2011 Fall CS202 Problem Solving
Final Project

Battle Tetris

What to do…

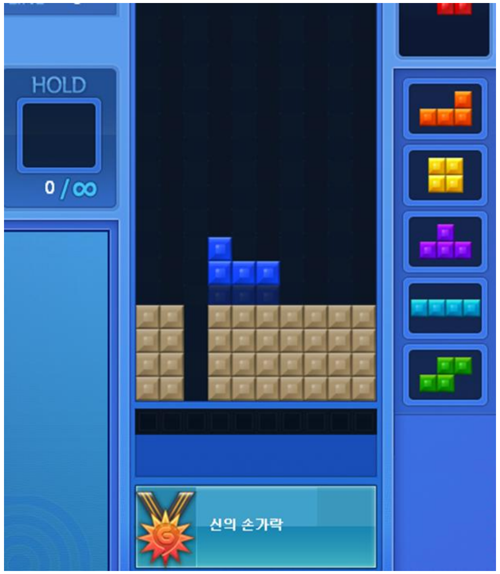
Project name: Battle Tetris

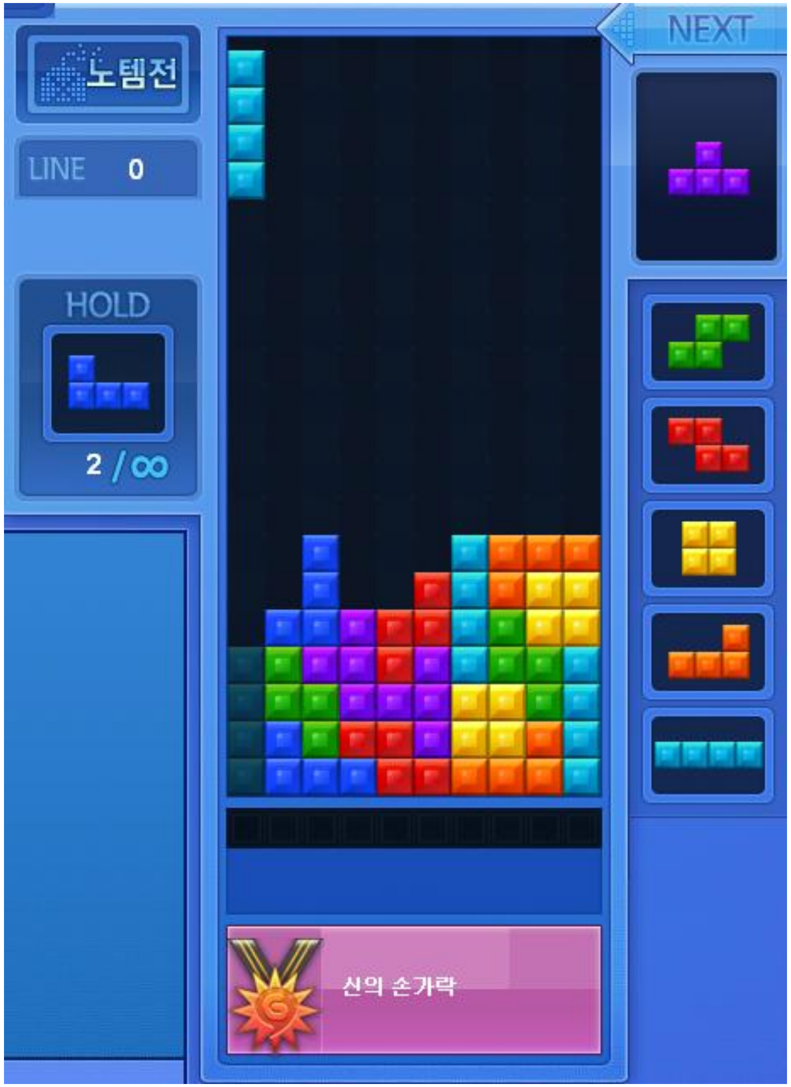
- Motivated by HanGame Tetris
    - http://tetris.hangame.com

- You should make AI algorithm for Tetris
    - Input
        - You and other person's current state of board (board, targetBoard)
        - Kind of current and next block(piece) (nextBlock)
        - And other context information (nowCombo, holdBlockNum, isOnHold, numOfGarbageLines, holePositionX)
    - Output
        - Where and how to drop the block (posX, turn)
        - Whether you will store(or exchange) the block or not (useHold)
        - Message to show

Tetris

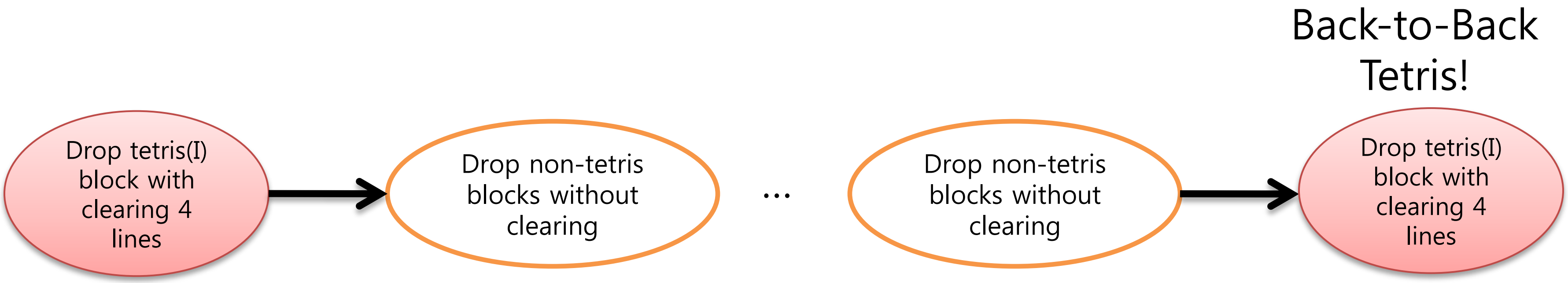
- If you delete(clear) 4 lines at once(tetris), the other party will be given 4 garbage lines
- If you delete 3 lines at once
  -> 2 garbage lines
- If you delete 2 lines at once
  -> 1 garbage line





