### 計算機圖學與應用

### Final Project Report

系別與年級：資訊工程研究所 碩二

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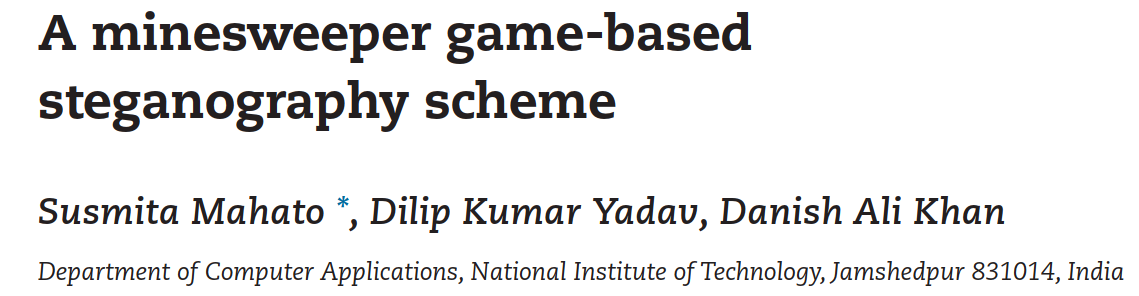
Table 1. Average Counts and entropy for 10 marked Mine1.txt to Mine5.txt position (SN=10) (count 小數2位，entropy 小數4位)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Level | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Entropy |
| 1 | Beginner | 26.6 | 28.4 | 13.2 | 2.7 | 0.1 | 0 | 0 | 0 | 0 | 10 | 1.997662 |
| 2 | Intermediate. | 63.9 | 80.5 | 49.9 | 17 | 4 | 0.6 | 0.1 | 0 | 0 | 40 | 2.269707 |
| 3 | Expert | 71.7 | 127.5 | 106.6 | 56.1 | 15.7 | 3 | 0.4 | 0 | 0 | 99 | 2.437849 |
| 4 | Custom-1 | 153 | 221 | 152.2 | 56.3 | 15 | 2.3 | 0.2 | 0 | 0 | 120 | 2.3308 |
| 5 | Custom-2 | 2.6 | 19.3 | 50.5 | 83.9 | 89.6 | 68.3 | 36 | 8.3 | 1.5 | 360 | 2.296484 |

Table 2. Average Counts and entropy for 6000 random Mine1.txt to Mine5.txt position (SN=6000) 請抄錄作業二random 6000筆之結果

Custom-2數據須補做

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Level | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Entropy |
| 1 | Beginner | 28.77 | 28.04 | 11.4 | 2.46 | 0.3 | 0.02 | 0 | 0 | 0 | 10 | 1.971392 |
| 2 | Intermediate. | 63.33 | 83.62 | 48.78 | 16.35 | 3.44 | 0.44 | 0.04 | 0 | 0 | 40 | 2.236311 |
| 3 | Expert | 70.46 | 130.86 | 108.17 | 52.07 | 15.92 | 3.1 | 0.38 | 0.03 | 0 | 99 | 2.427066 |
| 4 | Custom-1 | 153.4 | 226.45 | 148.23 | 56.25 | 13.43 | 2.02 | 0.2 | 0.01 | 0 | 120 | 2.314933 |
| 5 | Custom-2 | 2.91 | 17.8 | 49.69 | 83.27 | 92.5 | 69.43 | 33.69 | 9.54 | 1.18 | 360 | 2.290555 |

