**IMPLEMENTATION DETAILS:**

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**TEST CASE 1:**

In section *Anexes* you can find screenshots of the paths found by each algorithm.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | TRADIOTIONAL A\* (NO TIE BREAKING) | TRADIOTIONAL A\* (WITH TIE BREAKING) | | NODE ARRAY A\* | A\* WITH GOAL BOUNDING |
| Fill | 16% | 13% | 16% | | 14% |
| Nodes visited | 847 | 708 | 848 | | 751 |
| Nodes processed | 752 | 608 | 757 | | 686 |
| Max open list size | 97 | 104 | 97 | | 77 |
| Total processing time | 1.146s | 0.838s | 1.097s | | 1.001s |
| Processing time per node | 0.0015s | 0.0013s | 0.0014s | | 0.0015s |
| GetBestAndRemove | 15 calls | 15 calls | 756 calls | | 667 calls |
| AddToOpen | 35 calls | 15 calls | 847 calls | | 749 calls |
| SearchInOpen | 109 calls | 102 calls | 0 calls | | 0 calls |
| RemoveFromOpen | 15 calls | 15 calls | 756 calls | | 667 calls |
| Replace | 3 calls | 1 call | 0 calls | | 0 calls |
| AddToClosed | 15 calls | 15 calls | 756 calls | | 667 calls |
| SearchInClosed | 109 calls | 102 calls | 0 calls | | 0 calls |
| RemoveFromClosed | 0 calls | 0 calls | 0 calls | | 0 calls |

**TEST CASE 2:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | TRADIOTIONAL A\* (NO TIE BREAKING) | TRADIOTIONAL A\* (WITH TIE BREAKING) | | NODE ARRAY A\* | A\* WITH GOAL BOUNDING |
| Fill | 12% | 10% | 12% | | 9% |
| Nodes visited | 640 | 523 | 641 | | 481 |
| Nodes processed | 553 | 436 | 568 | | 445 |
| Max open list size | 89 | 91 | 88 | | 52 |
| Total processing time | 0.813s | 0.607s | 0.830s | | 0.659s |
| Processing time per node | 0.0015s | 0.0014s | 0.0015s | | 0.0015s |
| GetBestAndRemove | 15 calls | 15 calls | 561 calls | | 441 calls |
| AddToOpen | 16 calls | 16 calls | 634 calls | | 480 calls |
| SearchInOpen | 111 calls | 110 calls | 0 calls | | 0 calls |
| RemoveFromOpen | 15 calls | 15 calls | 561 calls | | 441 calls |
| Replace | 8 calls | 10 calls | 0 calls | | 0 calls |
| AddToClosed | 15 calls | 15 calls | 561 calls | | 441 calls |
| SearchInClosed | 111 calls | 110 calls | 0 calls | | 0 calls |
| RemoveFromClosed | 0 calls | 0 calls | 0 calls | |  |

**TEST CASE 3:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | TRADIOTIONAL A\* (NO TIE BREAKING) | TRADIOTIONAL A\* (WITH TIE BREAKING) | | NODE ARRAY A\* | A\* WITH GOAL BOUNDING |
| Fill | 17% | 14% | 17% | | 13% |
| Nodes visited | 898 | 734 | 899 | | 717 |
| Nodes processed | 815 | 644 | 820 | | 674 |
| Max open list size | 88 | 92 | 89 | | 84 |
| Total processing time | 1.212s | 0.902s | 1.220s | | 0.982s |
| Processing time per node | 0.0015s | 0.0014s | 0.0015s | | 0.0015s |
| GetBestAndRemove | 15 calls | 15 calls | 819 calls | | 672 calls |
| AddToOpen | 13 calls | 14 calls | 895 calls | | 717 calls |
| SearchInOpen | 108 calls | 116 calls | 0 calls | | 0 calls |
| RemoveFromOpen | 15 calls | 15 calls | 819 calls | | 672 calls |
| Replace | 7 calls | 14 calls | 0 calls | | 0 calls |
| AddToClosed | 15 calls | 15 calls | 819 calls | | 672 calls |
| SearchInClosed | 108 calls | 116 calls | 0 calls | | 0 calls |
| RemoveFromClosed | 0 calls | 0 calls | 0 calls | | 0 calls |

**TEST CASE 4:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | TRADIOTIONAL A\* (NO TIE BREAKING) | TRADIOTIONAL A\* (WITH TIE BREAKING) | | NODE ARRAY A\* | A\* WITH GOAL BOUNDING |
| Fill | 26% | 20% | 26% | | 12% |
| Nodes visited | 1365 | 1080 | 1366 | | 622 |
| Nodes processed | 1226 | 905 | 1235 | | 560 |
| Max open list size | 156 | 177 | 156 | | 72 |
| Total processing time | 1.855s | 1.301s | 1.815s | | 0.825s |
| Processing time per node | 0.0015s | 0.0014s | 0.0015s | | 0.0015s |
| GetBestAndRemove | 15 calls | 15 calls | 1233 calls | | 559 calls |
| AddToOpen | 19 calls | 27 calls | 1366 calls | | 622 calls |
| SearchInOpen | 110 calls | 119 calls | 0 calls | | 0 calls |
| RemoveFromOpen | 15 calls | 15 calls | 1233 calls | | 559 calls |
| Replace | 2 calls | 9 calls | 0 calls | | 0 calls |
| AddToClosed | 15 calls | 15 calls | 1233 calls | | 559 calls |
| SearchInClosed | 110 calls | 119 calls | 0 calls | | 0 calls |
| RemoveFromClosed | 0 calls | 0 calls | 0 calls | | 0 calls |

**TEST CASE 5:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | TRADIOTIONAL A\* (NO TIE BREAKING) | TRADIOTIONAL A\* (WITH TIE BREAKING) | | NODE ARRAY A\* | A\* WITH GOAL BOUNDING |
| Fill | 25% | 17% | 25% | | 22% |
| Nodes visited | 1357 | 899 | 1358 | | 1191 |
| Nodes processed | 1187 | 768 | 1199 | | 1055 |
| Max open list size | 172 | 133 | 169 | | 144 |
| Total processing time | 1.818 | 1.169s | 1.739s | | 1.573s |
| Processing time per node | 0.0015s | 0.0015s | 0.0015s | | 0.0015s |
| GetBestAndRemove | 15 calls | 15 calls | 1195 calls | | 1040 calls |
| AddToOpen | 13 calls | 14 calls | 1357 calls | | 1186 calls |
| SearchInOpen | 103 calls | 97 calls | 0 calls | | 0 calls |
| RemoveFromOpen | 15 calls | 15 calls | 1195 calls | | 1040 calls |
| Replace | 4 calls | 2 calls | 0 calls | | 0 calls |
| AddToClosed | 15 calls | 15 calls | 1195 calls | | 1040 calls |
| SearchInClosed | 103 calls | 97 calls | 0 calls | | 0 calls |
| RemoveFromClosed | 0 calls | 0 calls | 0 calls | | 0 calls |

**TEST CASE 6:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | TRADIOTIONAL A\* (NO TIE BREAKING) | TRADIOTIONAL A\* (WITH TIE BREAKING) | | NODE ARRAY A\* | A\* WITH GOAL BOUNDING |
| Fill | 45% | 37% | 45% | | 38% |
| Nodes visited | 2382 | 1981 | 2383 | | 2057 |
| Nodes processed | 2231 | 1801 | 2242 | | 1943 |
| Max open list size | 156 | 182 | 157 | | 130 |
| Total processing time | 3.285 | 2.758 | 2.961s | | 2.548s |
| Processing time per node | 0.0015s | 0.0015s | 0.0013s | | 0.0013s |
| GetBestAndRemove | 15 calls | 15 calls | 2233 calls | | 1939 calls |
| AddToOpen | 14 calls | 15 calls | 2380 calls | | 2057 calls |
| SearchInOpen | 110 calls | 107 calls | 0 calls | | 0 calls |
| RemoveFromOpen | 15 calls | 15 calls | 2233 calls | | 1939 calls |
| Replace | 6 calls | 9 calls | 0 calls | | 0 calls |
| AddToClosed | 15 calls | 15 calls | 2233 calls | | 1939 calls |
| SearchInClosed | 110 calls | 107 calls | 0 calls | | 0 calls |
| RemoveFromClosed | 0 calls | 0 calls | 0 calls | | 0 calls |