Back-to-Back Tetris

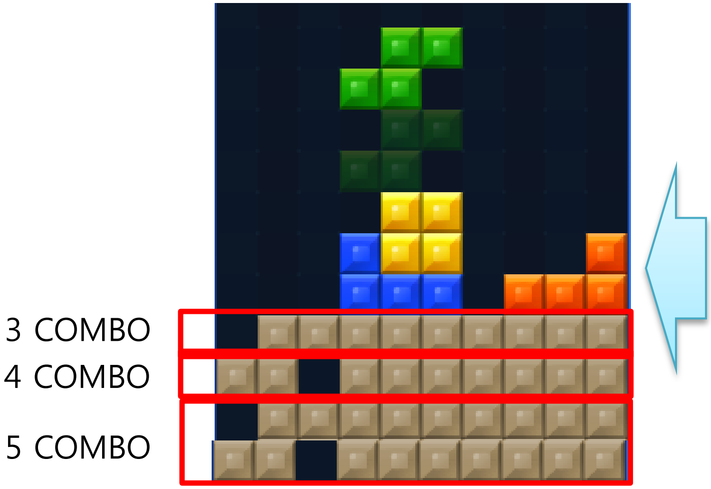
- A back-to-back tetris is, as the name states, a tetris (clearing 4 lines at a time) that's been cleared in a chain of consecutive tetrises.
  - the other party will be given 5 garbage lines


Back-to-Back Tetris!
Drop tetris(I) block with clearing 4 lines
Drop non-tetris blocks without clearing
…
Drop non-tetris blocks without clearing
Drop tetris(I) block with clearing 4 lines

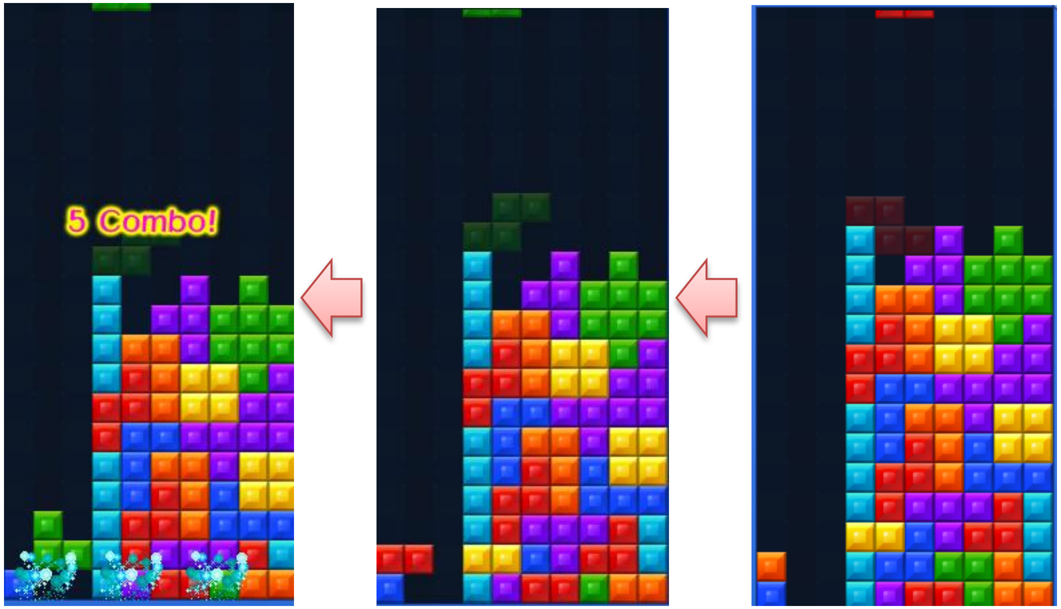
*http://answers.yahoo.com/question/index?qid=20080622152014AABZA48

Combo System

- After consecutive line deletion, the other party will be given..
  - 3~4 Combo : 1 line
  - 5~6 Combo : 2 lines
  - 7~8 Combo : 3 lines
  - 9~11 Combo : 4 lines



