Designing Agents with Task-Specific Minimal Representation

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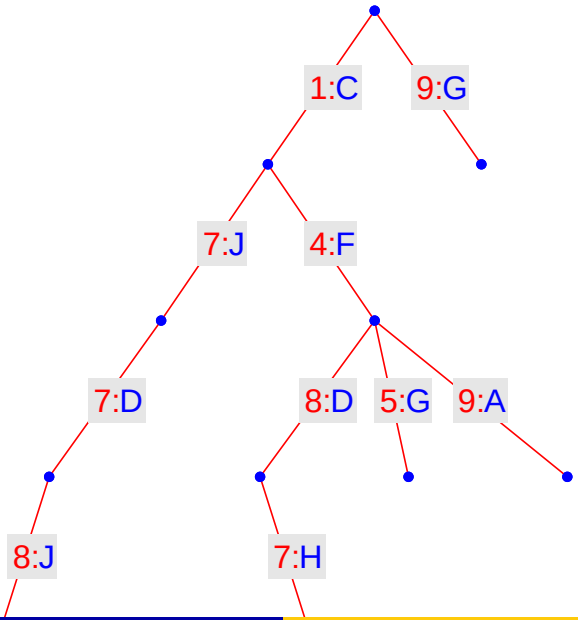
September 10, 2015

Bit-at-a-time (Censi)

Proposed by Andrea Censi, MIT-LIDS: Greedily separate ambiguous contexts along decision tree.



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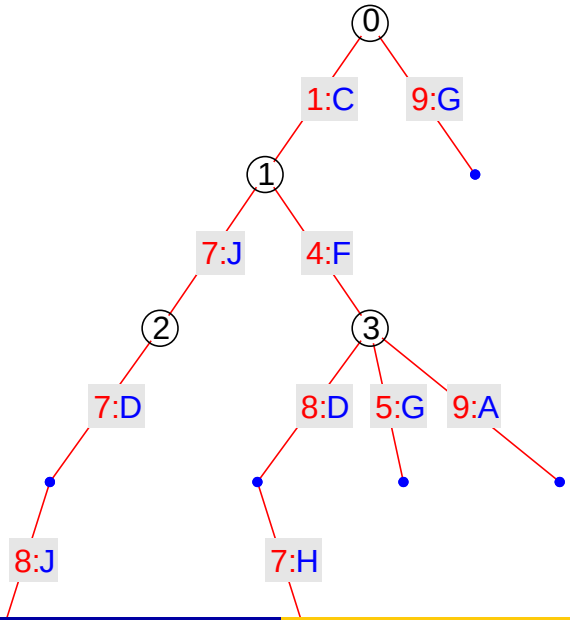