**ALGORITHM ANALYSIS AND COMPARISON:**

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**ANEXES:**

Uma imagem com texto, palavras cruzadas

Descrição gerada automaticamente

Figure 1 - Test case 1 for A\*, no tie breaker



Figure - Test case 1 for Node Array A\*

Uma imagem com texto, palavras cruzadas, quadro de resultados

Descrição gerada automaticamente

Figure - Test case 1 for Goal Bound



Figure - Test case 1 for A\* with tie breaker

Uma imagem com texto, palavras cruzadas, quadro de resultados

Descrição gerada automaticamente

Figure - Test case 2 for A\*, no tie breaker



Figure - Test case 2 for Node Array A\*

Uma imagem com texto, palavras cruzadas, quadro de resultados

Descrição gerada automaticamente

Figure - Test case 2 for Goal Bound

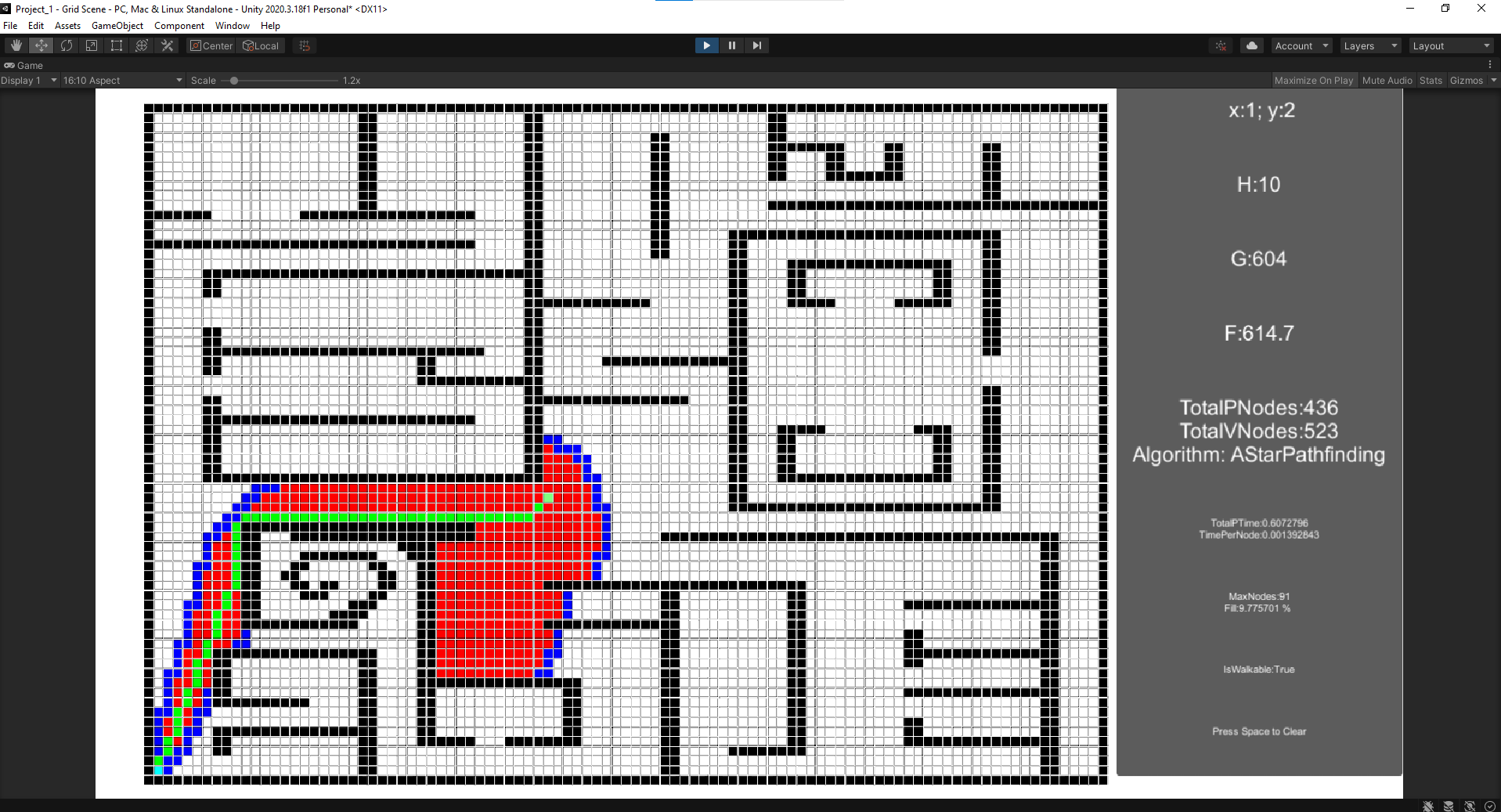


Figure - Test case 2 for A\* with tie breaker

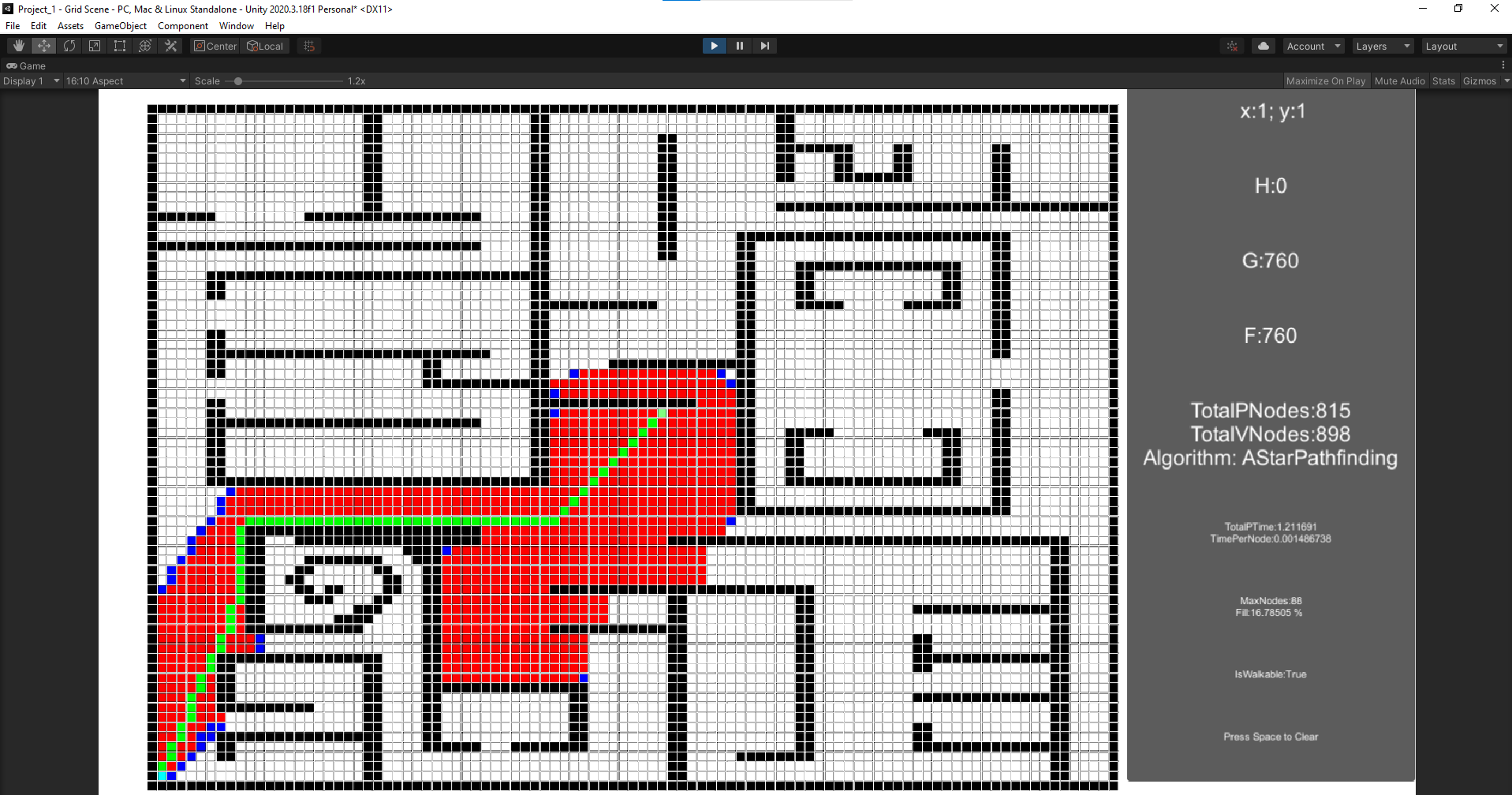


Figure - Test case 3 for A\*, no tie breaker