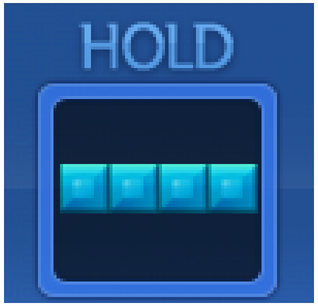
Enemy's board



My board

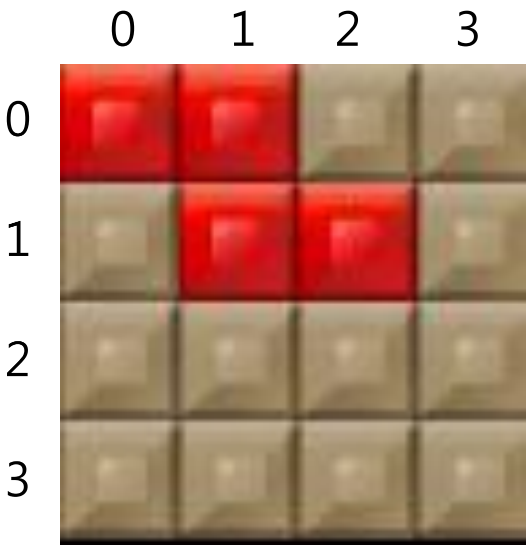
Holding Block

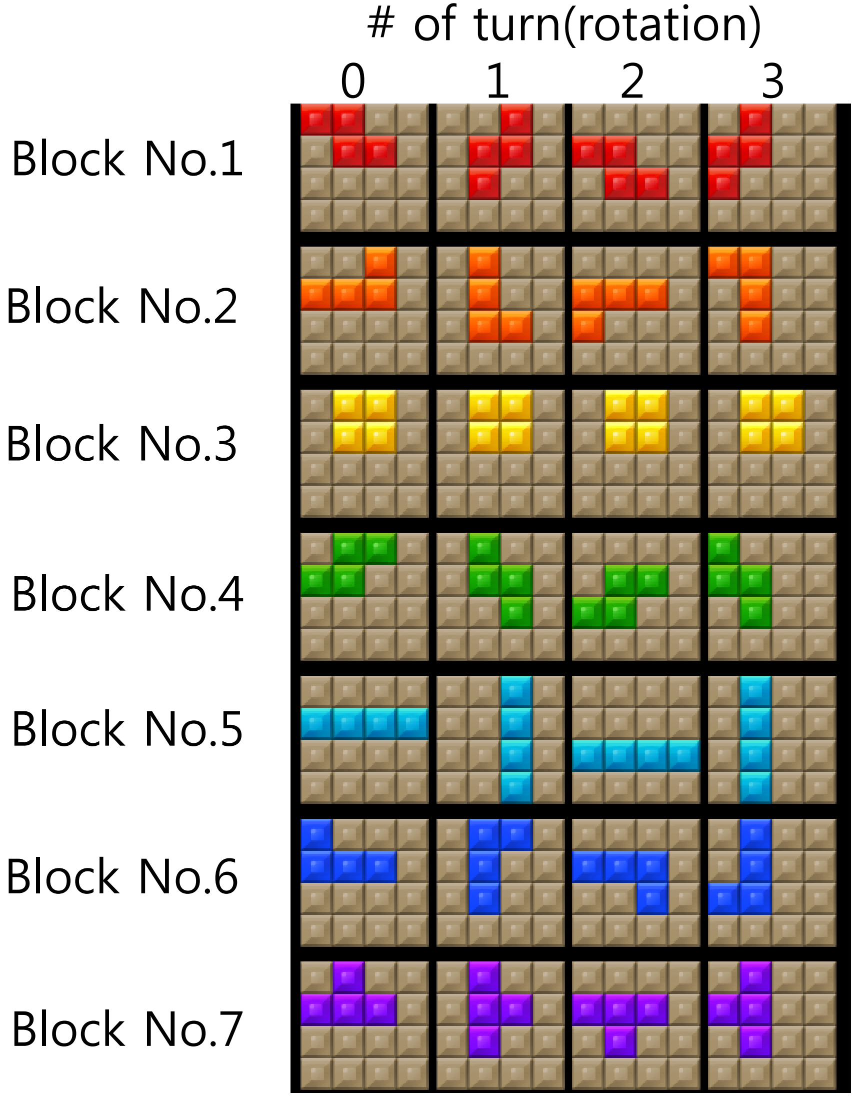
- You can store or exchange a block
  - If repository is empty
    - Current block is stored
  - Else
    - Current block is exchanged for the block in repository



- You can't use 'hold' consecutively without dropping the block

Block Information





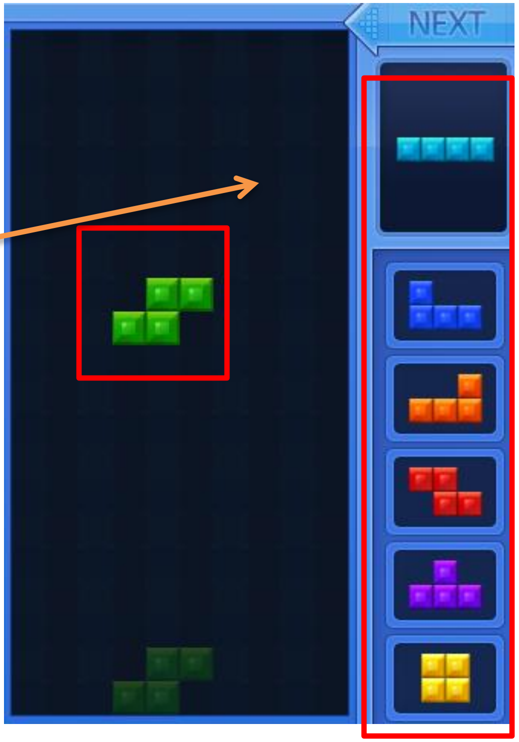
7-piece Bag System

Block count	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Block Kind No.	1	5	4	3	6	2	7	7	5	4	1	2	3	6	1	6	4
	Random order							Random order									

