

Cello Truth Table Update

- Generate input truth table for each permutation
- Circuit Score = (all_on) – min(partial/all_off)

Example configurations:

- nand + Eco1C1G1T1
- and + Bth1C1G1T1
- g92_boolean + SC1C1G1T1

These are fast circuits to test and the last one is multi-output

nand + Eco1C1G1T1 results

COUNTed: 142,560 iterations

```
////////////////////////////////////  
                          End of GATE ASSIGNMENT  
////////////////////////////////////
```

[DEBUG] final result for nand.v+Eco1C1G1T1: 2.711640861057231

```
////////////////////////////////////  
                          reconstructing netlist:  
////////////////////////////////////
```

```
('a', 2) input LacI_sensor 2 with ymax: 2.8 and ymin: 0.0034 with max sensor output of dict_items([('high', 2.8), ('low', 0.0034)])  
('b', 3) input TetR_sensor 3 with ymax: 4.4 and ymin: 0.0013 with max sensor output of dict_items([('high', 4.4), ('low', 0.0013)])
```

```
in_eval: input_response = STATE * (ymax - ymin) + ymin
```

```
83 gate NOT BM3R1 w/ inputs [2] and output 5, and individual gates ['B1_BM3R1', 'B2_BM3R1', 'B3_BM3R1'], best_gate = B3_BM3R1 with score 0.01024437951687001  
84 gate NOT QacR w/ inputs [3] and output 6, and individual gates ['Q1_QacR', 'Q2_QacR'], best_gate = Q2_QacR with score 0.031867354535932084  
85 gate NOR SrpR w/ inputs [5, 6] and output 7, and individual gates ['S1_SrpR', 'S2_SrpR', 'S3_SrpR', 'S4_SrpR'], best_gate = S4_SrpR with score 1.9293301786987629  
86 gate NOT PhlF w/ inputs [7] and output 4, and individual gates ['P1_PhlF', 'P2_PhlF', 'P3_PhlF'], best_gate = P3_PhlF with score 0.020894791280385933
```

```
gate_eval: hill_response = ymin + (ymax - ymin) / (1.0 + (x / K)**n)  
gate_eval: input_composition = x2 + x1
```

```
('out', 4) output YFP_reporter 4 with c: 0.4 and outscore=0.008357916512154373
```

```
output_eval: unit_conversion = c * x
```

```
Inputs: [LacI_sensor, TetR_sensor], Outputs: [YFP_reporter], Gates: [BM3R1, QacR, SrpR, PhlF]  
[0, 0, 0.7999996882935029, 2.7999861127795422, 0.007091856091461746, 6.799996943923462, 2.7199987775693852]  
[0, 1, 0.7999996882935029, 0.031867354535932084, 0.012539458368570799, 6.799966523387484, 2.7199866093549936]  
[1, 0, 0.01024437951687001, 2.7999861127795422, 0.00718376113285822, 6.799996774103083, 2.7199987096412332]  
[1, 1, 0.01024437951687001, 0.031867354535932084, 1.9293301786987629, 0.020894791280385933, 0.008357916512154373]
```

and + Bth1C1G1T1 results

COUNTed: 1,260 iterations

```
/////////////////////////////////////////////////////////////////
                        End of GATE ASSIGNMENT
/////////////////////////////////////////////////////////////////
```

