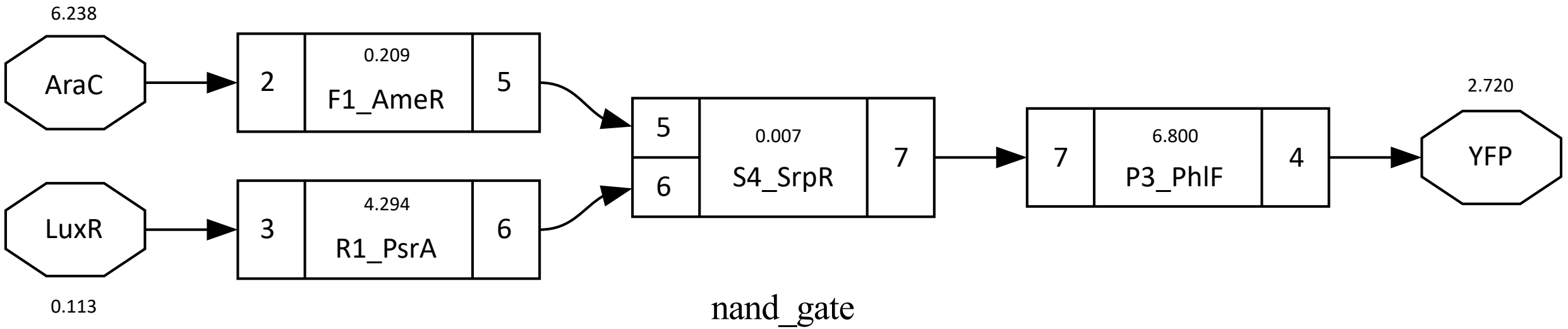
Cello V3 Core

Circuit Scoring Sanity Check



nand_gate

```
∫DEBUG∫ final result for nand.v+Eco1C1G1T1:
(2.7199988082362148, Inputs: [AraC_sensor, LuxR_sensor], Outputs: [YFP_reporter], Gates: [AmeR, PsrA, SrpR, PhlF])

reconstructing netlist:
('a', 2) input AraC_sensor 2 with ymax:2.5 and ymin:0.0082 and max composition of 6.238
('b', 3) input LuxR_sensor 3 with ymax:0.31 and ymin:0.025 and max composition of 0.113
input_response = STATE * (ymax - ymin) + ymin
83 gate NOT AmeR w/ inputs [2] and output 5, and individual gates ['F1_AmeR'], best_gate=F1_AmeR with score 0.20950670711838215
84 gate NOT PsrA w/ inputs [3] and output 6, and individual gates ['R1_PsrA'], best_gate=R1_PsrA with score 4.293503237275967
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 0.007049085238570375
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 6.799997020590537
hill_response = ymin + (ymax - ymin) / (1.0 + (x / K)**n)
input_composition = x2 + x1
('out', 4) output YFP_reporter 4 with c:0.4 and outscore=2.7199988082362148
unit_conversion = c * x
```

Equations:

- AraC = 2.5 * (2.5 - 0.0082) + 0.0082 = 6.2377
- LuxR = 0.31 * (0.31 – 0.025) + 0.025 = 0.11355
- F1_AmeR = 0.2 + ((3.8-0.2) / (1 + (6.238 / 0.09)**1.4)) = 0.2095
- R1_PsrA = 0.2 + ((5.9-0.2) / (1 + (0.113 / 0.19)**1.8)) = 4.2935
- S4_SrpR=0.007+((2.1-0.007)/(1+((0.2095+4.2935)/0.1)**2.8))= 0.0070
- P3_PhlF = 0.02 + ((6.8-0.02) / (1 + (0.007049 / 0.23)**4.2)) = 6.799997
- YFP = 0.4 * 6.79997 = 2.7199988 = 2.720

Compared to Cello V2…

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13:11:21.800 [main] INFO  SimulatedAnnealing -
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TMActivityEvaluation
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$1              0.0200  0.0205  0.0201  6.7313
b               0.0034  2.8000  0.0034  2.8000
$2              2.1000  2.1000  0.0071  0.0071
a               0.0013  0.0013  4.4000  4.4000
$3              3.7706  0.0702  3.7706  0.0702
out             0.0080  0.0082  0.0080  2.6925
-----------------------------------------

13:11:21.801 [main] INFO  SimulatedAnnealing - Node: $1         Type: NOR              Gate: P3_PhlF
13:11:21.801 [main] INFO  SimulatedAnnealing - Node: out        Type: PRIMARY_OUTPUT   Gate: YFP_reporter
13:11:21.802 [main] INFO  SimulatedAnnealing - Node: $2         Type: NOT              Gate: S4_SrpR
13:11:21.803 [main] INFO  SimulatedAnnealing - Node: $3         Type: NOT              Gate: A1_AmtR
13:11:21.803 [main] INFO  SimulatedAnnealing - Node: b          Type: PRIMARY_INPUT    Gate: LacI_sensor
13:11:21.804 [main] INFO  SimulatedAnnealing - Node: a          Type: PRIMARY_INPUT    Gate: TetR_sensor
13:11:21.805 [main] INFO  SimulatedAnnealing - Score: 327.62
13:11:21.805 [main] INFO  SimulatedAnnealing - Generating plots
13:11:37.401 [main] INFO  PLRuntimeObject - Executing Stage: placing
13:11:37.407 [main] INFO  PLRuntimeObject - Executing Algorithm: Eugene
13:11:37.448 [main] INFO  Eugene - building Eugene input script
13:11:37.457 [main] INFO  Eugene - running Eugene
13:11:39.530 [main] INFO  Eugene - processing Eugene output
13:11:39.535 [main] INFO  Eugene - generating dnaplotlib figures
13:11:41.225 [main] INFO  EXRuntimeObject - Executing Stage: export
13:11:41.231 [main] INFO  EXRuntimeObject - Executing Algorithm: SBOL
13:11:41.473 [main] INFO  SBOL - creating SBOL document
13:11:41.591 [main] INFO  SBOL - grouping inserts
13:11:41.599 [main] INFO  SBOL - adding design modules
13:11:41.605 [main] INFO  SBOL - Writing SBOL document.
and.v circuit score: 327.62
```

My Calculations:

```
LacI = input_response(2.8, 2.8, 0.0034)
TetR = input_response(2.8, 4.4, 0.0013)
A1_AmtR = hill_response(3.8, 0.06, 0.07, 1.6, LacI)
S4_SrpR = hill_response(2.1, 0.007, 0.1, 2.8, TetR)
P3_Phlf = hill_response(6.8, 0.02, 0.23, 4.2, input_composition(A1_AmtR, S4_SrpR))
YFP = sensor_response(0.4, P3_Phlf)
print("CIRCUIT SCORE: " + str(YFP))
# 2.702873338142905
```

Note: simulated annealing returns a different result every time.