- Game server generates next blocks that will be used in game

- Block no. will not be overlapped in 1-7, 8-14, 15-21…

- Each block will be shown within 13 consecutive drops



Game & Decision Information

- **Game Information(you will be given)**

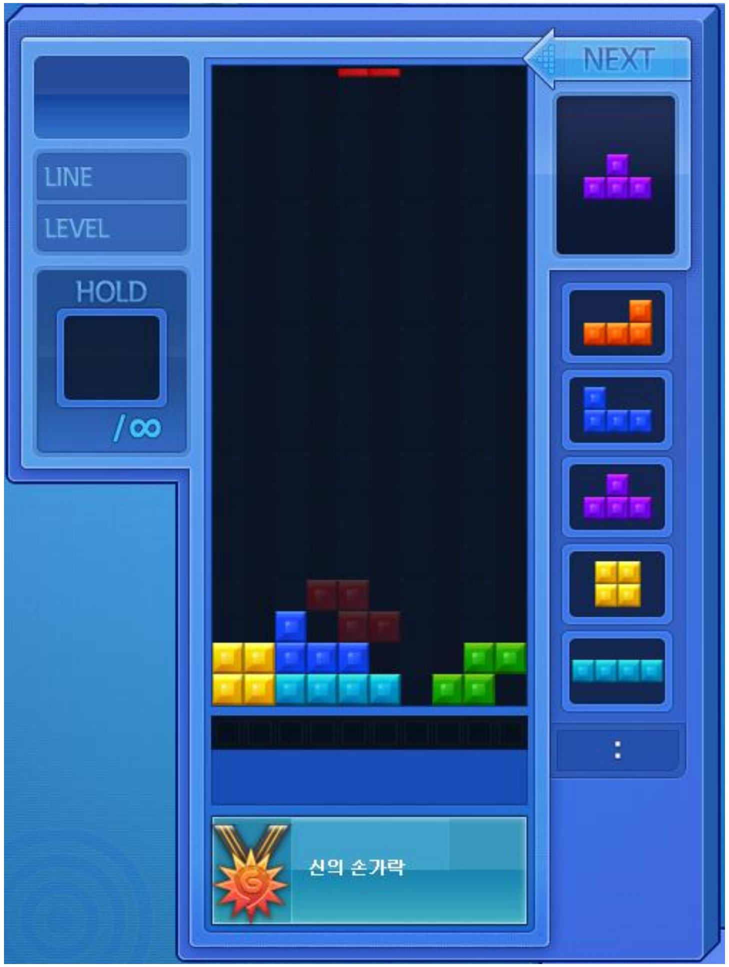
```
 board;                    //My game board
 targetBoard;              //Enemy's game board
 nextBlock[7];             //Block info.(index 0 is current block)
 nowCombo;                 // # of current combo
 holdBlockNum;             // # of current hold block(empty==0)
 isOnHold;                 // Whether 'hold' is used in previous decision.
                           //You can use 'useHold' on decision if this value is false(0)

 numOfGarbageLines;        // # of garbage lines to be pushed
 holePositionX[5];         // The x-position of the hole in garbage lines
```

- **Decision Information(you should send)**

```
posX;          // X position of dropping block(Pivot Position)
 turn;         // # of rotation
useHold;       // If useHold value is true(1), use 'hold'
message;       //Message to show (do not exceed 128 character)
```