Uma imagem com texto, palavras cruzadas

Descrição gerada automaticamente

Figure - Test case 3 for Node Array A\*

Uma imagem com texto, palavras cruzadas

Descrição gerada automaticamente

Figure - Test case 3 for Goal Bound

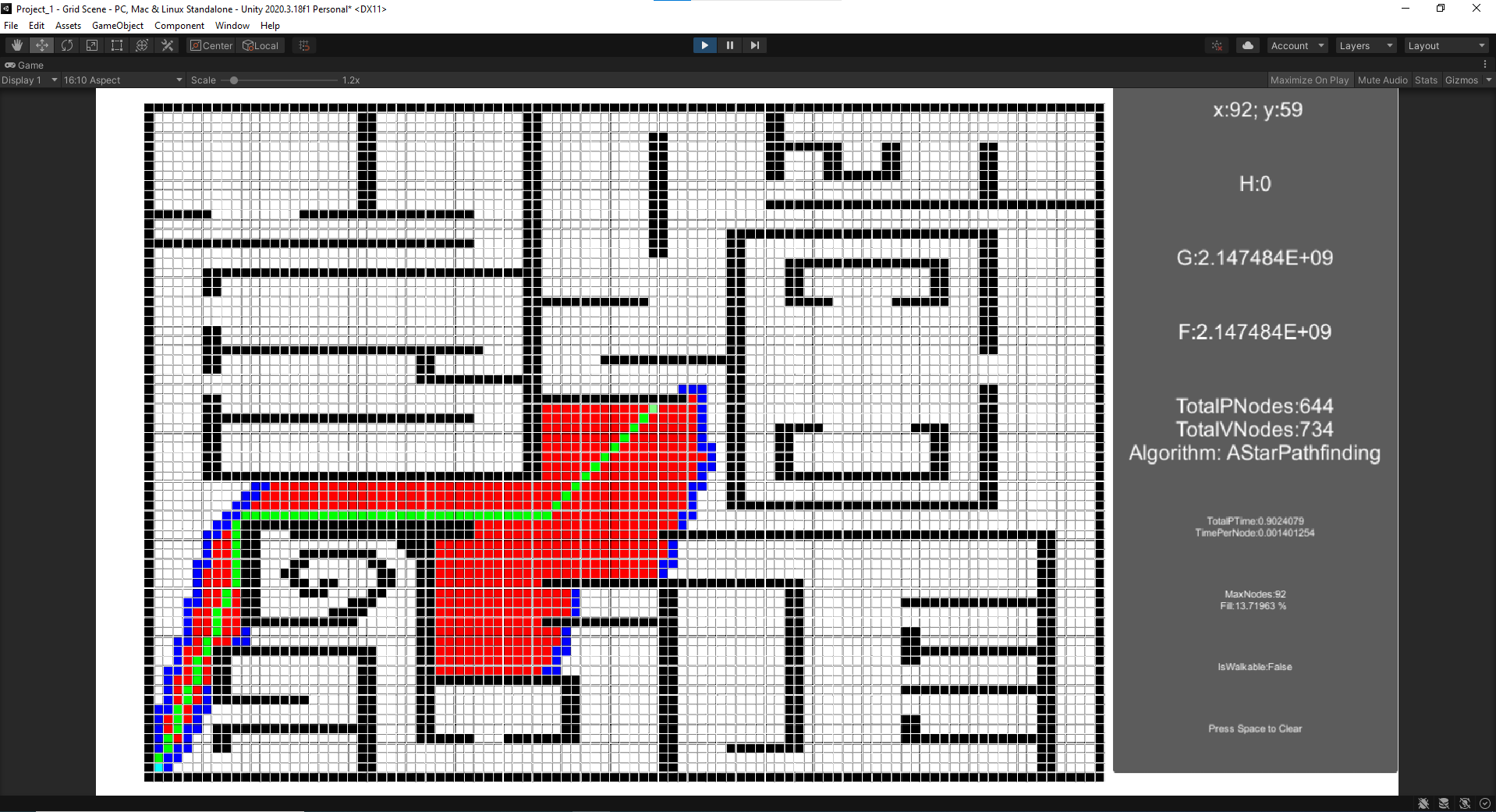


Figure - Test case 3 for A\* with tie breaker

