Theory of Computer Games 2022

Report of Project #1

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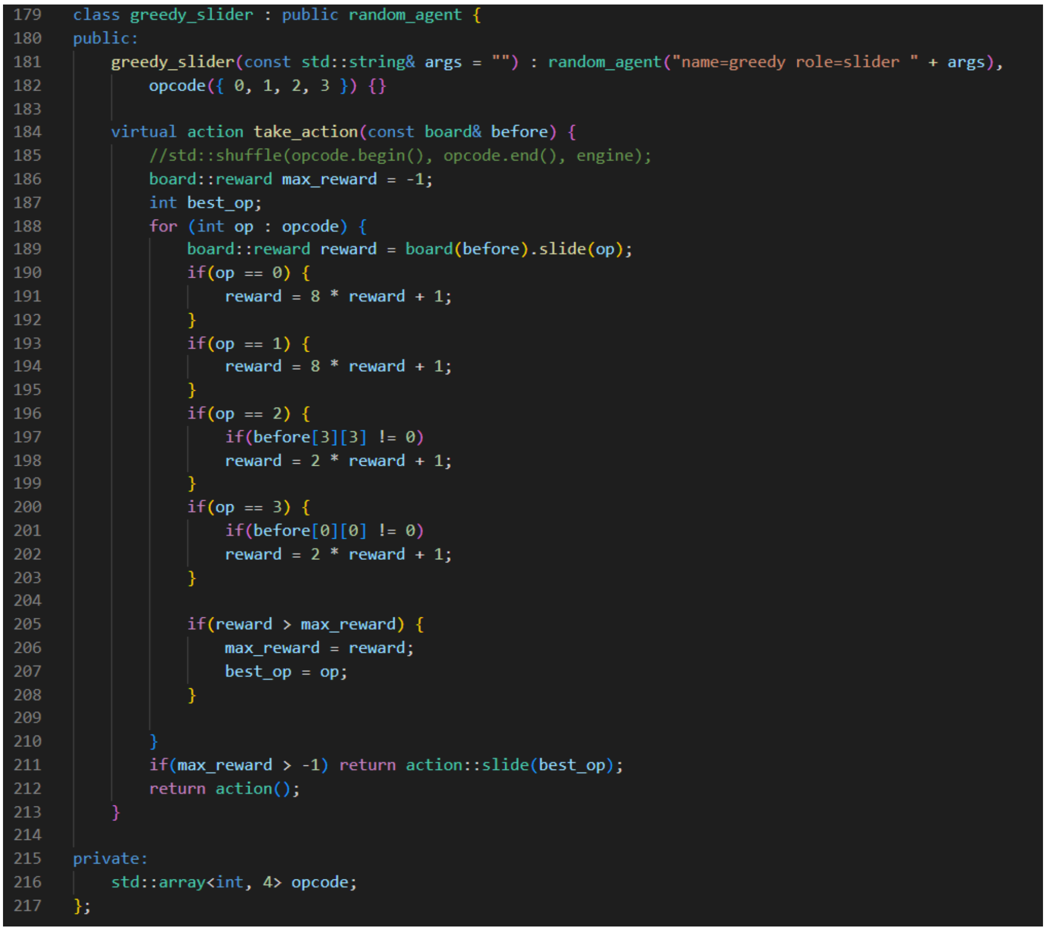
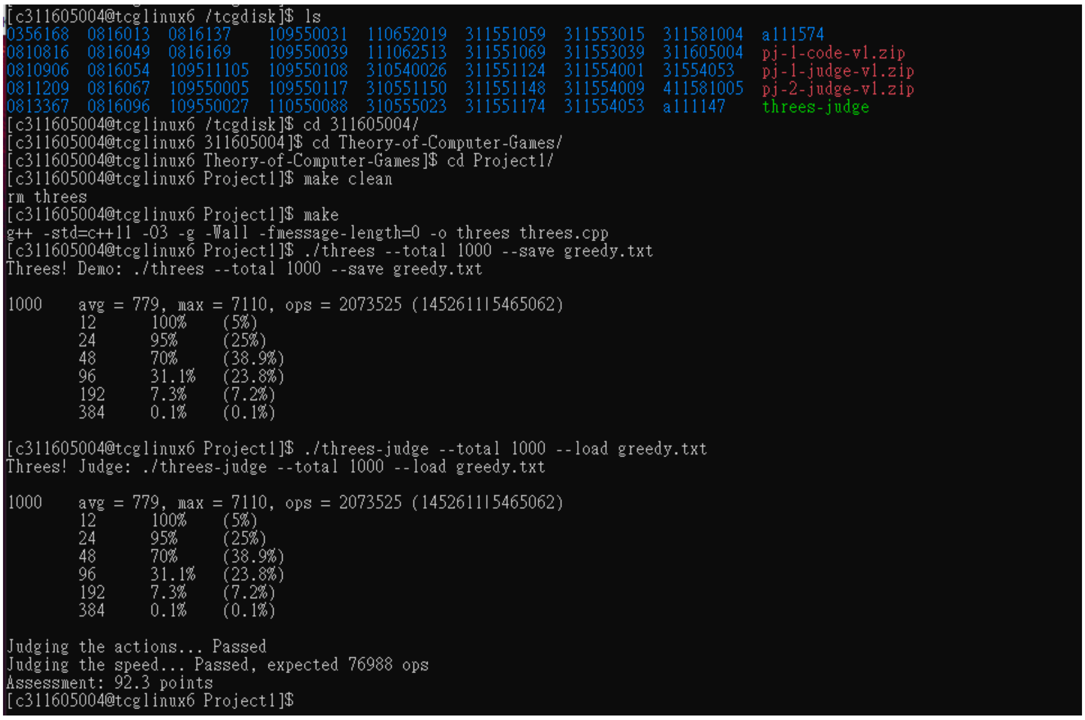
In project 1, our goal is to implement a simple heuristics-based player. For the framework of the game, and the environment, I followed the given sample.