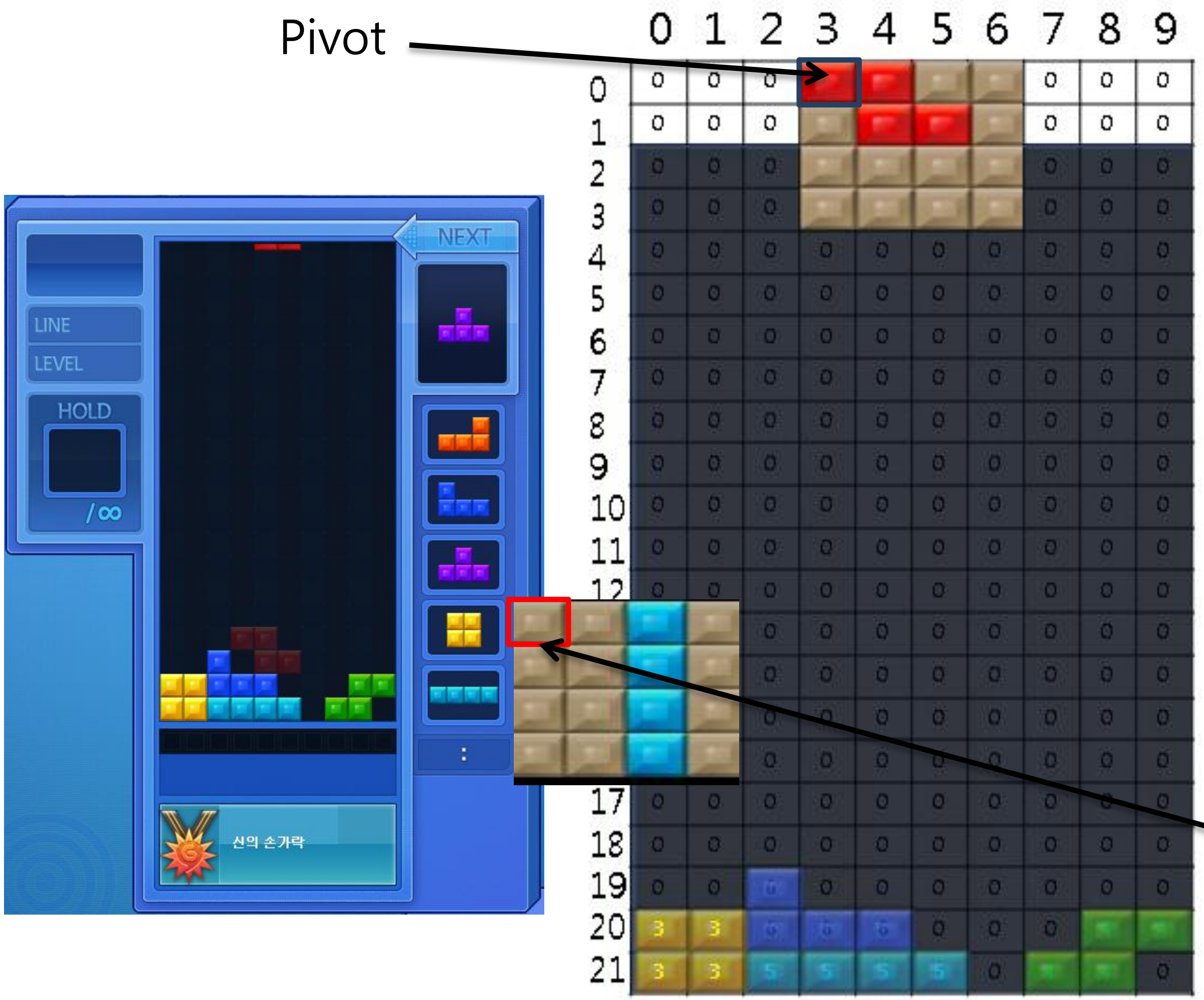
Board Presentation



	0	1	2	3	4	5	6	7	8	9
0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0
19	0	0	6	0	0	0	0	0	0	0
20	3	3	6	6	6	0	0	0	4	4
21	3	3	5	5	5	5	0	4	4	0

Will not be shown

Board Presentation



Pivot

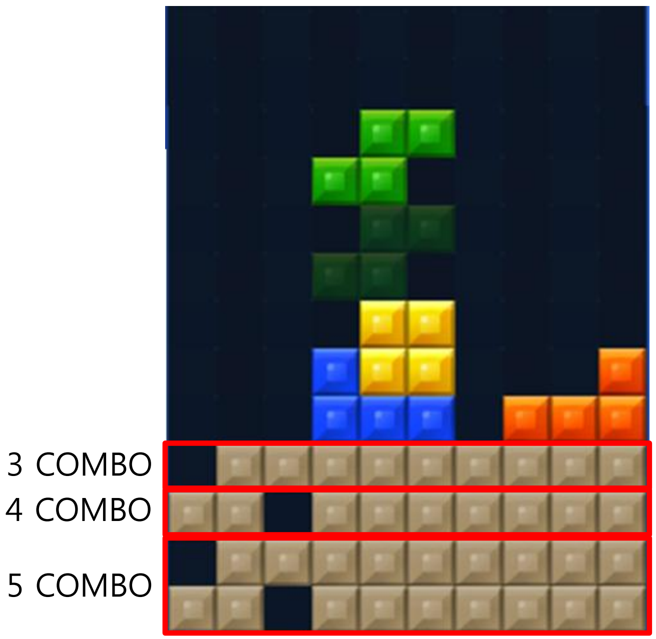
Current Block No : 1
Pos X : 3
Pos Y : 0
Turn : 0

Example)
board[20][0]= 3
board[20][8]= 4
nextBlock[]={1,7,2,6,7,3,5}

*X position of pivot can be minus value(e.g -2)

Garbage Block Info.

- Garbage line information that will be received after your decision is in ‘numOfGarbageLines’ and ‘holePositionX’



Example)