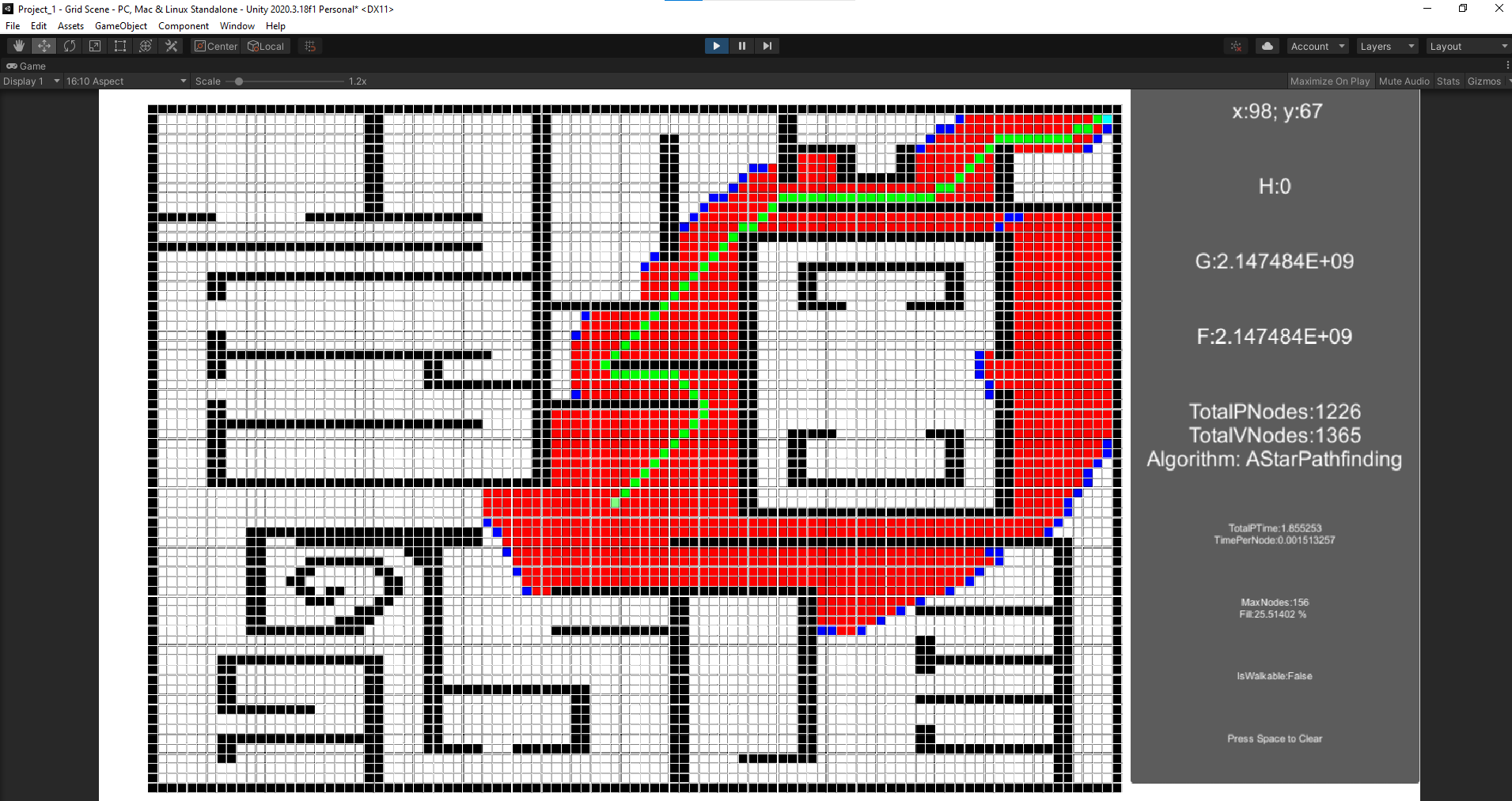


Figure - Test case 4 for A\*, no tie breaker

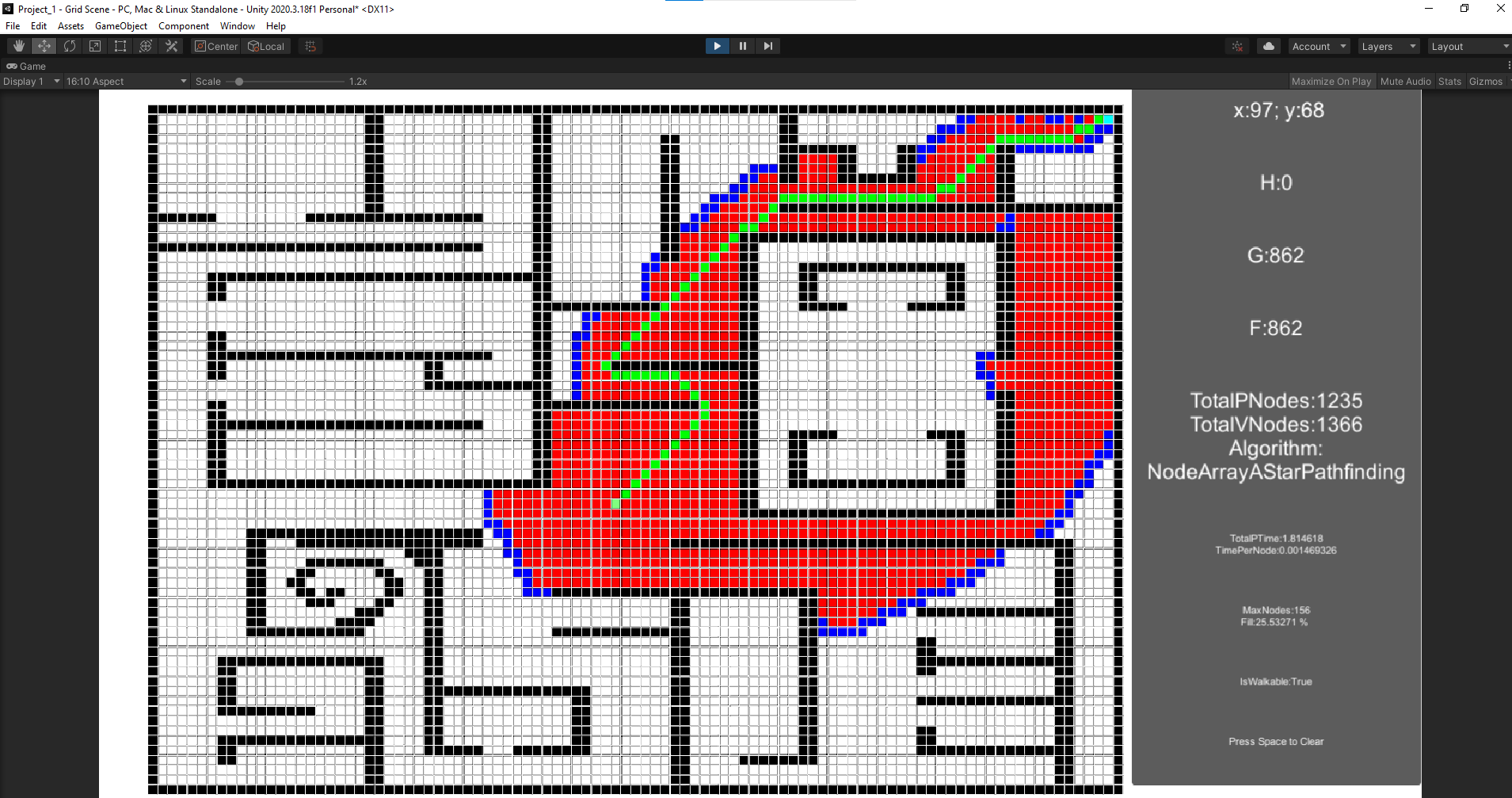


Figure - Test case 4 for Node Array A\*

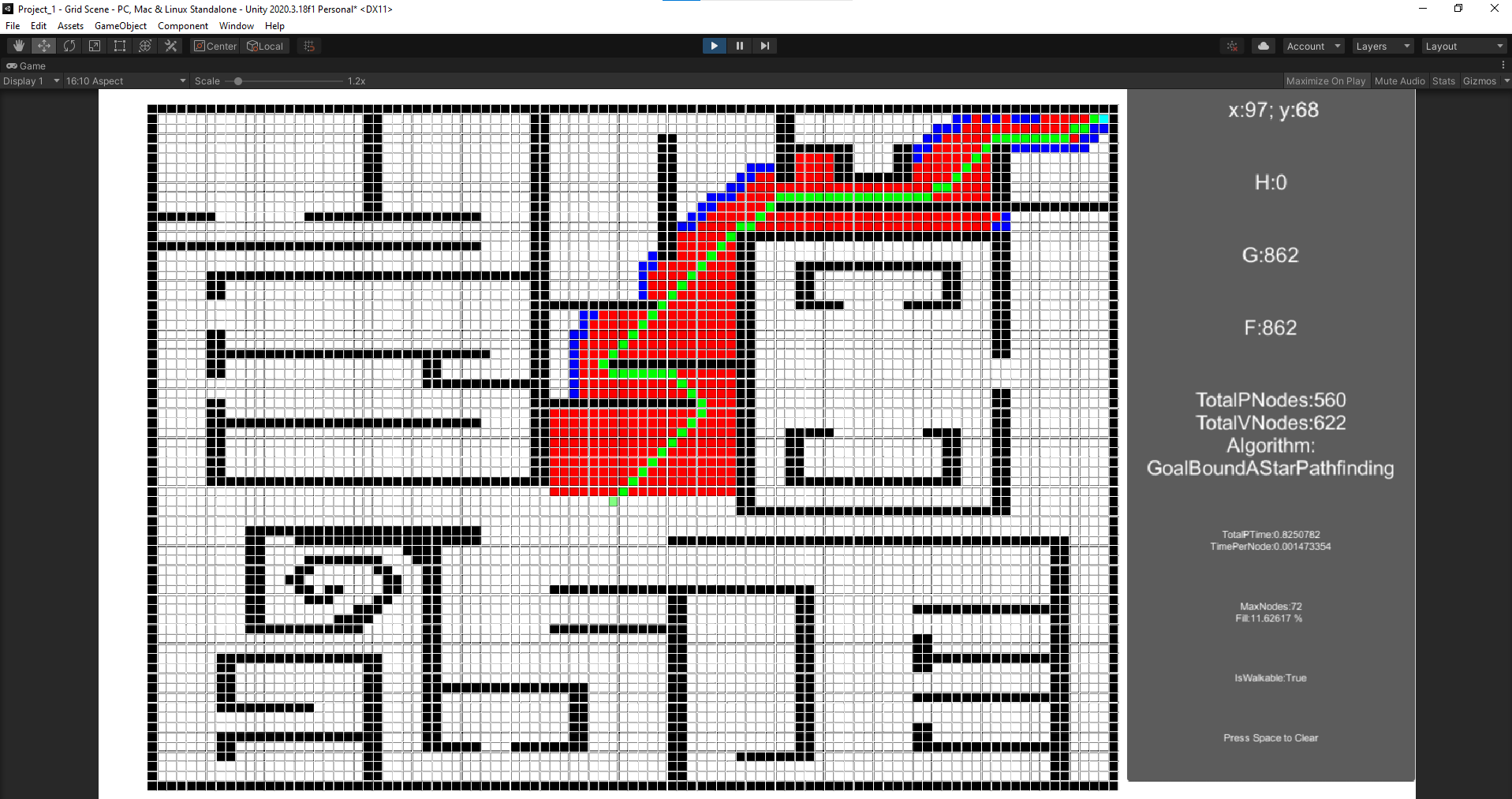


Figure - Test case 4 for Goal Bound

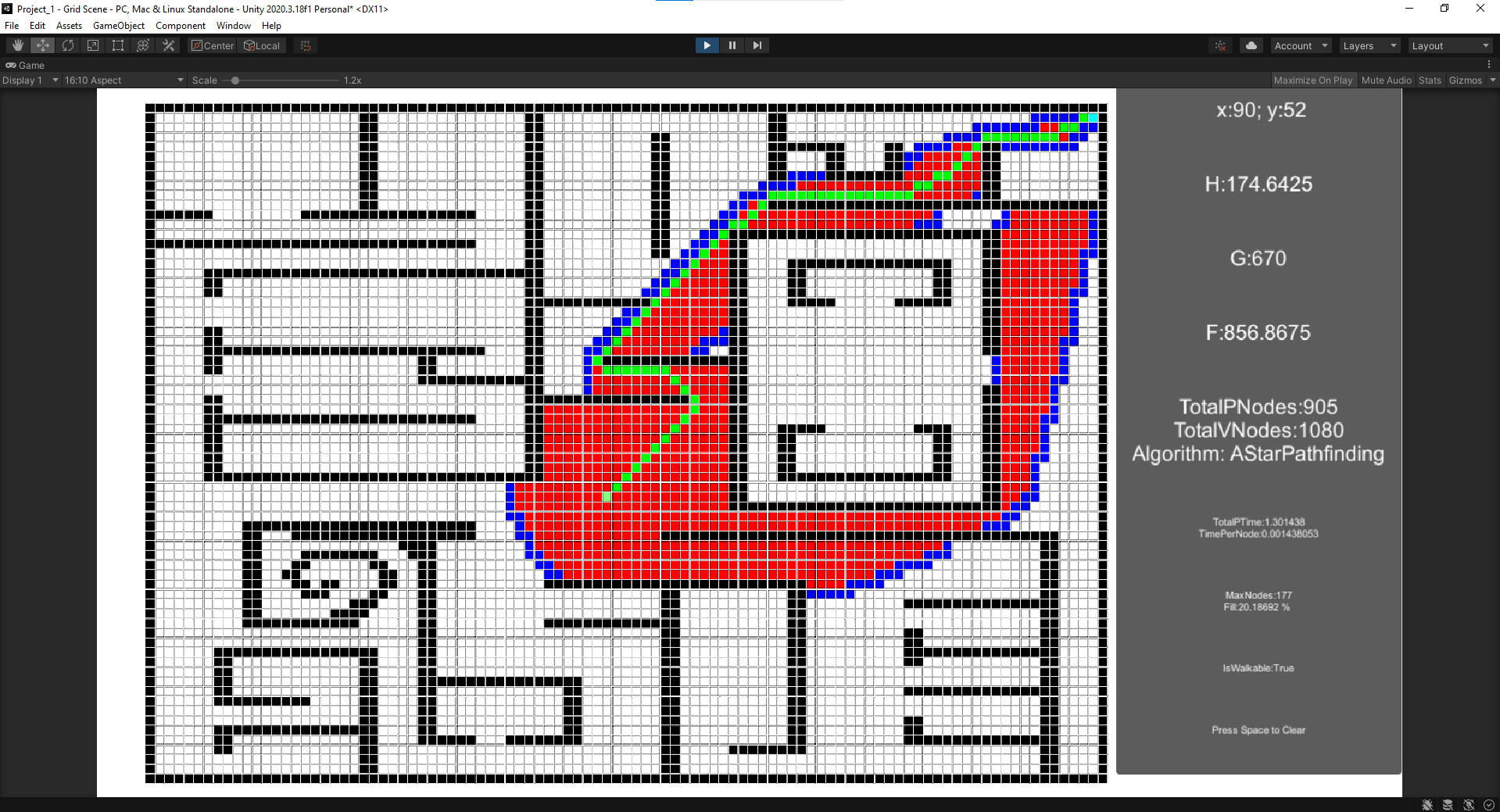


Figure - Test case 4 for A\* with tie breaker

