

- Class inheritance relationship

- Declaration relationship



Code structures

- class Game
  - int player_num

    Number of players
  - int piece_num

    Number of pieces per player
  - Board board and Yut yut

    Board class

    Yut class
  - Player *pPlayer

    Object of game player

```
protected:
  int player_num;
  int piece_num;
  Board board;
  Yut yut = Yut(0.5);

private:
  Player *pPlayer;
};
```

Code structures

- class Game
  - int menuSelect();

    select the number of players and the number of pieces per player.

    The function returns 0 if the user selects the end program, and returns 1 if the user selects the game start.
  - void run();

    run the game until the game ends.

    The function is called when the user selects the game start.

```
1  class Game {
2  /////////Feel free to add or subtract functions or variables. //////////
3  public:
4  Game() {}
5  virtual ~Game() {}
6  virtual int menuSelect();
7  void run();
8  void printPieceState();
9  void printCurrentTurn(int player_order);
10
```

Code structures

- class Game
  - void printPieceState();

    print the state of the pieces that have not started and the pieces that have arrived.

  - void printCurrentTurn();

    display the player's turn, the position of current pieces, and the current yut list.

Code structures

- class Board
  - vector<int_pair> board_mapping

    The (x,y) coordinates of the position of the piece on the board
  - vector<vector<int_pair> player_to_board

    Store (which player, number of pieces) values at each board position

```
typedef pair<int, int> int_pair;
```

```
class Board {
/////////Feel free to add or subtract functions or variables. //////////
public:
Board() {
player_to_board.assign(ROW, vector<int_pair>(COL, {-1, 0}));
board_mapping = {{-1, -1}, {8, 10}, {6, 10}, {4, 10}, {2, 10},
{0, 10}, {0, 8}, {0, 6}, {0, 4}, {0, 2},
{0, 0}, {2, 0}, {4, 0}, {6, 0}, {8, 0},
{10, 0}, {10, 2}, {10, 4}, {10, 6}, {10, 8},
{1, 9}, {3, 7}, {5, 5}, {7, 3}, {9, 1},
{1, 1}, {3, 3}, {7, 7}, {9, 9}, {10, 10}};
}
void initializeBoard();
void printBoard();

```

```
private:
const int ROW = 11;
const int COL = 11;
vector<int_pair> board_mapping;
vector<vector<int_pair>> player_to_board;
void printPlayer(int player_order, int num_pieces);
};
```

Code structures

- class Board
  - vector<int_pair> board_mapping

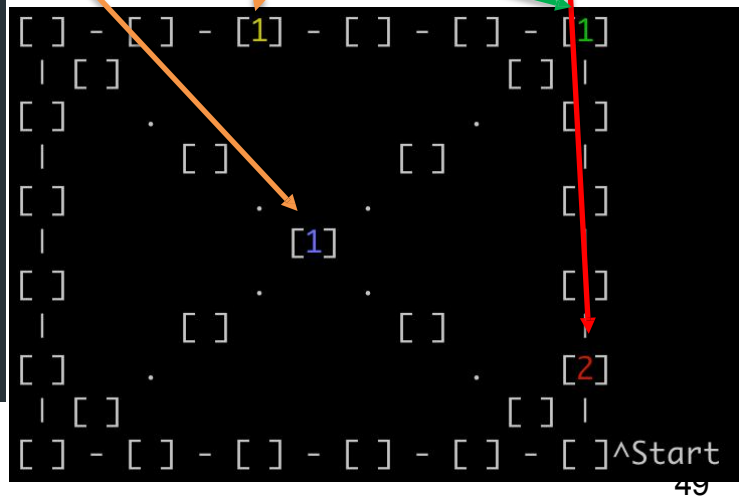
    (ex) board_mapping[22] = {5, 5}, board_mapping[8] = {0, 4}
  - vector<vector<int_pair> player_to_board

    (ex) player_to_board[0][10] = {2, 1}, player_to_board[8][10] = {0, 2}

```
typedef pair<int, int> int_pair;
```

```
class Board {
/////////Feel free to add or subtract functions or variables. //////////
public:
Board() {
player_to_board.assign(ROW, vector<int_pair>(COL, {-1, 0}));
board_mapping = {{-1, -1}, {8, 10}, {6, 10}, {4, 10}, {2, 10},
{0, 10}, {0, 8}, {0, 6}, {0, 4}, {0, 2},
{0, 0}, {2, 0}, {4, 0}, {6, 0}, {8, 0},
{10, 0}, {10, 2}, {10, 4}, {10, 6}, {10, 8},
{1, 9}, {3, 7}, {5, 5}, {7, 3}, {9, 1},
{1, 1}, {3, 3}, {7, 7}, {9, 9}, {10, 10}};
}
void initializeBoard();
void printBoard();