For 3 COMBO

numOfGarbageLines:1

holePositionX[4]={0,0,0,0,0}

For 4 COMBO

numOfGarbageLines:1

holePositionX[4]={2,0,0,0,0}

For 5 COMBO

numOfGarbageLines:1

holePositionX[4]={0, 2,0,0,0}

Win & Lose Condition

- You will win
  - The other party is died

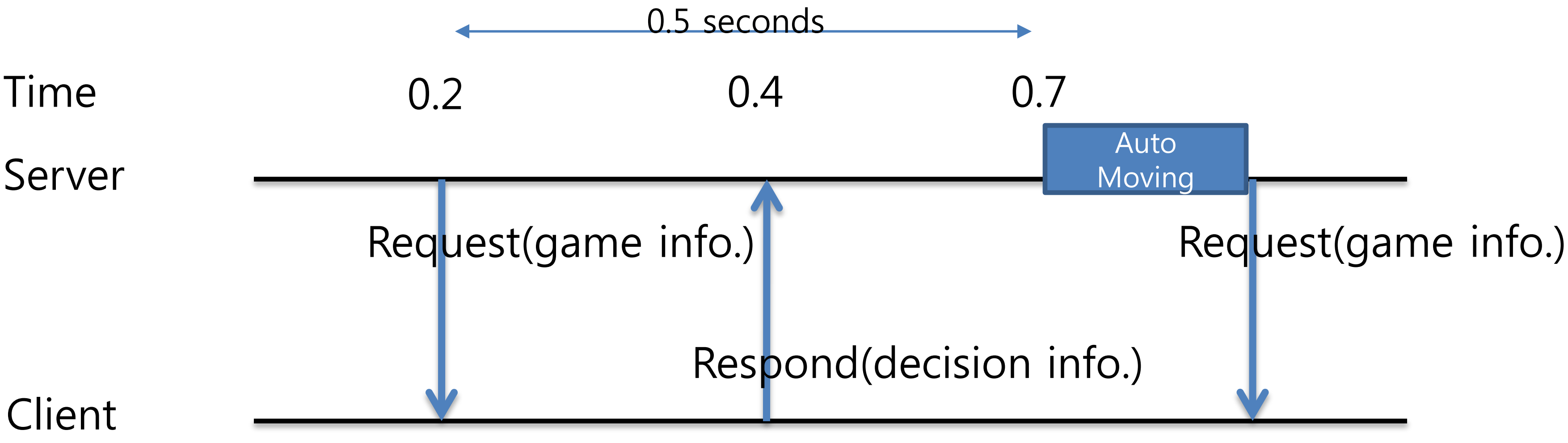
- You will lose
  - If the block that you chose is crashed the current blocks in your board or walls
  - Consecutive use of ‘hold’

- Draw condition
  - If two players are died together within 0.5 seconds

Additional Information

- Server will react your decision after '***Respond Time Limit***" seconds from the time that the server sent the game info.

Example) If Respond Time Limit is 0.5



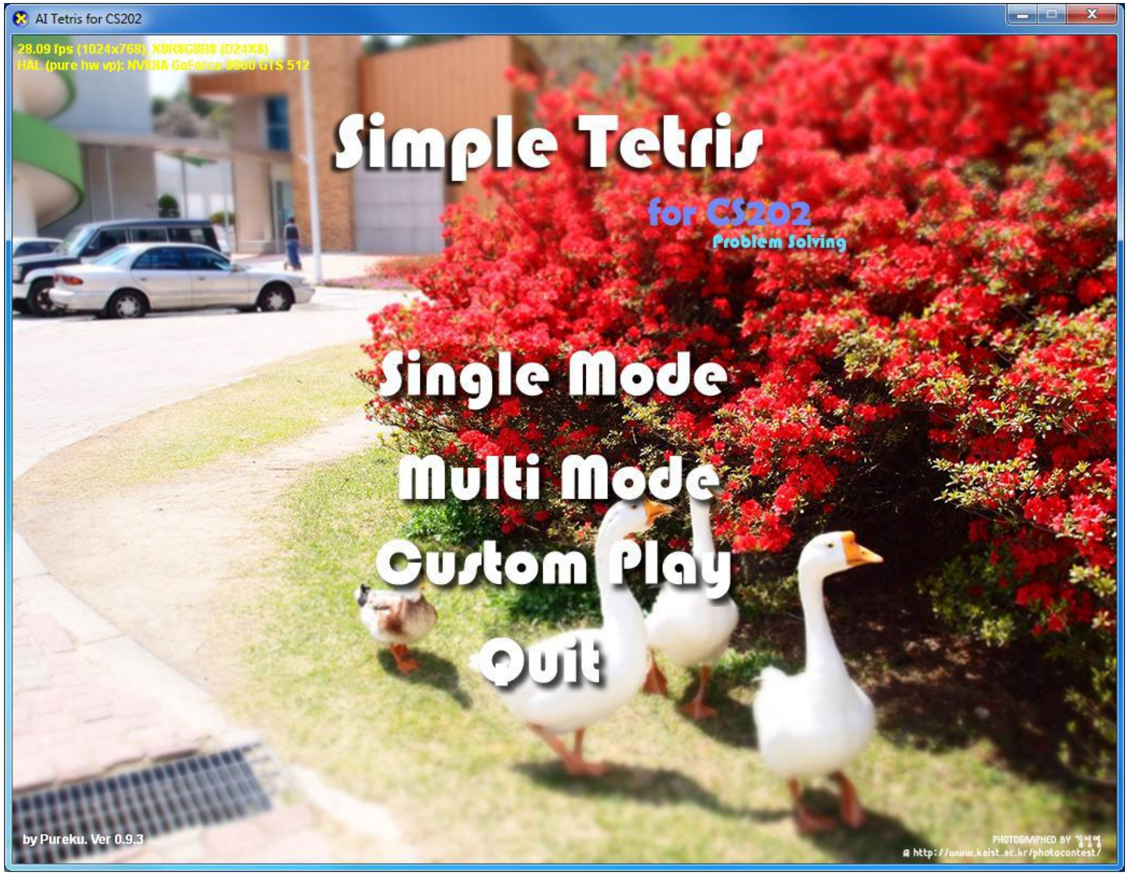
Additional Information

- For **AI vs AI** or **AI vs nobody**
  - Garbage blocks will be pushed after some time to prevent tedious play