The original given method was to play randomly, but care nothing about the reward. In the following method which I implemented, I applied the backward method and an 8 x 4 tuple network. In my implementation, I calculate the corresponding reward of each operations, which are “slide up”, “slide down”, “slide left”, “slide right”. By calculating reward of each potential operations, I will choose the operation with the highest reward and act to it. The following figure is the implementation of my greedy sliding method.



```
class greedy_slider : public random_agent {
public:
    greedy_slider(const std::string& args = "") : random_agent("name=greedy role=slider " + args),
        opcode({ 0, 1, 2, 3 }) {}

    virtual action take_action(const board& before) {
        //std::shuffle(opcode.begin(), opcode.end(), engine);
        board::reward max_reward = -1;
        int best_op;
        for (int op : opcode) {
            board::reward reward = board(before).slide(op);
            if(op == 0) {
                reward = 8 * reward + 1;
            }
            if(op == 1) {
                reward = 8 * reward + 1;
            }
            if(op == 2) {
                if(before[3][3] != 0)
                reward = 2 * reward + 1;
            }
            if(op == 3) {
                if(before[0][0] != 0)
                reward = 2 * reward + 1;
            }

            if(reward > max_reward) {
                max_reward = reward;
                best_op = op;
            }

        }
        if(max_reward > -1) return action::slide(best_op);
        return action();
    }

private:
    std::array<int, 4> opcode;
};
```

With my greedy sliding method introduced above, I obtained a way better result than the original strategy with the score of “92.3” in the provided Linux workstation, which the score of the original random method is about “65.7”. The capture of the result is shown in the following figure.



```
[c311605004@tcglinux6 /tcgdisk]$ ls
0356168  0816013  0816137    109550031  110652019  311551059  311553015  311581004  a111574
0810816  0816049  0816169    109550039  111062513  311551069  311553039  311605004  pj-1-code-v1.zip
0810906  0816054  109511105  109550108  310540026  311551124  311554001  31554053   pj-1-judge-v1.zip
0811209  0816067  109550005  109550117  310551150  311551148  311554009  411581005  pj-2-judge-v1.zip
0813367  0816096  109550027  110550088  310555023  311551174  311554053  a111147    threes-judge
[c311605004@tcglinux6 /tcgdisk]$ cd 311605004/
[c311605004@tcglinux6 311605004]$ cd Theory-of-Computer-Games/
[c311605004@tcglinux6 Theory-of-Computer-Games]$ cd Project1/
[c311605004@tcglinux6 Project1]$ make clean
rm threes
[c311605004@tcglinux6 Project1]$ make
g++ -std=c++11 -O3 -g -Wall -fmessage-length=0 -o threes threes.cpp
[c311605004@tcglinux6 Project1]$ ./threes --total 1000 --save greedy.txt
Threes! Demo: ./threes --total 1000 --save greedy.txt

1000    avg = 779, max = 7110, ops = 2073525 (145261|5465062)
        12      100%    (5%)
        24      95%     (25%)
        48      70%     (38.9%)
        96      31.1%   (23.8%)
        192     7.3%    (7.2%)
        384     0.1%    (0.1%)

[c311605004@tcglinux6 Project1]$ ./threes-judge --total 1000 --load greedy.txt
Threes! Judge: ./threes-judge --total 1000 --load greedy.txt

1000    avg = 779, max = 7110, ops = 2073525 (145261|5465062)
        12      100%    (5%)
        24      95%     (25%)
        48      70%     (38.9%)
        96      31.1%   (23.8%)
        192     7.3%    (7.2%)
        384     0.1%    (0.1%)

Judging the actions... Passed
Judging the speed... Passed, expected 76988 ops
Assessment: 92.3 points
[c311605004@tcglinux6 Project1]$
```