**WID170047 Tan Zhi Qin**

**Activity 3: Heuristic Analysis Report**

**Heuristic Algorithm Pseudocode**

The custom heuristic code is defined at *wid170047\_score* in file *game\_agent.py*. The explanation of the pseudocode is as follow:

1. If the current player loses the game in this state, return negative infinity. Else if the current player wins the game in this state, return positive infinity.
2. During the early game stages, move towards center of map where more free spaces is available. States where the position of current player nearer to the boundary map will have lower value.

where *p* is the number of player moves, *o* is the number of opponent moves, *k* is a tuneable variable and *d* is the distance from the center

1. During the mid game stages, the player tries to be more aggressive by attempting to reduce opponents possible moves, heuristic function in this case is taken from *weighted\_chances\_heuristics.*
2. Finally, during the late game stages, the player tries to be more defensive by maximizing self possible moves, heuristic function in this case is taken from *weighted\_chances\_heuristics*.

**Tournament Results**

This script evaluates the performance of the custom heuristic function by

comparing the strength of an agent using iterative deepening (ID) search with

alpha-beta pruning against the strength rating of agents using other heuristic

functions. The `ID\_Improved` agent provides a baseline by measuring the

performance of a basic agent using Iterative Deepening and the "improved"

heuristic (from lecture) on your hardware. The `Student` agent then measures

the performance of Iterative Deepening and the custom heuristic against the

same opponents.

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Evaluating: ID\_Improved

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Playing Matches:

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Match 1: ID\_Improved vs Random Result: 1724 to 276

Match 2: ID\_Improved vs MM\_Null Result: 1395 to 605

Match 3: ID\_Improved vs MM\_Open Result: 1012 to 988

Match 4: ID\_Improved vs MM\_Improved Result: 952 to 1048

Match 5: ID\_Improved vs AB\_Null Result: 1297 to 703

Match 6: ID\_Improved vs AB\_Open Result: 1150 to 850

Match 7: ID\_Improved vs AB\_Improved Result: 1142 to 858

Results:

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ID\_Improved 61.94%

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Evaluating: Student1

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Playing Matches:

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Match 1: Student1 vs Random Result: 1736 to 264

Match 2: Student1 vs MM\_Null Result: 1458 to 542

Match 3: Student1 vs MM\_Open Result: 1136 to 864

Match 4: Student1 vs MM\_Improved Result: 1036 to 964

Match 5: Student1 vs AB\_Null Result: 1411 to 589

Match 6: Student1 vs AB\_Open Result: 1230 to 770

Match 7: Student1 vs AB\_Improved Result: 1218 to 782

Results:

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Student1 65.89%

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Evaluating: Student2

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Playing Matches:

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Match 1: Student2 vs Random Result: 1745 to 255

Match 2: Student2 vs MM\_Null Result: 1433 to 567

Match 3: Student2 vs MM\_Open Result: 1106 to 894

Match 4: Student2 vs MM\_Improved Result: 1041 to 959

Match 5: Student2 vs AB\_Null Result: 1388 to 612

Match 6: Student2 vs AB\_Open Result: 1235 to 765

Match 7: Student2 vs AB\_Improved Result: 1209 to 791

Results:

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Student2 65.41%

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Evaluating: Student3

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Playing Matches:

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Match 1: Student3 vs Random Result: 1724 to 276

Match 2: Student3 vs MM\_Null Result: 1412 to 588

Match 3: Student3 vs MM\_Open Result: 1092 to 908

Match 4: Student3 vs MM\_Improved Result: 1018 to 982

Match 5: Student3 vs AB\_Null Result: 1336 to 664

Match 6: Student3 vs AB\_Open Result: 1210 to 790

Match 7: Student3 vs AB\_Improved Result: 1197 to 803

Results:

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Student3 64.21%

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Evaluating: Student4

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Playing Matches:

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Match 1: Student4 vs Random Result: 1726 to 274

Match 2: Student4 vs MM\_Null Result: 1392 to 608

Match 3: Student4 vs MM\_Open Result: 1098 to 902

Match 4: Student4 vs MM\_Improved Result: 986 to 1014

Match 5: Student4 vs AB\_Null Result: 1317 to 683

Match 6: Student4 vs AB\_Open Result: 1178 to 822

Match 7: Student4 vs AB\_Improved Result: 1195 to 805

Results:

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Student4 63.51%

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Evaluating: Student5

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Playing Matches:

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Match 1: Student5 vs Random Result: 1719 to 281

Match 2: Student5 vs MM\_Null Result: 1439 to 561

Match 3: Student5 vs MM\_Open Result: 1088 to 912

Match 4: Student5 vs MM\_Improved Result: 998 to 1002

Match 5: Student5 vs AB\_Null Result: 1354 to 646

Match 6: Student5 vs AB\_Open Result: 1222 to 778

Match 7: Student5 vs AB\_Improved Result: 1207 to 793

Results:

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Student5 64.48%

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Evaluating: Student6

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Playing Matches:

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Match 1: Student6 vs Random Result: 1741 to 259

Match 2: Student6 vs MM\_Null Result: 1520 to 480

Match 3: Student6 vs MM\_Open Result: 1112 to 888

Match 4: Student6 vs MM\_Improved Result: 1059 to 941

Match 5: Student6 vs AB\_Null Result: 1418 to 582

Match 6: Student6 vs AB\_Open Result: 1245 to 755

Match 7: Student6 vs AB\_Improved Result: 1209 to 791

Results:

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Student6 66.46%

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Evaluating: Student7

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Playing Matches:

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Match 1: Student7 vs Random Result: 1714 to 286

Match 2: Student7 vs MM\_Null Result: 1435 to 565

Match 3: Student7 vs MM\_Open Result: 1138 to 862

Match 4: Student7 vs MM\_Improved Result: 1084 to 916

Match 5: Student7 vs AB\_Null Result: 1369 to 631

Match 6: Student7 vs AB\_Open Result: 1199 to 801

Match 7: Student7 vs AB\_Improved Result: 1224 to 776

Results:

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Student7 65.45%

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Evaluating: WID170047

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Playing Matches:

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Match 1: WID170047 vs Random Result: 1751 to 249

Match 2: WID170047 vs MM\_Null Result: 1482 to 518

Match 3: WID170047 vs MM\_Open Result: 1115 to 885

Match 4: WID170047 vs MM\_Improved Result: 1066 to 934

Match 5: WID170047 vs AB\_Null Result: 1403 to 597

Match 6: WID170047 vs AB\_Open Result: 1230 to 770

Match 7: WID170047 vs AB\_Improved Result: 1266 to 734

Results:

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WID170047 66.52%

**References**

Aguilar Jimenez, J.C. (2018, January 9). *COMP6231: Search Heuristics for Isolation*. http://ajulio.com/assets/documents/Adversarial\_Game.pdf

Becker, K. (2020, April 3). *Analysis of Game Playing Heuristics for Isolation*. RPubs. https://www.rpubs.com/primaryobjects/isolation