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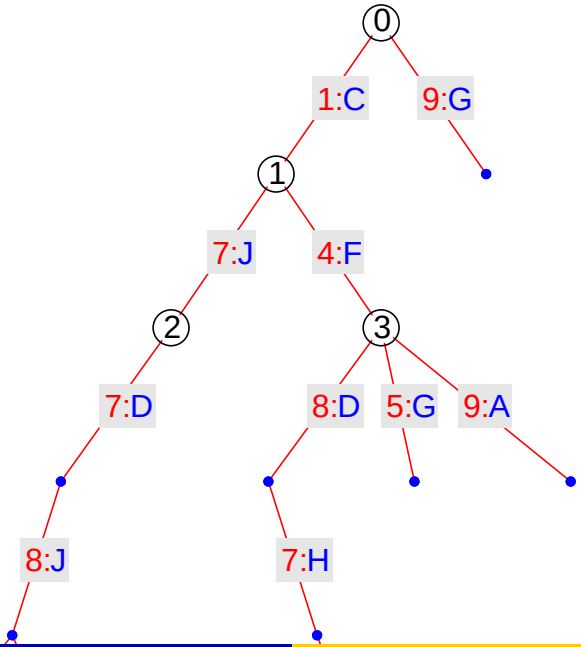
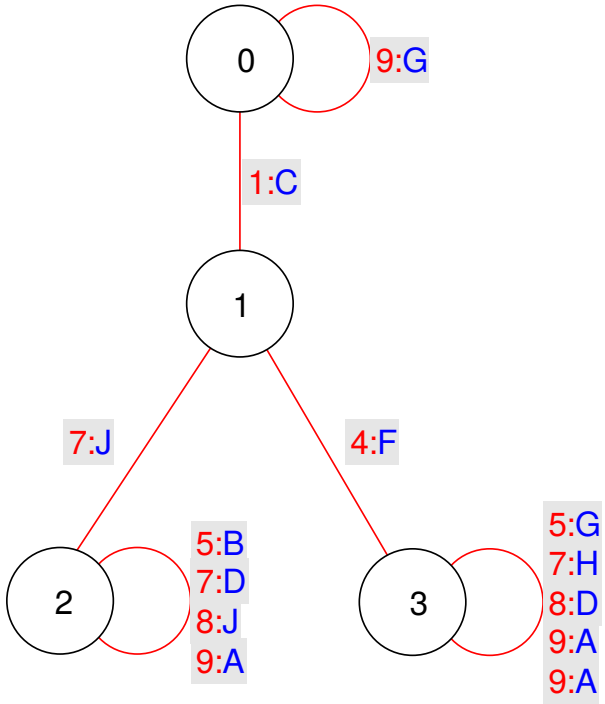
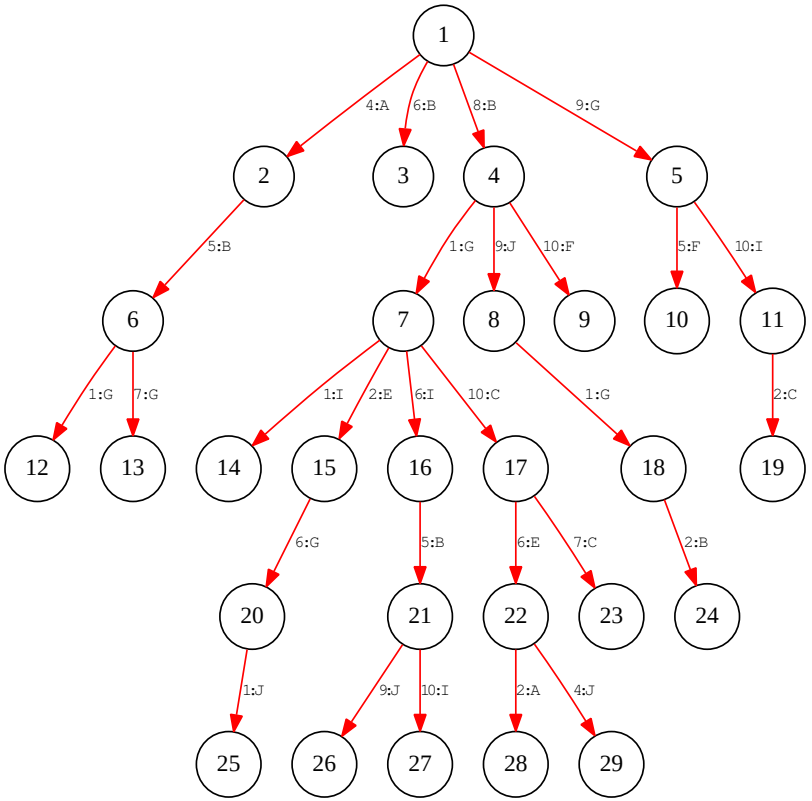