與論文比較average entropy

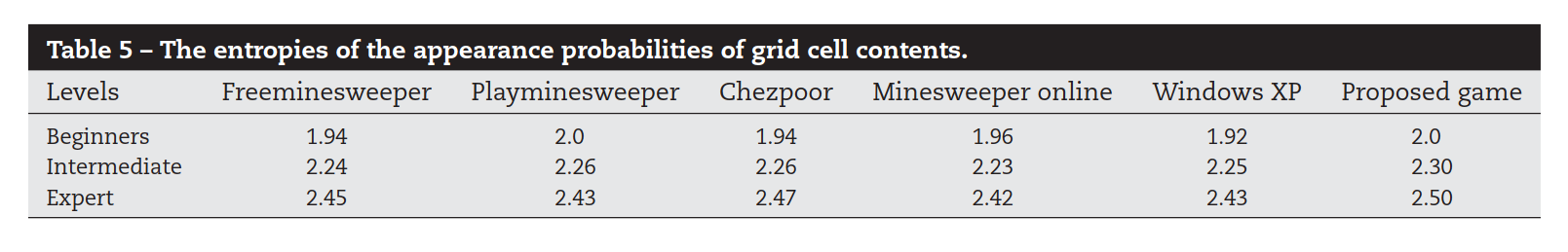


Table 3 The entropy comparison with current state-of-the-art schemes

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Levels | A1 | A2 | A3 | A4 | A5 | A6 | Our | Random |
| Beginners | 1.94 | 2.00 | 1.94 | 1.96 | 1.92 | 2.00 | 1.997662 | 1.971392 |
| Inter. | 2.24 | 2.26 | 2.26 | 2.23 | 2.25 | 2.30 | 2.269707 | 2.236311 |
| Expert. | 2.45 | 2.43 | 2.47 | 2.42 | 2.43 | 2.50 | 2.437849 | 2.427066 |
| Custom-1 | - | - | - | - | - | - | 2.3308 | 2.314933 |
| Custom-2 | - | - | - | - | - | - | 2.296484 | 2.290555 |

1. A1: Freeminesweeper
2. A2: Playminesweeper
3. A3: Chezpoor
4. A4: Minesweeper online
5. A5: Window XP
6. A6: Mahato *et al*.

Appendix A:

Statistics for the Experiments

Game Level 1: Beginner, , 10 mines

Table A1. Counts and Entropy for Game Level 1

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Level | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Entropy |
| 1 | 1 | 27 | 28 | 12 | 4 | 0 | 0 | 0 | 0 | 0 | 10 | 2.053100 |
| 2 | 1 | 25 | 28 | 11 | 7 | 0 | 0 | 0 | 0 | 0 | 10 | 2.122234 |
| 3 | 1 | 29 | 29 | 11 | 2 | 0 | 0 | 0 | 0 | 0 | 10 | 1.956690 |
| 4 | 1 | 34 | 20 | 14 | 2 | 1 | 0 | 0 | 0 | 0 | 10 | 2.044362 |
| 5 | 1 | 30 | 18 | 21 | 2 | 0 | 0 | 0 | 0 | 0 | 10 | 2.022278 |
| 6 | 1 | 20 | 37 | 12 | 2 | 0 | 0 | 0 | 0 | 0 | 10 | 1.927169 |
| 7 | 1 | 23 | 35 | 10 | 3 | 0 | 0 | 0 | 0 | 0 | 10 | 1.960093 |
| 8 | 1 | 31 | 24 | 14 | 2 | 0 | 0 | 0 | 0 | 0 | 10 | 1.992425 |
| 9 | 1 | 26 | 29 | 14 | 2 | 0 | 0 | 0 | 0 | 0 | 10 | 1.998922 |
| 10 | 1 | 21 | 36 | 13 | 1 | 0 | 0 | 0 | 0 | 0 | 10 | 1.899344 |
| Ave | 1 | 26.6 | 28.4 | 13.2 | 2.7 | 0.1 | 0 | 0 | 0 | 0 | 10 | 1.997662 |

Game Level 2: Intermediate, , 40mines

Table A2. Counts and Entropy for Game Level 2

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Level | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Entropy |
| 1 | 1 | 69 | 72 | 50 | 20 | 3 | 2 | 0 | 0 | 0 | 40 | 2.320367 |
| 2 | 1 | 62 | 83 | 53 | 13 | 5 | 0 | 0 | 0 | 0 | 40 | 2.240388 |
| 3 | 1 | 64 | 82 | 48 | 16 | 5 | 1 | 0 | 0 | 0 | 40 | 2.289515 |
| 4 | 1 | 58 | 76 | 62 | 17 | 3 | 0 | 0 | 0 | 0 | 40 | 2.254358 |
| 5 | 1 | 57 | 86 | 53 | 18 | 2 | 0 | 0 | 0 | 0 | 40 | 2.224027 |
| 6 | 1 | 65 | 92 | 35 | 20 | 3 | 1 | 0 | 0 | 0 | 40 | 2.237433 |
| 7 | 1 | 61 | 77 | 58 | 16 | 4 | 0 | 0 | 0 | 0 | 40 | 2.261885 |
| 8 | 1 | 66 | 78 | 50 | 14 | 7 | 1 | 0 | 0 | 0 | 40 | 2.307751 |
| 9 | 1 | 75 | 75 | 43 | 19 | 2 | 1 | 1 | 0 | 0 | 40 | 2.284219 |
| 10 | 1 | 62 | 84 | 47 | 17 | 6 | 0 | 0 | 0 | 0 | 40 | 2.277132 |
| Ave | 1 | 63.9 | 80.5 | 49.9 | 17 | 4 | 0.6 | 0.1 | 0 | 0 | 40 | 2.269707 |