```



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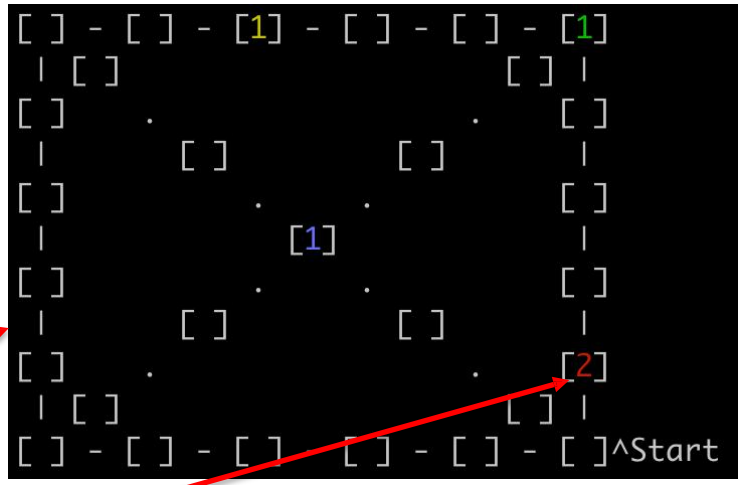
Code structures

- class Board
  - void initializeBoard();

    Initialize board state
  - void printBoard();

    Print the entire board
  - void printPlayer

    Print player in the




```
class Board {
/////////Feel free to add or subtract functions or variables. //////////
public:
Board() {
player_to_board.assign(ROW, vector<int_pair>(COL, {-1, 0}));
board_mapping = {{-1, -1}, {8, 10}, {6, 10}, {4, 10}, {2, 10},
{0, 10}, {0, 8}, {0, 6}, {0, 4}, {0, 2},
{0, 0}, {2, 0}, {4, 0}, {6, 0}, {8, 0},
{10, 0}, {10, 2}, {10, 4}, {10, 6}, {10, 8},
{1, 9}, {3, 7}, {5, 5}, {7, 3}, {9, 1},
{1, 1}, {3, 3}, {7, 7}, {9, 9}, {10, 10}};
}
void initializeBoard();
void printBoard();
```

```
private:
const int ROW = 11;
const int COL = 11;
vector<int_pair> board_mapping;
vector<vector<int_pair>> player_to_board;
void printPlayer(int player_order, int num_pieces);
};
```

Code structures

- class YutName

  string name: back-do, do, gae, geol, yut, and mo

  bool operator< : to print a list of yut results in the order of back-do, do, gae, geol, yut, mo

```
class YutName {
public:
string name;
bool operator<(const YutName &other) const {
//////////////////IMPLEMENT HERE//////////////////////////////////

//////////////////////////////////////////////////////////////////
}
};
```

Code structures

- class Yut
  - float prob (=0.5)

    probability of a single yut stick coming up heads or tails
  - int throwOneYut() : throw a single yut stick (0 or 1)
  - string throwFourYuts() : throw four yut sticks

    return: back-do, do, gae, geol, yut, mo

```
1  class Yut {
2  /////////Feel free to add or subtract functions or variables. //////////
3  public:
4  Yut(float prob) : prob(prob) {}
5  friend class Player;
6  friend class AnimalPlayer;
7
8  private:
9  float prob;
10 int throwOneYut();
11 string throwFourYuts();
12 };
```

Friend class
Player class can use private functions in Yut class

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Code structures

- class Player
  - vector<int> pieces : a list of the player's pieces positions
  - int arrived_piece_num : number of arrived pieces
  - multiset<Yutname> yut_list: stores the list of yut results that the player currently has.

Compared to <std::set>, <std::multiset> allows duplicate elements to be stored while maintaining them in sorted order.

```
1  class Player {
2  /////////Feel free to add or subtract functions or variables. //////////
3
4  public:
5  Player() {}
6  int movePlayer(int pos, string yut);
7  void throwYut(Yut &yut);
8
9  protected:
10 vector<int> pieces;
11 int arrived_piece_num = 0;
12 multiset<YutName> yut_list;
13 };
```

Code structures

- class Player
  - void throwYut(Yut &yut)

    Player can throw Yut (Yut class declares Player class as a friend class)

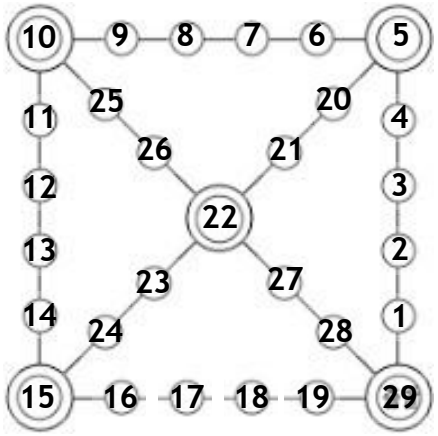
```
1  class Player {
2  /////////Feel free to add or subtract functions or variables. //////////
3
4  public:
5  Player() {}
6  int movePlayer(int pos, string yut);
7  void throwYut(Yut &yut);
8
9  protected:
10 vector<int> pieces;
11 int arrived_piece_num = 0;
12 multiset<YutName> yut_list;
13 };
```

Code structures

- class Player
  - int movePlayer(int pos, string yut)

    Input
    - int pos: initial position of piece
    - string yut: yut result (ex. do, gae, geol, …)

    Return: the final position of the piece
    - if a piece is arrived, then return 100




```
1  class Player {
2  /////////Feel free to add or subtract functions or variables. //////////
3
4  public:
5  Player() {}
6  int movePlayer(int pos, string yut);
7  void throwYut(Yut &yut);
8
9  protected:
10 vector<int> pieces;
11 int arrived_piece_num = 0;
12 multiset<YutName> yut_list;
13 };
```