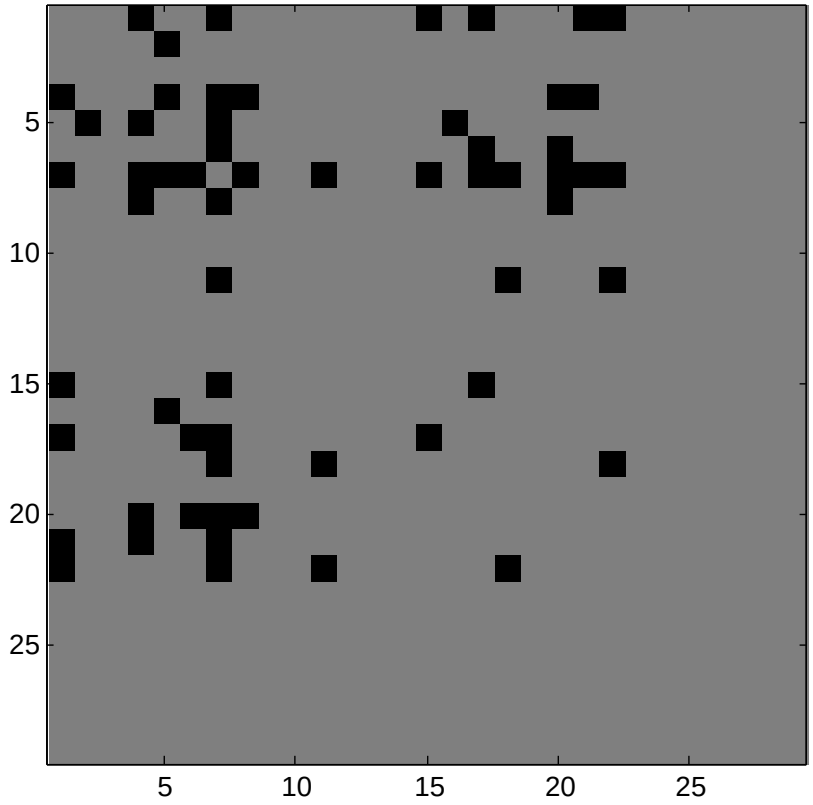


Greedy Clique Covering

Greedily combine compatible states



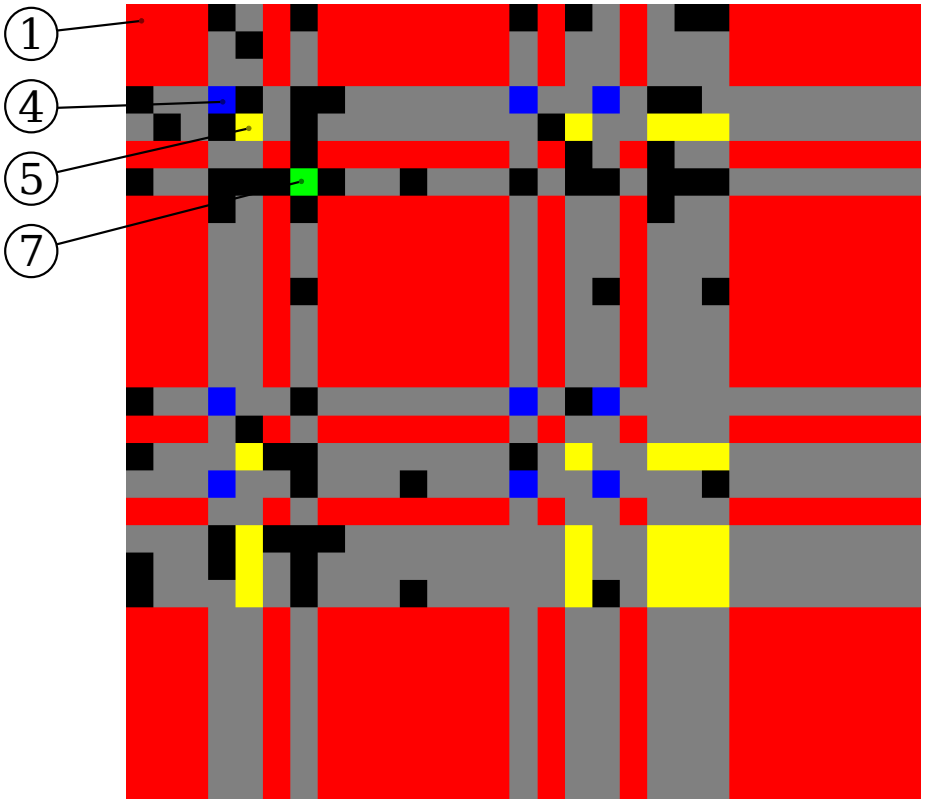
(c) Decision Tree



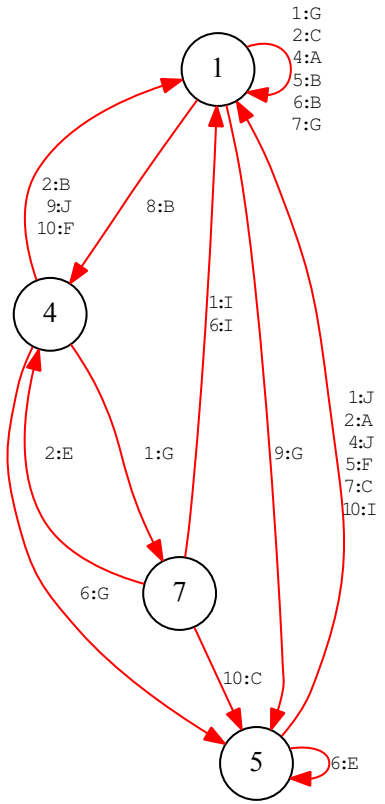
(d) Compatibility Matrix

Greedy Clique Covering