Game Level 3: Expert, , 99 mines

Table A3. Counts and Entropy for Game Level 3

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Level | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Entropy |
| 1 | 1 | 64 | 141 | 93 | 65 | 16 | 2 | 0 | 0 | 0 | 99 | 2.422352 |
| 2 | 1 | 74 | 112 | 118 | 56 | 15 | 6 | 0 | 0 | 0 | 99 | 2.470002 |
| 3 | 1 | 74 | 125 | 105 | 56 | 18 | 2 | 1 | 0 | 0 | 99 | 2.461484 |
| 4 | 1 | 71 | 124 | 112 | 58 | 14 | 2 | 0 | 0 | 0 | 99 | 2.421998 |
| 5 | 1 | 89 | 114 | 99 | 60 | 16 | 2 | 1 | 0 | 0 | 99 | 2.472899 |
| 6 | 1 | 48 | 147 | 113 | 55 | 17 | 1 | 0 | 0 | 0 | 99 | 2.363394 |
| 7 | 1 | 61 | 142 | 106 | 51 | 14 | 6 | 1 | 0 | 0 | 99 | 2.438950 |
| 8 | 1 | 75 | 114 | 127 | 52 | 11 | 2 | 0 | 0 | 0 | 99 | 2.393439 |
| 9 | 1 | 78 | 136 | 94 | 50 | 20 | 3 | 0 | 0 | 0 | 99 | 2.448598 |
| 10 | 1 | 83 | 120 | 99 | 58 | 16 | 4 | 1 | 0 | 0 | 99 | 2.485368 |
| Ave | 1 | 71.7 | 127.5 | 106.6 | 56.1 | 15.7 | 3 | 0.4 | 0 | 0 | 99 | 2.437849 |

Game Level 4: Custom-1, , 120 mines

Table A4. Counts and Entropy for Game Level 3

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Level | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Entropy |
| 1 | 1 | 170 | 220 | 128 | 59 | 19 | 4 | 0 | 0 | 0 | 120 | 2.363924 |
| 2 | 1 | 148 | 229 | 145 | 61 | 13 | 3 | 1 | 0 | 0 | 120 | 2.343622 |
| 3 | 1 | 145 | 225 | 172 | 45 | 9 | 4 | 0 | 0 | 0 | 120 | 2.284916 |
| 4 | 1 | 141 | 239 | 144 | 60 | 15 | 1 | 0 | 0 | 0 | 120 | 2.312274 |
| 5 | 1 | 156 | 209 | 169 | 50 | 16 | 0 | 0 | 0 | 0 | 120 | 2.306952 |
| 6 | 1 | 141 | 227 | 158 | 57 | 16 | 1 | 0 | 0 | 0 | 120 | 2.321572 |
| 7 | 1 | 152 | 226 | 146 | 59 | 16 | 1 | 0 | 0 | 0 | 120 | 2.327044 |
| 8 | 1 | 163 | 211 | 152 | 54 | 14 | 5 | 1 | 0 | 0 | 120 | 2.362432 |
| 9 | 1 | 152 | 228 | 139 | 61 | 19 | 1 | 0 | 0 | 0 | 120 | 2.341257 |
| 10 | 1 | 162 | 196 | 169 | 57 | 13 | 3 | 0 | 0 | 0 | 120 | 2.344006 |
| Ave | 1 | 153 | 221 | 152.2 | 56.3 | 15 | 2.3 | 0.2 | 0 | 0 | 120 | 2.330800 |