Seconds	**60**	**70**	**80**	**90**	**95**	**100**	**105**	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**142**	**145**	**147**	**150**	**153**	**155**
Lines	1	1	1	2	2	2	2	2	2	2	2	3	3	3	3	3	3	4	4	4

Game Images

- Title Screen



AI Tetris for CS202

```
28.09 fps (1024x768), X8R8G8B8 (D24X8)
HAL (pure hw vp): NVIDIA GeForce 8800 GTS 512
```

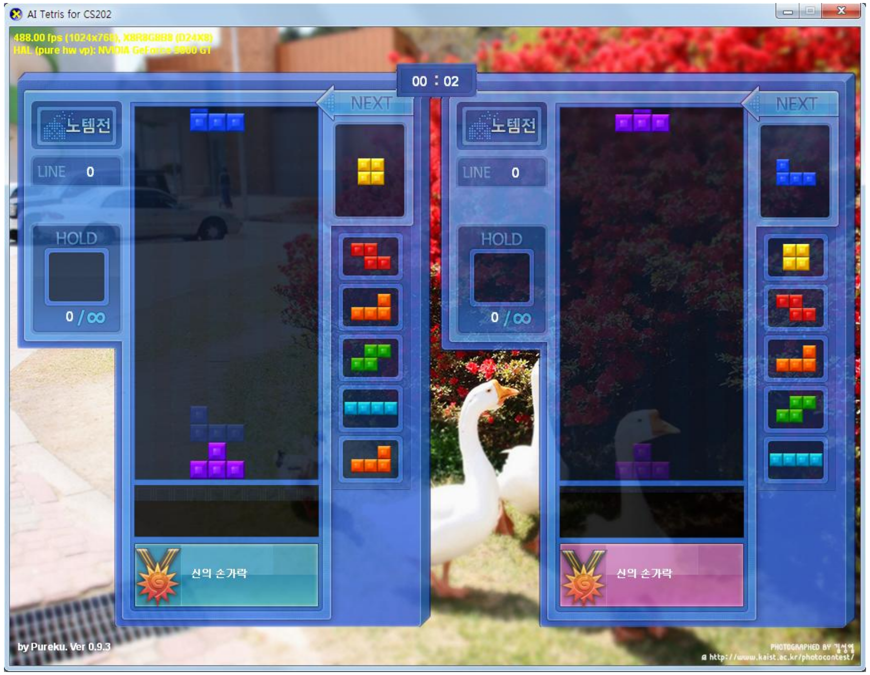
by Pureku. Ver 0.9.3

PHOTOGRAPHED BY 김성열
@ http://www.kaist.ac.kr/photocontest/

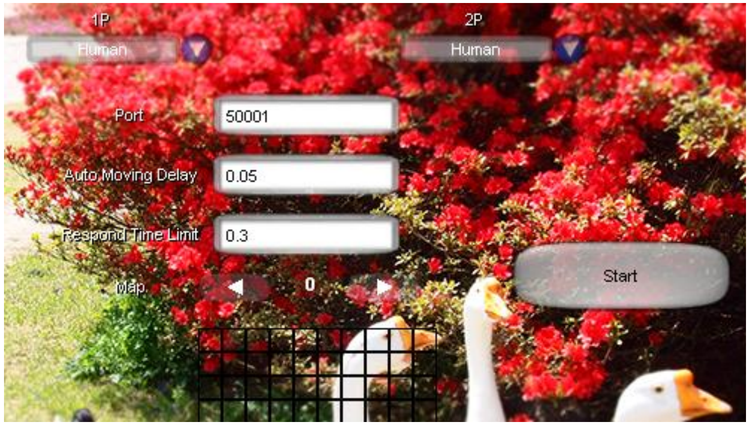
Control keys

You can control block by keyboard in 'Single Mode' or 'Multi Mode'

- **Single Mode** or '**Person vs AI**'
    - Move & Rotate: Arrow keys
    - Hard drop: Space key
    - Hold: Shift key
- **Multi Mode**
    - 1P
        - Move& Rotate: 'R','D','F','G'
        - Hard drop: Left shift key
        - Hold: 'Z'
    - 2P
        - Move& Rotate: Arrow keys
        - Hard drop: Right shift key
        - Hold: '/'



Custom Play



1P: Human

2P: Human

Port: 50001

Auto Moving Delay: 0.05

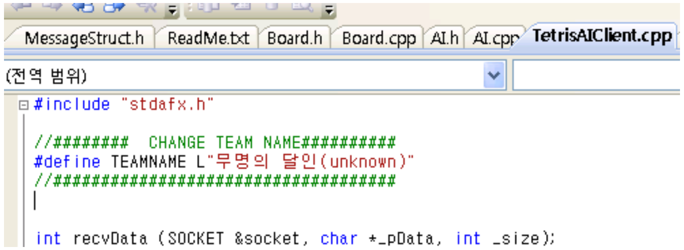
Respond Time Limit: 0.3

Map: 0

- You can connect AI client after setting and clicking ‘start’ button

AI Client

- C++ Client
  - Implemented by using visual studio 2010
  - Set team name in ‘TetrisAIClient.cpp’ file



```
#include "stdafx.h"

//########  CHANGE TEAM NAME##########
#define TEAMNAME L"무명의 달인(unknown)"
//####################################


int recvData (SOCKET &socket, char *_pData, int _size);
```

