

Theory of Computer Games (Fall 2021) Homework 1 Review

NTU CSIE

November 29, 2021

Outline

- 1 Score
- 2 Implementation
- 3 Discussion
- 4 Test Boards

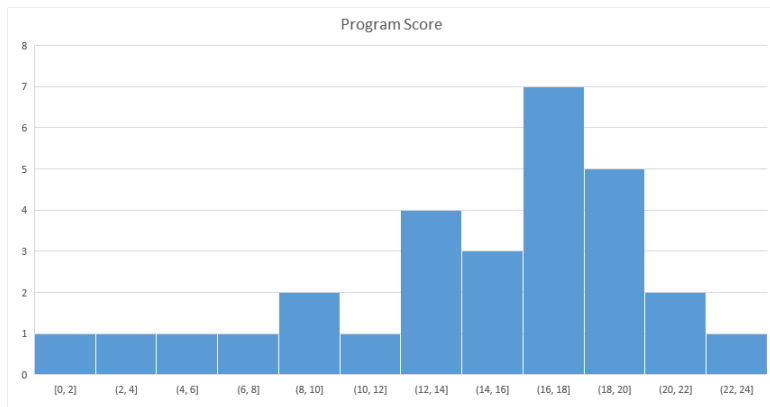
Grading Policy

Grading Policy

$$\text{Your Point} = P \times \left(\frac{\text{Your Score}}{\text{Boss Score}} \times W_1 + \text{Report Score} \times W_2 - M \right) \times D$$

- P : 25
- Your Score : $\in [0, 26]$
- Boss Score : 21.2125 (Test Boards)
- W_1 : 0.8
- Report Score : $\in [0, 1]$
- W_2 : 0.2
- M : $0.06 \times \#$ of missing requirements
- D : $(1 - 0.1 \times \#$ of days late)

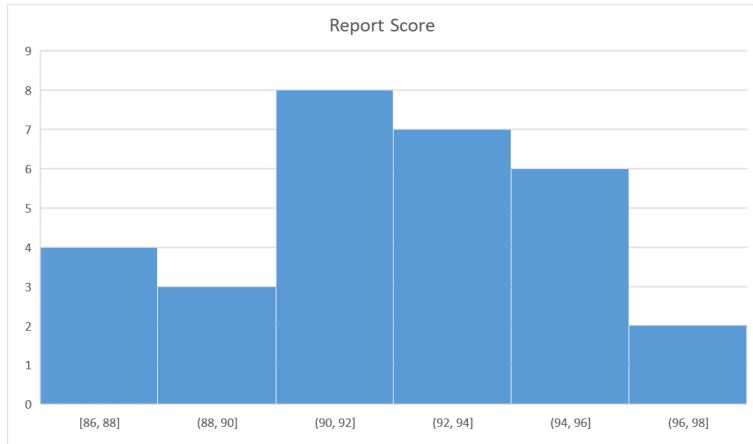
Program Score Distribution



Statistic

- Average: 14.6
- Standard Deviation: 5.6

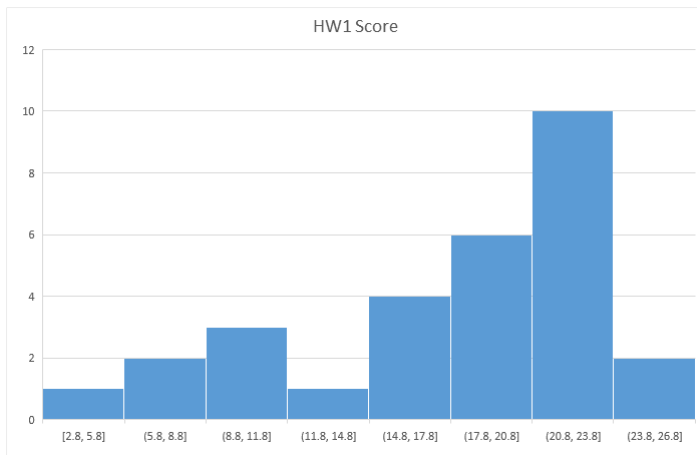
Report Score Distribution



Statistic

- Average: 92.5
- Standard Deviation: 3.1

HW1 Score Distribution



Statistic

- Average: 17.6
- Standard Deviation: 5.7

Implementation

Evaluation function

- Static value (Experiment, Training, ...)
- Dynamic value (Pawn, King, ...)
- Distance (Manhattan, Chebyshev, ...)
- Location (Center, Corner, ...)
- Mobility (Neighborhood, Blank, ...)