Game Level 5: Custom-2, , 360 mines

Table A5. Counts and Entropy for Game Level 3

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Level | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Entropy |
| 1 | 1 | 4 | 17 | 59 | 88 | 72 | 64 | 41 | 12 | 3 | 360 | 2.345008 |
| 2 | 1 | 6 | 26 | 63 | 73 | 83 | 61 | 37 | 9 | 2 | 360 | 2.356580 |
| 3 | 1 | 4 | 24 | 50 | 80 | 86 | 75 | 38 | 2 | 1 | 360 | 2.291444 |
| 4 | 1 | 2 | 14 | 39 | 89 | 105 | 64 | 40 | 6 | 1 | 360 | 2.252653 |
| 5 | 1 | 0 | 17 | 50 | 83 | 96 | 76 | 28 | 10 | 0 | 360 | 2.251993 |
| 6 | 1 | 1 | 22 | 57 | 85 | 85 | 60 | 36 | 13 | 1 | 360 | 2.317017 |
| 7 | 1 | 1 | 12 | 40 | 100 | 84 | 78 | 35 | 9 | 1 | 360 | 2.252104 |
| 8 | 1 | 2 | 27 | 48 | 74 | 102 | 61 | 38 | 6 | 2 | 360 | 2.305297 |
| 9 | 1 | 2 | 14 | 52 | 85 | 95 | 74 | 30 | 7 | 1 | 360 | 2.263957 |
| 10 | 1 | 4 | 20 | 47 | 82 | 88 | 70 | 37 | 9 | 3 | 360 | 2.328791 |
| Ave | 1 | 2.6 | 19.3 | 50.5 | 83.9 | 89.6 | 68.3 | 36 | 8.3 | 1.5 | 360 | 2.296484 |

Exhibit marked boards, recognized boards, secret digits, secret binary

每種Game Level僅需列出任10個內的3個即可，但是recognition影像需與之對應。

Mine\_9\_9\_10\_Mark\_001.png

|  |
| --- |
|  |
| Secret digits: 332481324403 |
| Secret binary: 0100110101101001011011100110010101110011 |

Mine\_9\_9\_10\_Mark\_002.png

|  |
| --- |
|  |
| Secret digits: 512802254949 |
| Secret binary: 0111011101100101011001010111000001100101 |

Mine\_9\_9\_10\_Mark\_003.png

|  |
| --- |
|  |
| Secret digits: 490170053408 |
| Secret binary: 0111001000100000011010010111001100100000 |

Figure 1. The marked board at the beginner level

Mine\_9\_9\_10\_Mark\_Rec\_001.png

|  |
| --- |
|  |
| Secret digits: 332481324403 |
| Secret binary: 0100110101101001011011100110010101110011 |

Mine\_9\_9\_10\_Mark\_Rec\_002.png

|  |
| --- |
|  |
| Secret digits: 512802254949 |
| Secret binary: 0111011101100101011001010111000001100101 |

Mine\_9\_9\_10\_Mark\_Rec\_003.png

|  |
| --- |
|  |
| Secret digits: 490170053408 |
| Secret binary: 0111001000100000011010010111001100100000 |

Figure 2. The recognized marked board at the beginner level

Mine\_16\_16\_40\_Mark\_001.png

|  |
| --- |
|  |
| Secret digits: 1726341736221617464216248365724383207504243823 |
| Secret binary: 01001101011010010110111001100101011100110111011101100101011001010111000001100101011100100010000001101001011100110010000001100001001000000110110001101111 |

Mine\_16\_16\_40\_Mark\_002.png

|  |
| --- |
|  |
| Secret digits: 2306157276545030041304832723188232552311711585 |
| Secret binary: 01100111011010010110001100100000011100000111010101111010011110100110110001100101001000000111011001101001011001000110010101101111001000000110011101100001 |

Mine\_16\_16\_40\_Mark\_003.png

|  |
| --- |
|  |
| Secret digits: 2439590593991832854291973836017989391880059168 |
| Secret binary: 01101101011001010010000001100111011001010110111001110010011001010010000001100111011001010110111001100101011100100110000101101100011011000111100100100000 |

Figure 3. The marked board at the intermediate level

Mine\_16\_16\_40\_Mark\_Rec\_001.png

|  |
| --- |
|  |
| Secret digits: 1726341736221617464216248365724383207504243823 |
| Secret binary: 01001101011010010110111001100101011100110111011101100101011001010111000001100101011100100010000001101001011100110010000001100001001000000110110001101111 |

Mine\_16\_16\_40\_Mark\_Rec\_002.png

|  |
| --- |
|  |
| Secret digits: 2306157276545030041304832723188232552311711585 |
| Secret binary: 01100111011010010110001100100000011100000111010101111010011110100110110001100101001000000111011001101001011001000110010101101111001000000110011101100001 |