  - Implement ‘AI::decision(Game_Info gameInfo)’ method
- Java Client
  - Implemented by using eclipse(you can import project file)
  - Set team name by changing field named ‘TEAM_NAME’ in AI.java
  - Implement ‘AI.decision(GameInfo gameInfo)’ method

Sample heuristic algorithm is implemented in ‘decision’ method to show how to implement AI

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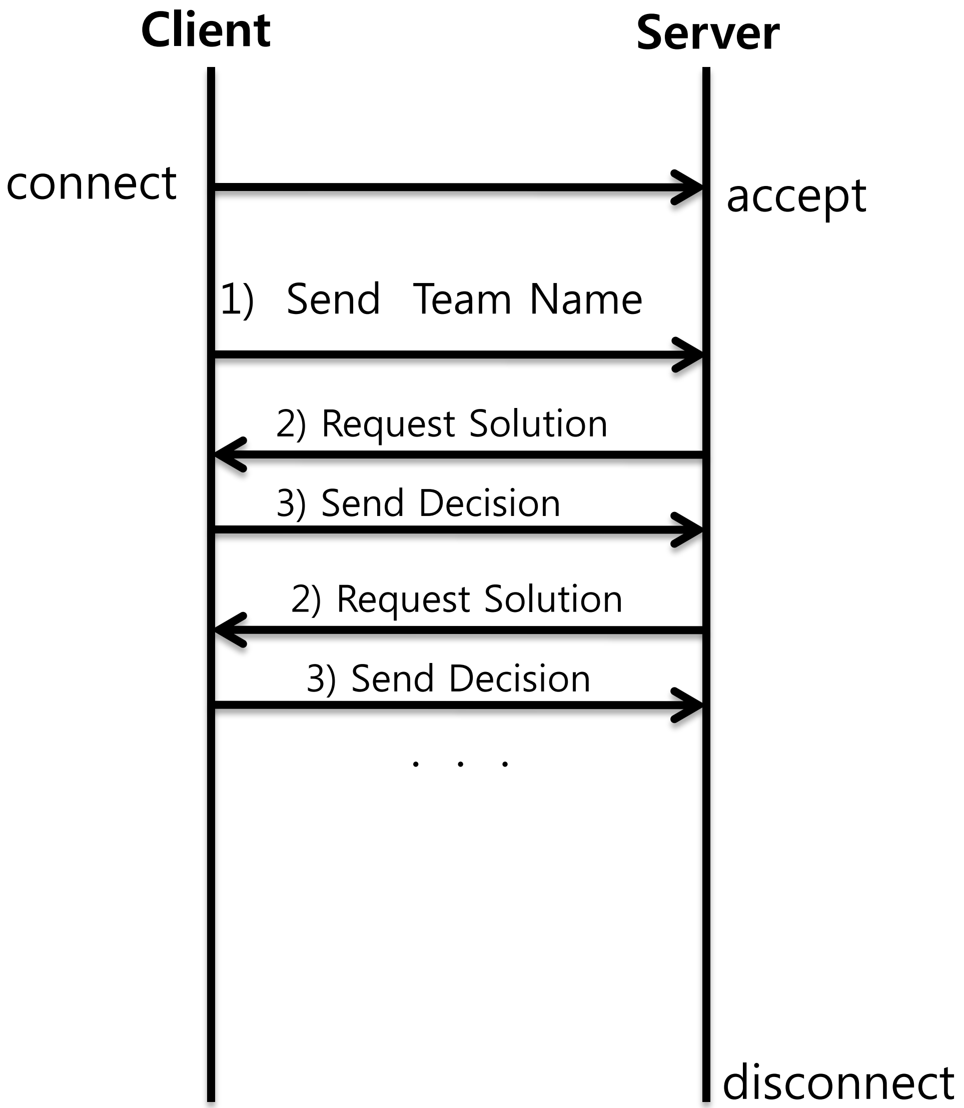
Final Project

AI Tetris Protocol Specification

Protocol Overview



Client

Server

connect

accept

1) Send Team Name

2) Request Solution

3) Send Decision

2) Request Solution

3) Send Decision

. . .

disconnect

1) Send Team Name

- Team Name [256 bytes]
  - Should be encoded with UTF-16 Little-endian
  - End with NULL(0) character

2) Request Solution

- Game information [456 Bytes]

```
 {
        BYTE board[22][10];      //My game board(BYTE is unsigned char in c)
        BYTE targetBoard[22][10]; //Enemy’s game board
        BYTE nextBlock[7];            //Block info.(index 0 is current block)
        BYTE nowCombo;              // # of current combo
        BYTE holdBlockNum;        // # of current hold block(empty==0)
        BYTE isOnHold;               // You can’t use ‘hold’ if true
        BYTE numOfGarbageLines;    // # of garbage lines to be pushed
        BYTE holePositionX[5];  // The x-position of the hole in garbage
                                          lines
}
```

3)Give Decision

- Decision information [264 Bytes]

```
{
        int posX;            // X position of dropping block
        BYTE turn;           // # of rotation
        BYTE useHold;   // Use ‘hold’ if useHold is not 0
        BYTE message[256]   //Message to show
        BYTE reserved[2]; //For aligning struct(don’t use)
}
```

  - int is little-endian byte order
  - Message should be encoded with UTF-16 Little-endian