[DEBUG] final result for and.v+Bth1C1G1T1: 0.5573282649662823

```
/////////////////////////////////////////////////////////////////
                        reconstructing netlist:
/////////////////////////////////////////////////////////////////
```

```
('a', 2) input IPTG_sensor 2 with ymax: 4.29668167 and ymin: 0.02731338 with max sensor output of dict_items([('high', 4.29668167), ('low', 0.02731338)])
('b', 3) input aTc_sensor 3 with ymax: 6.44789857 and ymin: 0.02857148 with max sensor output of dict_items([('high', 6.44789857), ('low', 0.02857148)])
```

```
in_eval: input_response = STATE * (ymax - ymin) + ymin
```

```
81 gate NOT M5 w/ inputs [2] and output 5, and individual gates ['Gate5'], best_gate = Gate5 with score 0.00396039799923152
82 gate NOT M3 w/ inputs [3] and output 6, and individual gates ['Gate3'], best_gate = Gate3 with score 0.003208112306557924
83 gate NOR M1 w/ inputs [5, 6] and output 4, and individual gates ['Gate1'], best_gate = Gate1 with score 0.6936005856282005
```

```
gate_eval: hill_response = ymin + (ymax - ymin) / (1.0 + (x / K)**n)
gate_eval: input_composition = x2 + x1
```

```
('out', 4) output nanoluc_reporter 4 with c: 1.0 and outscore=0.6936005856282005
```

```
output_eval: unit_conversion = c * x
```

```
Inputs: [IPTG_sensor, aTc_sensor], Outputs: [nanoluc_reporter], Gates: [M5, M3, M1]
[0, 0, 0.28232882127296305, 0.31964495227186557, 0.1362723206619182, 0.1362723206619182]
[0, 1, 0.28232882127296305, 0.003208112306557924, 0.2672343699328287, 0.2672343699328287]
[1, 0, 0.00396039799923152, 0.31964495227186557, 0.2416998638163316, 0.2416998638163316]
[1, 1, 0.00396039799923152, 0.003208112306557924, 0.6936005856282005, 0.6936005856282005]
```

g92_boolean + SC1C1G1T1 results

COUNTed: 725,760 iterations

```
////////////////////////////////////  
                          End of GATE ASSIGNMENT  
////////////////////////////////////
```

[DEBUG] final result for g92_boolean.v+SC1C1G1T1: 3.7997206086777937

```
////////////////////////////////////  
                          reconstructing netlist:  
////////////////////////////////////
```

('t1', 2) input aTc_sensor 2 with ymax: 2.5 and ymin: 0.002 with max sensor output of dict_items([('high', 2.5), ('low', 0.002)])
('in91', 3) input IPTG_sensor 3 with ymax: 2.5 and ymin: 0.0082 with max sensor output of dict_items([('high', 2.5), ('low', 0.0082)])

in_eval: input_response = STATE * (ymax - ymin) + ymin

100 gate NOT BM3RI w/ inputs [6] and output 4, and individual gates ['P1_BM3RI'], best_gate = P1_BM3RI with score 5.057251454023572
95 gate NOT IcaR w/ inputs [2] and output 7, and individual gates ['P1_IcaR'], best_gate = P1_IcaR with score 0.00396255375624779
96 gate NOT QacR w/ inputs [3] and output 8, and individual gates ['P1_QacR'], best_gate = P1_QacR with score 0.002388435011526839
97 gate NOR CI w/ inputs [7, 8] and output 5, and individual gates ['P1_CI', 'P2_CI'], best_gate = P2_CI with score 3.8198298639125787
98 gate NOR LexA w/ inputs [2, 3] and output 9, and individual gates ['P1_LexA', 'P2_LexA'], best_gate = P2_LexA with score 0.01103975596973001
99 gate NOR HKCI w/ inputs [5, 9] and output 6, and individual gates ['P1_HKCI'], best_gate = P1_HKCI with score 0.02005893596643057

gate_eval: hill_response = ymin + (ymax - ymin) / (1.0 + (x / K)**n)
gate_eval: input_composition = x1 + x2

('out108', 4) output YFP_reporter 4 with c: 1.0 and outscore=5.057251454023572
('out98', 5) output RFP_reporter 5 with c: 1.0 and outscore=3.8198298639125787

output_eval: unit_conversion = c * x

Inputs: [aTc_sensor, IPTG_sensor], Outputs: [YFP_reporter, RFP_reporter], Gates: [BM3RI, IcaR, QacR, CI, LexA, HKCI]
[0, 0, 0.004789398630342142, 2.649972563721841, 2.239941970174329, 0.02010925523478516, 2.2299934583028946, 2.1665655162951762, 0.004789398630342142, 0.02010925523478516]
[0, 1, 0.0047908204303952874, 2.649972563721841, 0.002388435011526839, 0.020718839569828992, 0.01155963967781538, 2.16532798471047, 0.0047908204303952874, 0.020718839569828992]
[1, 0, 0.004792011398988548, 0.00396255375624779, 2.239941970174329, 0.021203016721892877, 0.011554374914766853, 2.1642936220194007, 0.004792011398988548, 0.021203016721892877]
[1, 1, 5.057251454023572, 0.00396255375624779, 0.002388435011526839, 3.8198298639125787, 0.01103975596973001, 0.02005893596643057, 5.057251454023572, 3.8198298639125787]