Mine\_16\_16\_40\_Mark\_Rec\_003.png

|  |
| --- |
|  |
| Secret digits: 2439590593991832854291973836017989391880059168 |
| Secret binary: 01101101011001010010000001100111011001010110111001110010011001010010000001100111011001010110111001100101011100100110000101101100011011000111100100100000 |

Figure 4. The recognized marked board at the intermediate level

Mine\_30\_16\_99\_Mark\_001.png

|  |
| --- |
|  |
| Secret digits: 10836422708307170470341890973812691540558643995172156422971512427468199036628343994312377363300456884069 |
| Secret binary: 01001101011010010110111001100101011100110111011101100101011001010111000001100101011100100010000001101001011100110010000001100001001000000110110001101111011001110110100101100011001000000111000001110101011110100111101001101100011001010010000001110110011010010110010001100101011011110010000001100111011000010110110101100101001000000110011101100101 |

Mine\_30\_16\_99\_Mark\_002.png

|  |
| --- |
|  |
| Secret digits: 15460797753187676270692504538708833001225746738810627073226079663279486278048050615766655012514124952366 |
| Secret binary: 01101110011100100110010100100000011001110110010101101110011001010111001001100001011011000110110001111001001000000111000001101100011000010111100101100101011001000010000001101111011011100010000001110000011001010111001001110011011011110110111001100001011011000010000001100011011011110110110101110000011101010111010001100101011100100111001100101110 |

Mine\_30\_16\_99\_Mark\_003.png

|  |
| --- |
|  |
| Secret digits: 4525644735997547003699987279163114978592657586179230195108232206502140664753049477555429972700115332197 |
| Secret binary: 00100000010101000110100001100101001000000110011101100001011011010110010100100000011001100110010101100001011101000111010101110010011001010111001100100000011000010010000001100111011100100110100101100100001000000110111101100110001000000110001101101100011010010110001101101011011000010110001001101100011001010010000001110100011010010110110001100101 |

Figure 5. The marked board at the expert level

Mine\_30\_16\_99\_Mark\_Rec\_001.png

|  |
| --- |
|  |
| Secret digits: 10836422708307170470341890973812691540558643995172156422971512427468199036628343994312377363300456884069 |
| Secret binary: 01001101011010010110111001100101011100110111011101100101011001010111000001100101011100100010000001101001011100110010000001100001001000000110110001101111011001110110100101100011001000000111000001110101011110100111101001101100011001010010000001110110011010010110010001100101011011110010000001100111011000010110110101100101001000000110011101100101 |

Mine\_30\_16\_99\_Mark\_Rec\_002.png

|  |
| --- |
|  |
| Secret digits: 15460797753187676270692504538708833001225746738810627073226079663279486278048050615766655012514124952366 |
| Secret binary: 01101110011100100110010100100000011001110110010101101110011001010111001001100001011011000110110001111001001000000111000001101100011000010111100101100101011001000010000001101111011011100010000001110000011001010111001001110011011011110110111001100001011011000010000001100011011011110110110101110000011101010111010001100101011100100111001100101110 |

Mine\_30\_16\_99\_Mark\_Rec\_003.png

|  |
| --- |
|  |
| Secret digits: 4525644735997547003699987279163114978592657586179230195108232206502140664753049477555429972700115332197 |
| Secret binary: 00100000010101000110100001100101001000000110011101100001011011010110010100100000011001100110010101100001011101000111010101110010011001010111001100100000011000010010000001100111011100100110100101100100001000000110111101100110001000000110001101101100011010010110001101101011011000010110001001101100011001010010000001110100011010010110110001100101 |

Figure 6. The recognized marked board at the expert level

Mine\_30\_24\_120\_Mark\_001.png

|  |
| --- |
|  |
| Secret digits: 56265923586098789990864525035785041496425830242171837158561864277961419470120885926023245542430134826870721760454751170394777475200350496 |
| Secret binary: 010011010110100101101110011001010111001101110111011001010110010101110000011001010111001000100000011010010111001100100000011000010010000001101100011011110110011101101001011000110010000001110000011101010111101001111010011011000110010100100000011101100110100101100100011001010110111100100000011001110110000101101101011001010010000001100111011001010110111001110010011001010010000001100111011001010110111001100101011100100110000101101100011011000111100100100000 |