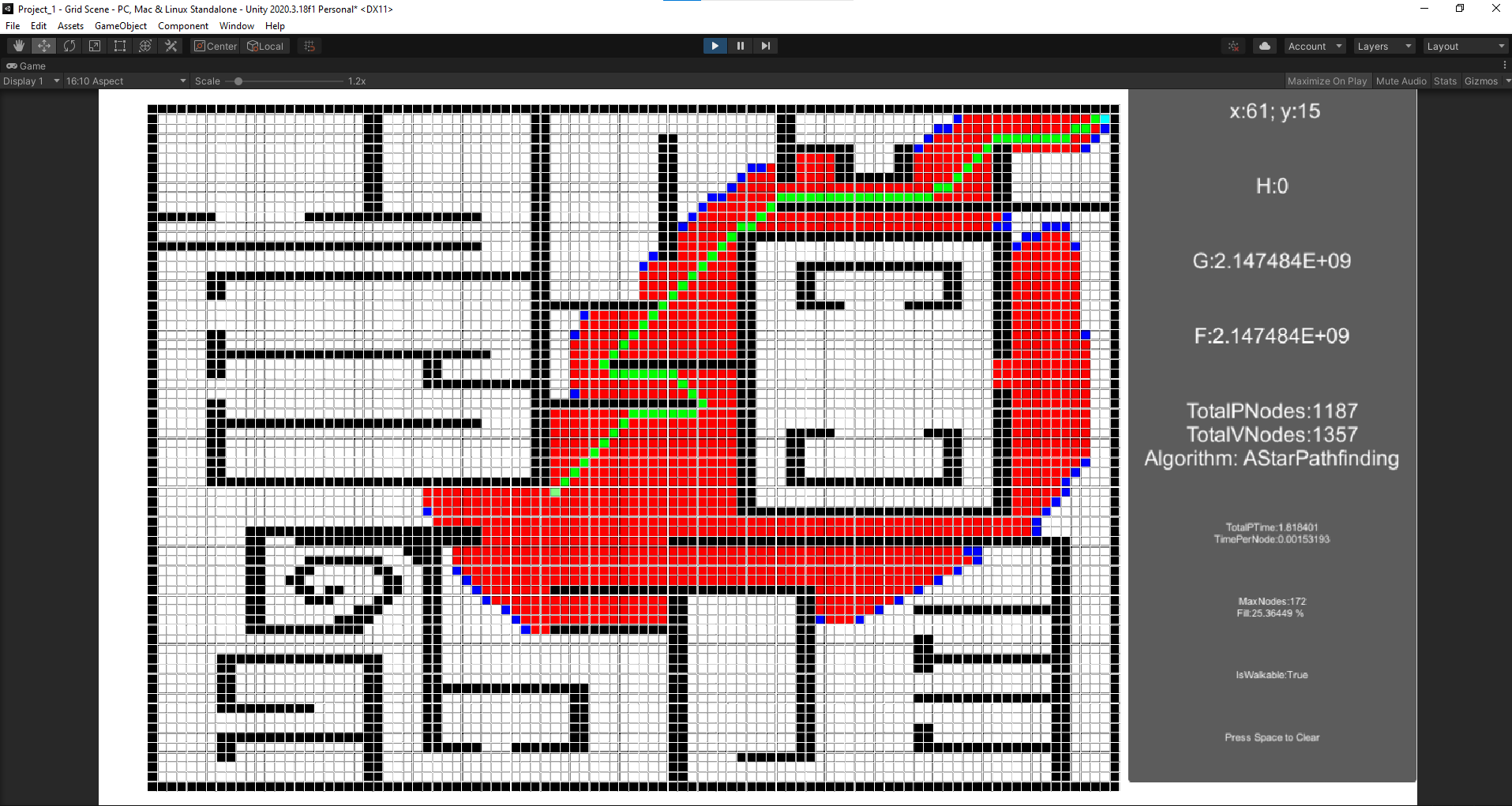


Figure - Test case 5 for A\*, no tie breaker

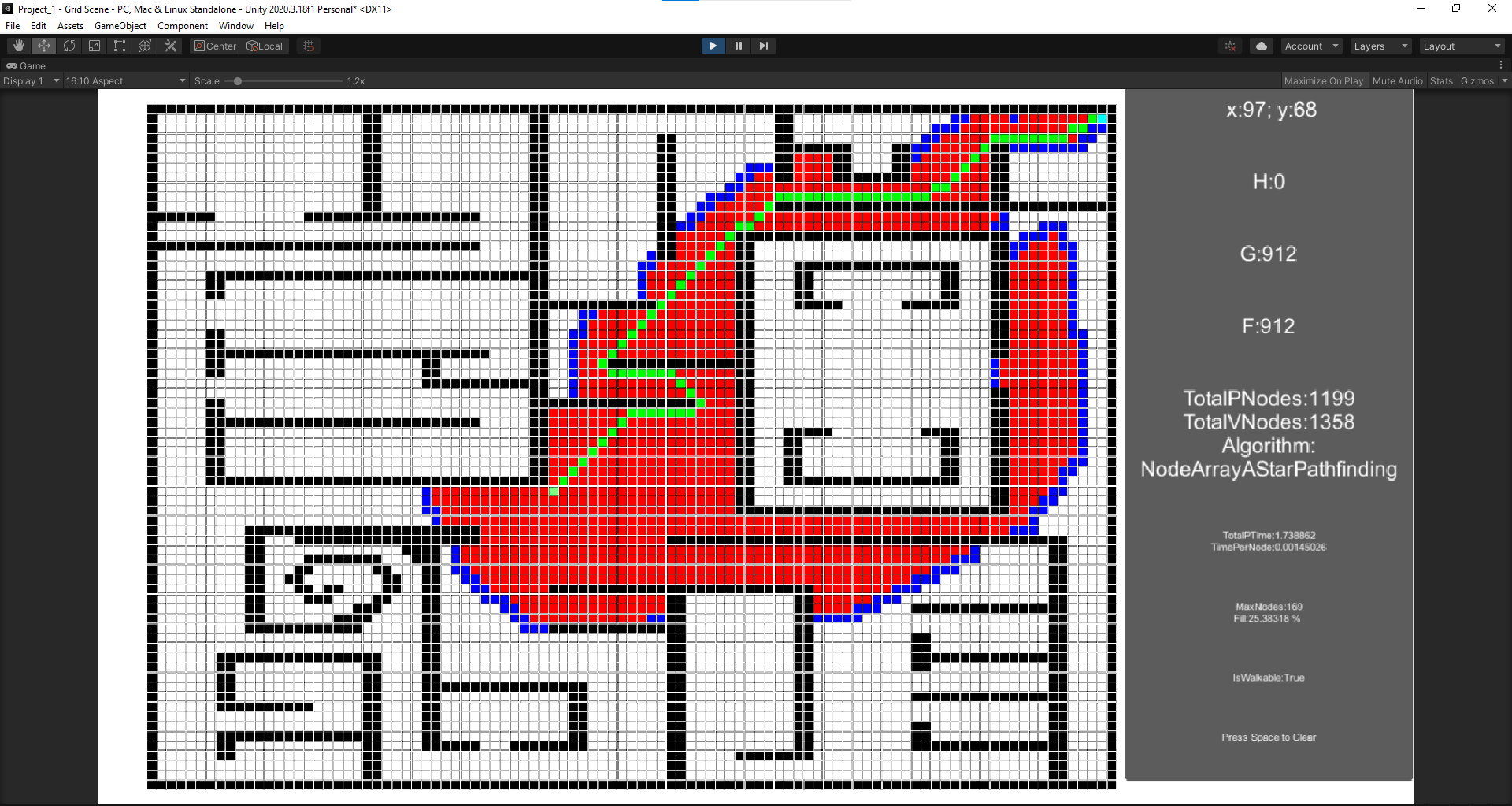


Figure - Test case 5 for Node Array A\*

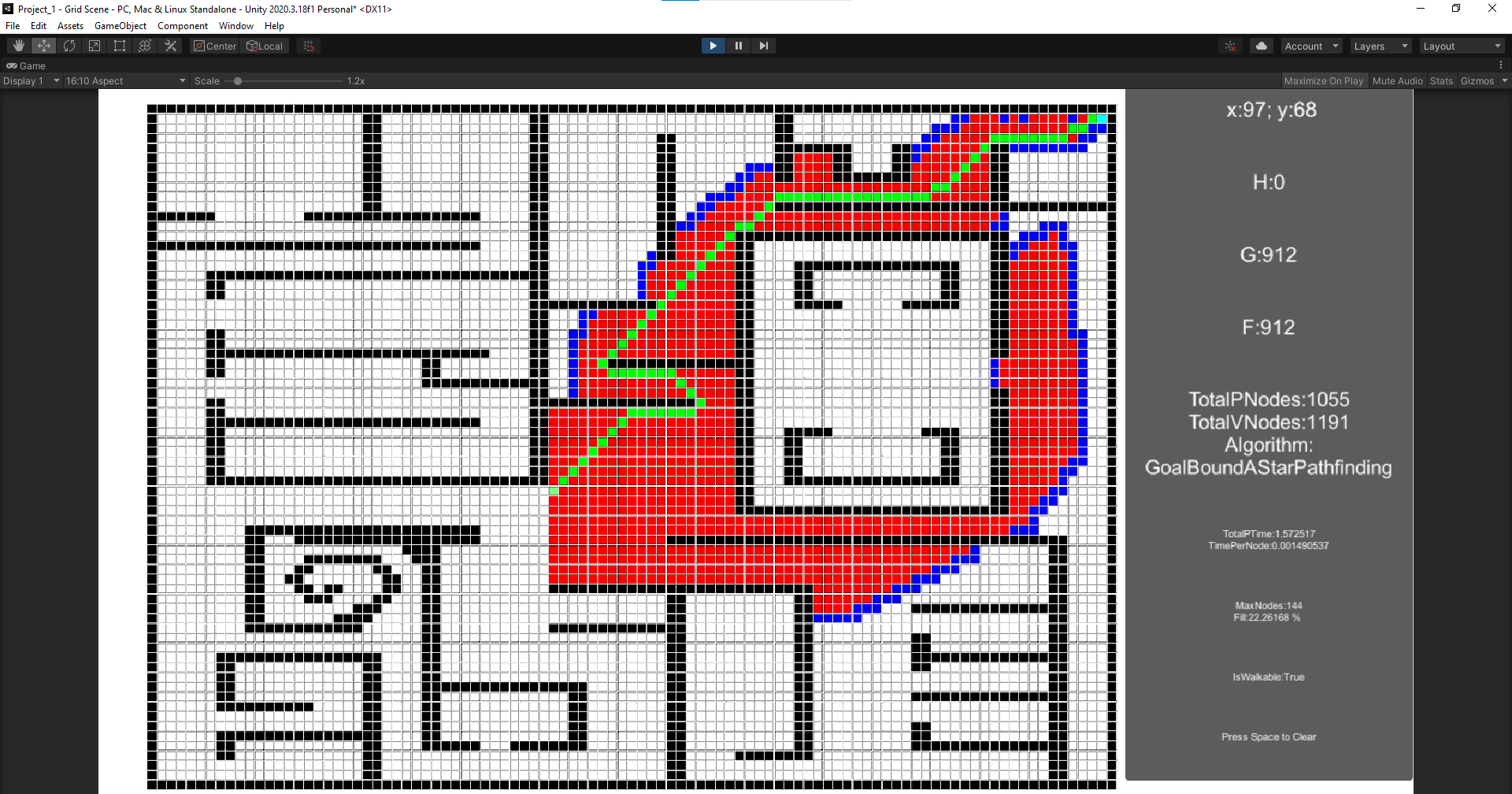


Figure - Test case 5 for Goal Bound

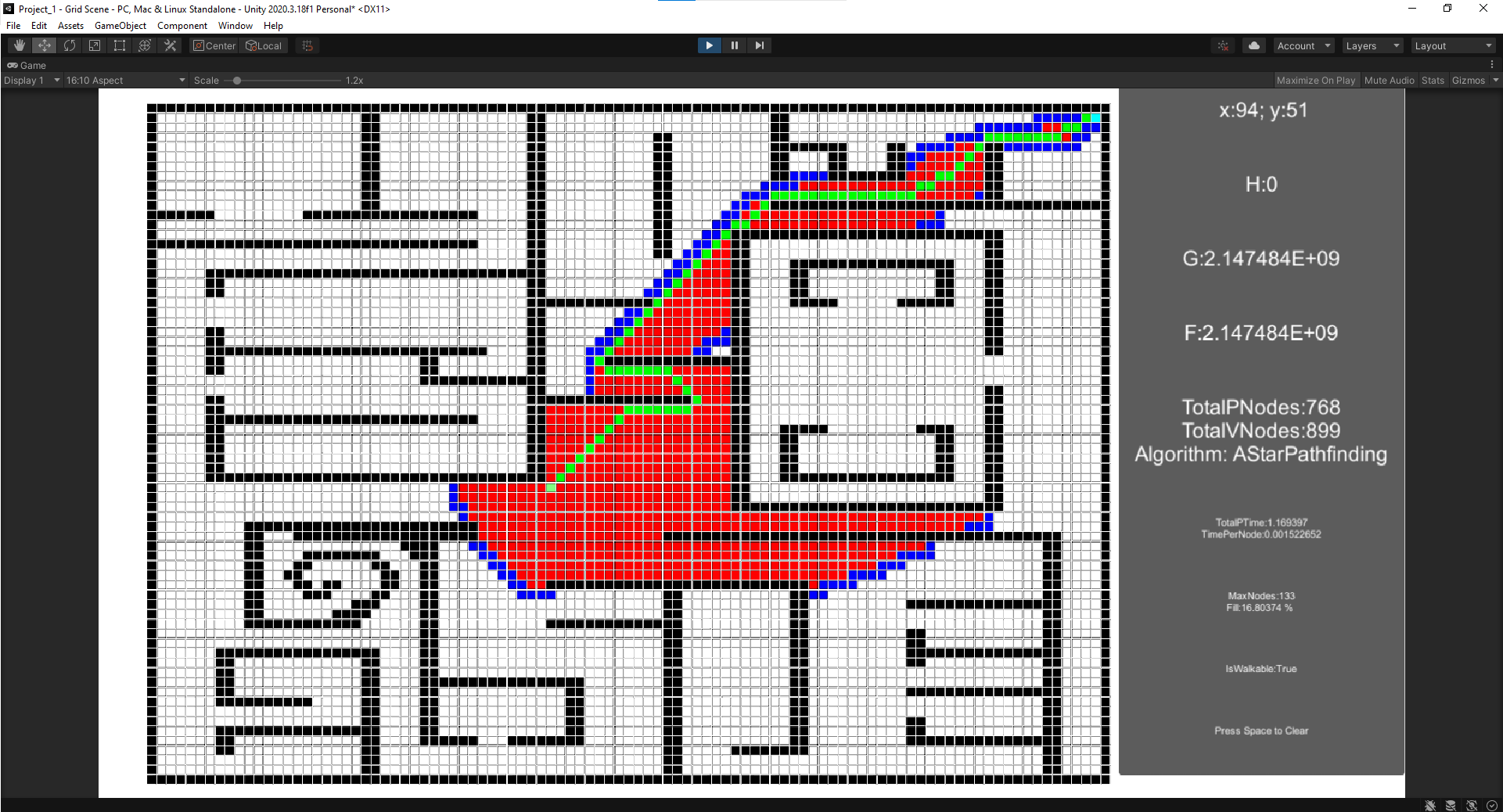