Move ordering

- Eat > Move
- Score

Move Generator

- Linked-list
- Table (Adjacent index)

Game tree complexity

DarkChess

- Average Game Length: 90
- Average Move: 32

$$32^{90} \approx 2.9 \times 10^{135}$$

HW1

- Average Game Length: 117
- Average Move: 12

$$12^{117} \approx 1.8 \times 10^{126}$$

State space complexity

DarkChess:

$$\sum_{p_1=0}^5 \sum_{p_2=0}^2 \cdots \sum_{p_{14}=0}^1 \sum_{d_1=0}^{5-p_1} \sum_{d_2=0}^{2-p_2} \cdots \sum_{d_{14}=0}^{1-p_{14}} \frac{32!}{\underbrace{D! (32 - P - D)!}_{\text{Covered pieces}} \prod_{i=1}^{14} p_i!}$$

$$\left(P = \sum_{i=1}^{14} p_i \quad D = \sum_{i=1}^{14} d_i \right)$$

$$\approx 1.03 \times 10^{36}$$

State space complexity

HW1:

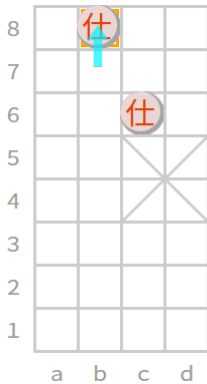
$$\overbrace{\sum_{p_1=0}^5 \sum_{p_2=0}^2 \cdots \sum_{p_{12}=0}^1}^{\text{Flipped pieces}} \frac{32!}{\underbrace{(32 - P)!}_{\text{Dead pieces}} \prod_{i=1}^{12} p_i!}$$
$$\left(P = \sum_{i=1}^{12} p_i \right)$$
$$\approx 2.97 \times 10^{27}$$

0 (Sample 0)

Average Score: 1.2250



0



1.075 (W)



1.1875 (W)

1 (Sample 1)

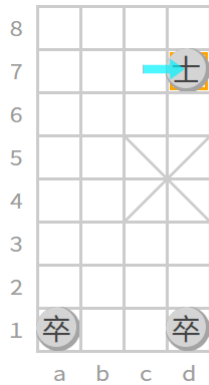
Average Score: 1.0542



1



1.225 (W)



1.1125 (W)

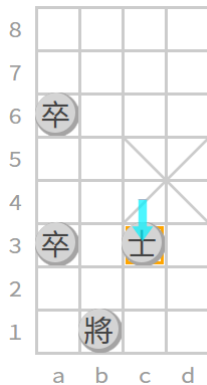
Average Score: 0.8646



2



1.1125 (W)



1.15 (W)

3 (Sample 2)

Average Score: 0.8896



3



1.3 (W)

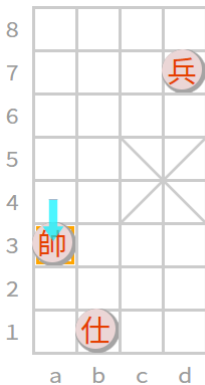


1.225 (W)

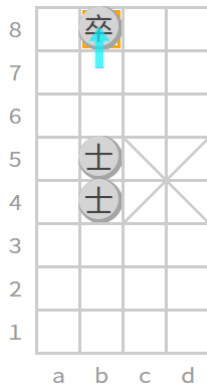
Average Score: 0.8708



4



1.1125 (W)



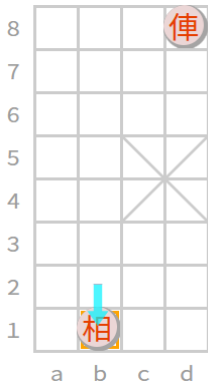
1.1125 (W)

5 (Sample 4)

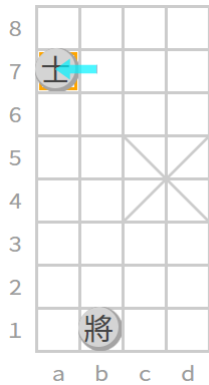
Average Score: 0.6625



5



1.075 (W)



1.075 (W)

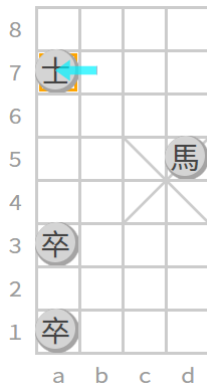
Average Score: 0.8708



6



1.1875 (W)



1.15 (W)

7 (Sample 8)

Average Score: 0.8771



7



1.15 (W)

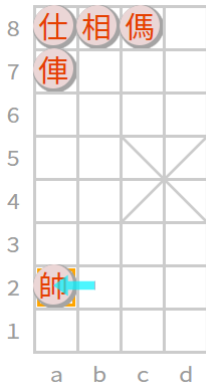


0.2375 (D)

Average Score: 0.6938



8



1.1875 (W)



1.1875 (W)

Average Score: 0.3500



9



1.15 (W)



0.2 (D)