Mine\_30\_24\_120\_Mark\_002.png

|  |
| --- |
|  |
| Secret digits: 81713653262998592703708285780311976465925559516747785350936882804709010027406169394882312275559449428573289099510506753303990600950902630 |
| Secret binary: 011100000110110001100001011110010110010101100100001000000110111101101110001000000111000001100101011100100111001101101111011011100110000101101100001000000110001101101111011011010111000001110101011101000110010101110010011100110010111000100000010101000110100001100101001000000110011101100001011011010110010100100000011001100110010101100001011101000111010101110010011001010111001100100000011000010010000001100111011100100110100101100100001000000110111101100110 |

Mine\_30\_24\_120\_Mark\_003.png

|  |
| --- |
|  |
| Secret digits: 23541123699414476266471504521340949229607003374411464240373484256636772016171059656729649862393850172418977982825571820058410604381495660 |
| Secret binary: 001000000110001101101100011010010110001101101011011000010110001001101100011001010010000001110100011010010110110001100101011100110010110000100000011101110110100101110100011010000010000001101000011010010110010001100100011001010110111000100000001000100110110101101001011011100110010101110011001000100010000000001010001010000110010001100101011100000110100101100011011101000110010101100100001000000110000101110011001000000110111001100001011101100110000101101100 |

Figure 7. The marked board at the Custome-1 level

Mine\_30\_24\_120\_Mark\_Rec\_001.png

|  |
| --- |
|  |
| Secret digits: 56265923586098789990864525035785041496425830242171837158561864277961419470120885926023245542430134826870721760454751170394777475200350496 |
| Secret binary: 010011010110100101101110011001010111001101110111011001010110010101110000011001010111001000100000011010010111001100100000011000010010000001101100011011110110011101101001011000110010000001110000011101010111101001111010011011000110010100100000011101100110100101100100011001010110111100100000011001110110000101101101011001010010000001100111011001010110111001110010011001010010000001100111011001010110111001100101011100100110000101101100011011000111100100100000 |

Mine\_30\_24\_120\_Mark\_Rec\_002.png

|  |
| --- |
|  |
| Secret digits: 81713653262998592703708285780311976465925559516747785350936882804709010027406169394882312275559449428573289099510506753303990600950902630 |
| Secret binary: 011100000110110001100001011110010110010101100100001000000110111101101110001000000111000001100101011100100111001101101111011011100110000101101100001000000110001101101111011011010111000001110101011101000110010101110010011100110010111000100000010101000110100001100101001000000110011101100001011011010110010100100000011001100110010101100001011101000111010101110010011001010111001100100000011000010010000001100111011100100110100101100100001000000110111101100110 |

Mine\_30\_24\_120\_Mark\_Rec\_003.png

|  |
| --- |
|  |
| Secret digits: 23541123699414476266471504521340949229607003374411464240373484256636772016171059656729649862393850172418977982825571820058410604381495660 |
| Secret binary: 001000000110001101101100011010010110001101101011011000010110001001101100011001010010000001110100011010010110110001100101011100110010110000100000011101110110100101110100011010000010000001101000011010010110010001100100011001010110111000100000001000100110110101101001011011100110010101110011001000100010000000001010001010000110010001100101011100000110100101100011011101000110010101100100001000000110000101110011001000000110111001100001011101100110000101101100 |

Figure 8. The recognized marked board at the Custome-1 level

Mine\_30\_24\_360\_Mark\_001.png

|  |
| --- |
|  |
| Secret digits: 6515148844901565170860826680409833494931362209875747442339038398110577637973331393781997474080335150627478905592119019398222796593730447920538153813783265132469190298426133221673902847728345230206461332904080331880 |
| Secret binary: 0100110101101001011011100110010101110011011101110110010101100101011100000110010101110010001000000110100101110011001000000110000100100000011011000110111101100111011010010110001100100000011100000111010101111010011110100110110001100101001000000111011001101001011001000110010101101111001000000110011101100001011011010110010100100000011001110110010101101110011100100110010100100000011001110110010101101110011001010111001001100001011011000110110001111001001000000111000001101100011000010111100101100101011001000010000001101111011011100010000001110000011001010111001001110011011011110110111001100001011011000010000001100011011011110110110101110000011101010111010001100101011100100111001100101110001000000101010001101000 |