Figure - Test case 5 for A\* with tie breaker



Figure - Test case 6 for A\*, no tie breaker

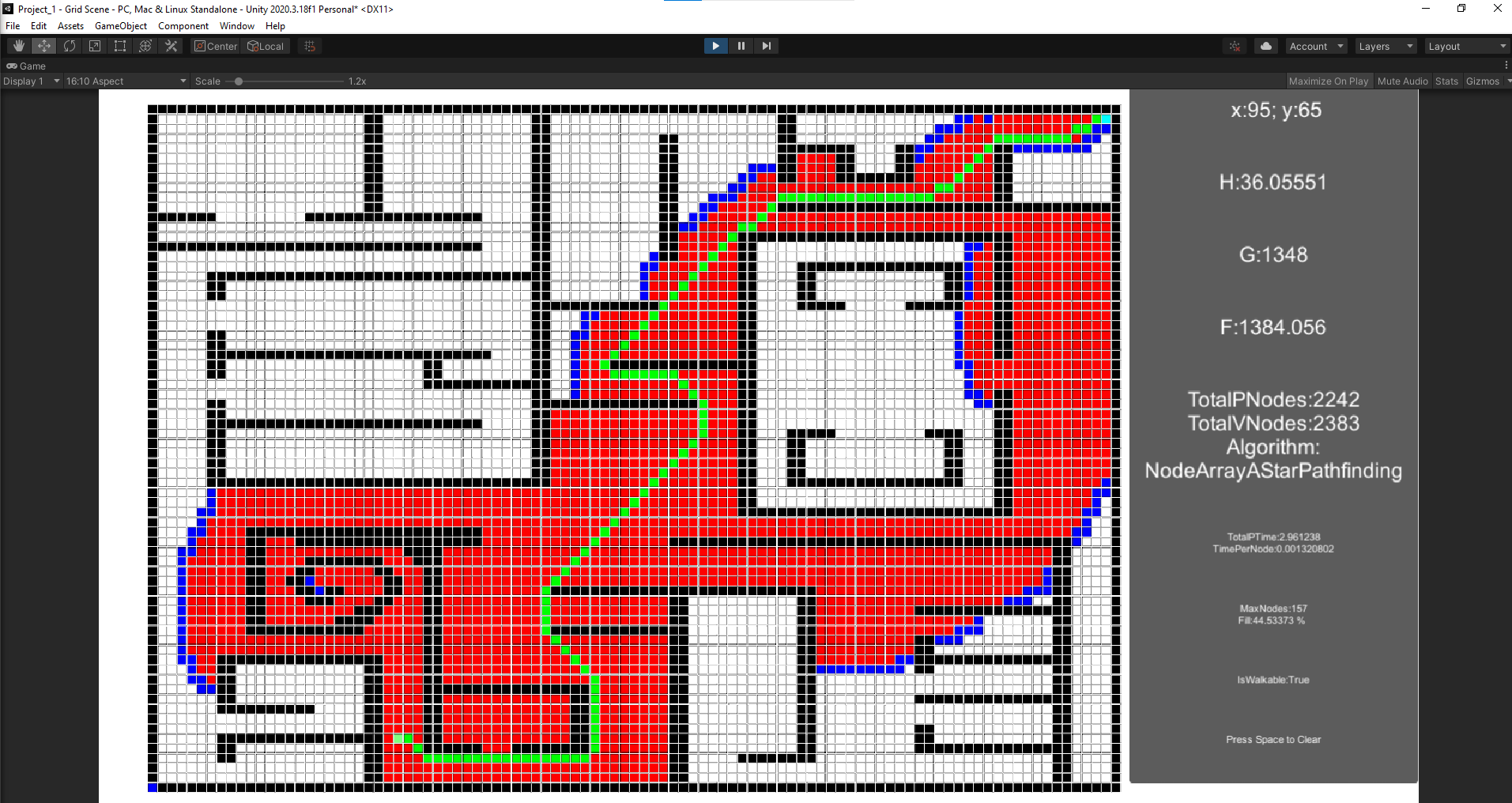


Figure - Test case 6 for Node Array A\*

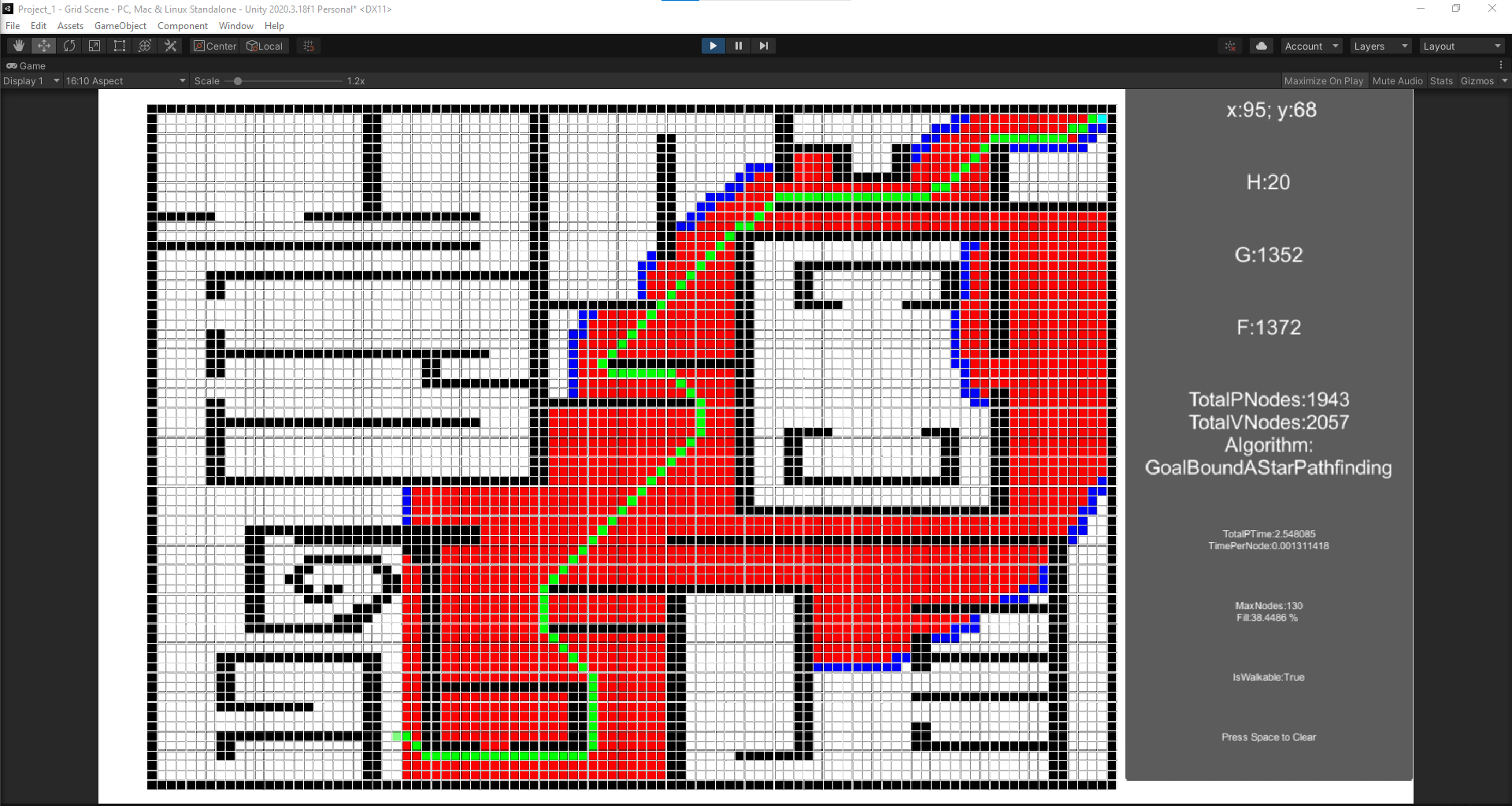


Figure - Test case 6 for Goal Bound

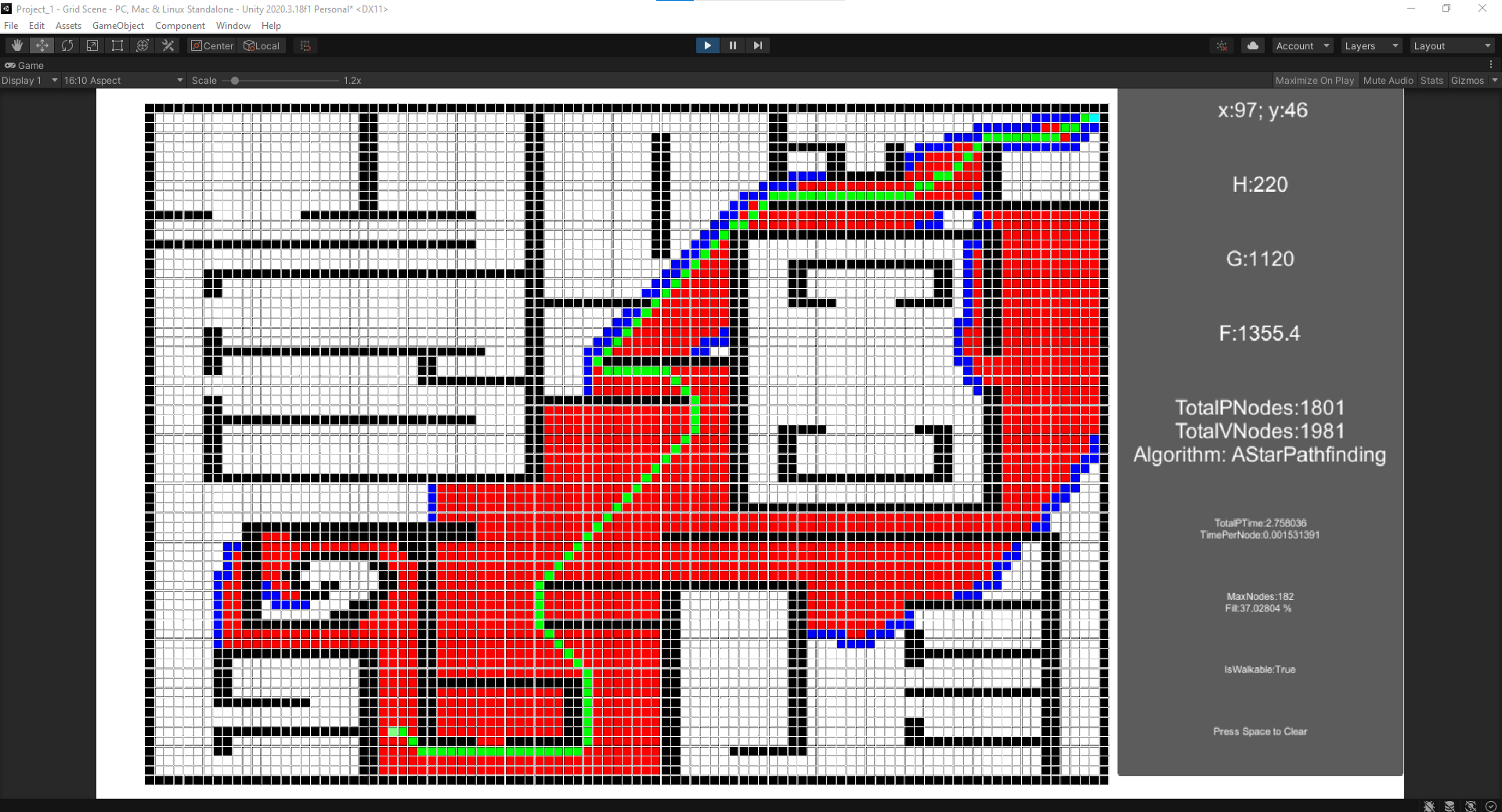


Figure - Test case 6 for A\* with tie breaker