Mine\_30\_24\_360\_Mark\_002.png

|  |
| --- |
|  |
| Secret digits: 8511032651370462339800829010365788781681347931176202531448577914396670394191990680408408347747708825458365557813647862295162003726266012265709711669266789555359183035109088671442777561112855559128293733887753155360 |
| Secret binary: 0110010100100000011001110110000101101101011001010010000001100110011001010110000101110100011101010111001001100101011100110010000001100001001000000110011101110010011010010110010000100000011011110110011000100000011000110110110001101001011000110110101101100001011000100110110001100101001000000111010001101001011011000110010101110011001011000010000001110111011010010111010001101000001000000110100001101001011001000110010001100101011011100010000000100010011011010110100101101110011001010111001100100010001000000000101000101000011001000110010101110000011010010110001101110100011001010110010000100000011000010111001100100000011011100110000101110110011000010110110000100000011011010110100101101110011001010111001100100000 |

Mine\_30\_24\_360\_Mark\_003.png

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|  |
| Secret digits: 8873233427690774785574795192806791111561626125569093332211187703950627746785549381163975089068490791349630171337456785458902280334670755193855562439599481785475200607756526786506390595884264338464257846004314759538 |
| Secret binary: 0110100101101110001000000111010001101000011001010010000001101111011100100110100101100111011010010110111001100001011011000010000001100111011000010110110101100101001010010010000001110011011000110110000101110100011101000110010101110010011001010110010000100000011101000110100001110010011011110111010101100111011010000110111101110101011101000010000001110100011010000110010100100000011000100110111101100001011100100110010000101110001000000000101001010100011010000110010100100000011011110110001001101010011001010110001101110100011010010111011001100101001000000110100101110011001000000111010001101111001000000110001101101100011001010110000101110010001000000111010001101000011001010010000001100010011011110110000101110010 |

Figure 9. The marked board at the Custome-2 level

Mine\_30\_24\_360\_Mark\_Rec\_001.png

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|  |
| Secret digits: 6515148844901565170860826680409833494931362209875747442339038398110577637973331393781997474080335150627478905592119019398222796593730447920538153813783265132469190298426133221673902847728345230206461332904080331880 |
| Secret binary: 0100110101101001011011100110010101110011011101110110010101100101011100000110010101110010001000000110100101110011001000000110000100100000011011000110111101100111011010010110001100100000011100000111010101111010011110100110110001100101001000000111011001101001011001000110010101101111001000000110011101100001011011010110010100100000011001110110010101101110011100100110010100100000011001110110010101101110011001010111001001100001011011000110110001111001001000000111000001101100011000010111100101100101011001000010000001101111011011100010000001110000011001010111001001110011011011110110111001100001011011000010000001100011011011110110110101110000011101010111010001100101011100100111001100101110001000000101010001101000 |

Mine\_30\_24\_360\_Mark\_Rec\_002.png

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|  |
| Secret digits: 8511032651370462339800829010365788781681347931176202531448577914396670394191990680408408347747708825458365557813647862295162003726266012265709711669266789555359183035109088671442777561112855559128293733887753155360 |
| Secret binary: 0110010100100000011001110110000101101101011001010010000001100110011001010110000101110100011101010111001001100101011100110010000001100001001000000110011101110010011010010110010000100000011011110110011000100000011000110110110001101001011000110110101101100001011000100110110001100101001000000111010001101001011011000110010101110011001011000010000001110111011010010111010001101000001000000110100001101001011001000110010001100101011011100010000000100010011011010110100101101110011001010111001100100010001000000000101000101000011001000110010101110000011010010110001101110100011001010110010000100000011000010111001100100000011011100110000101110110011000010110110000100000011011010110100101101110011001010111001100100000 |

Mine\_30\_24\_360\_Mark\_Rec\_003.png

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|  |
| Secret digits: 8873233427690774785574795192806791111561626125569093332211187703950627746785549381163975089068490791349630171337456785458902280334670755193855562439599481785475200607756526786506390595884264338464257846004314759538 |
| Secret binary: 0110100101101110001000000111010001101000011001010010000001101111011100100110100101100111011010010110111001100001011011000010000001100111011000010110110101100101001010010010000001110011011000110110000101110100011101000110010101110010011001010110010000100000011101000110100001110010011011110111010101100111011010000110111101110101011101000010000001110100011010000110010100100000011000100110111101100001011100100110010000101110001000000000101001010100011010000110010100100000011011110110001001101010011001010110001101110100011010010111011001100101001000000110100101110011001000000111010001101111001000000110001101101100011001010110000101110010001000000111010001101000011001010010000001100010011011110110000101110010 |

Figure 10. The recognized marked board at the Custome-2 level