Greedily combine compatible states

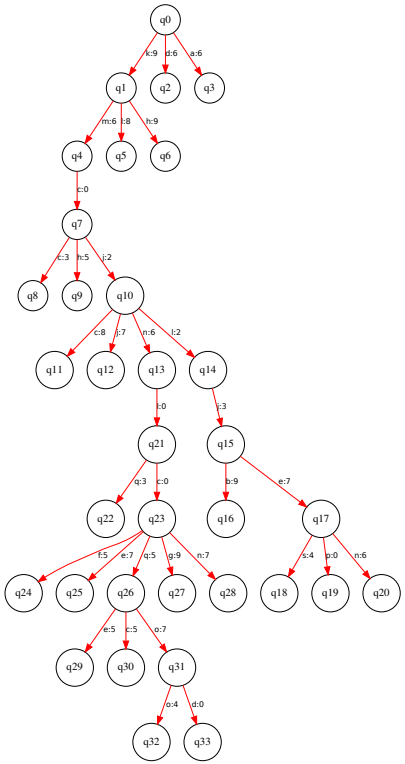


(e) Greedy Clique Covering



(f) Reduced Rep

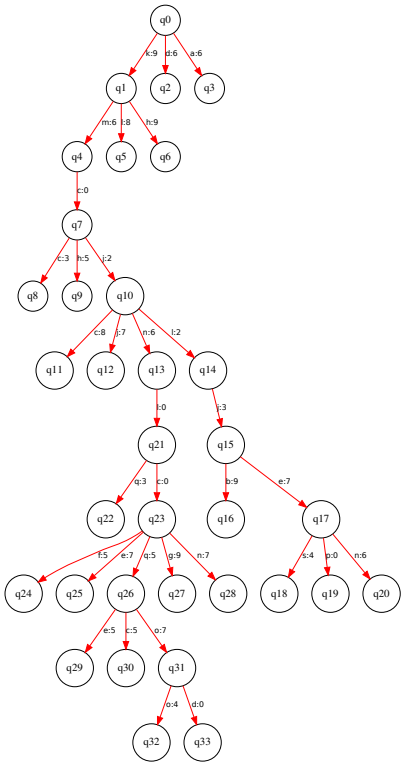
Poisson Random Tree

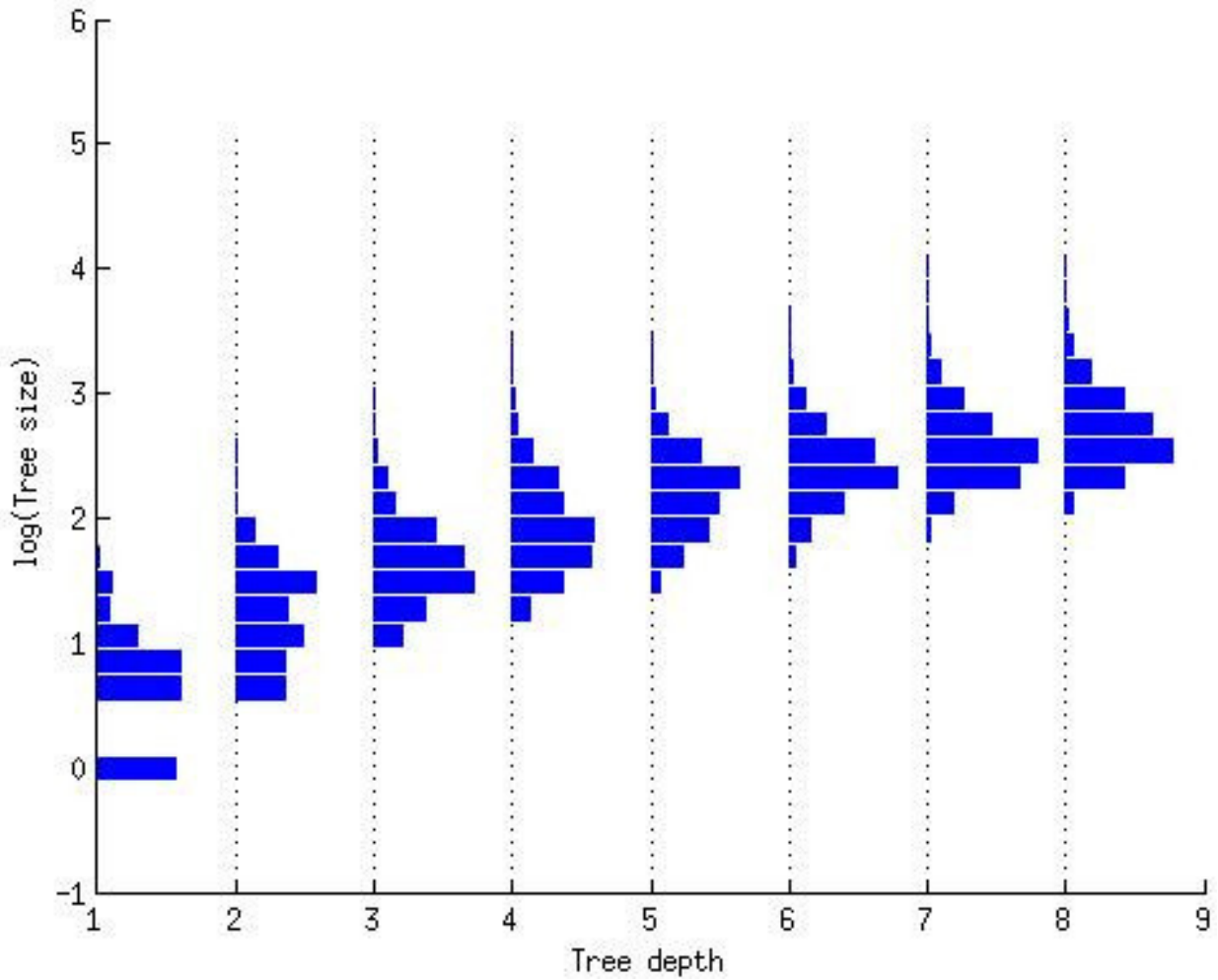


Generated by recursively adding $X \sim \text{Poisson}(\lambda)$ children to each new node. Result is conditioned on process not terminating before depth H.

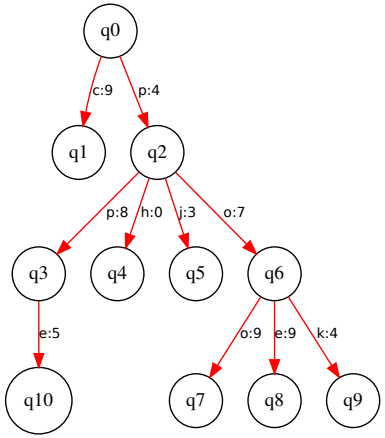
Models a birth/death process where individuals continuously produce offspring at a rate of λ per lifetime.

Poisson Random Tree

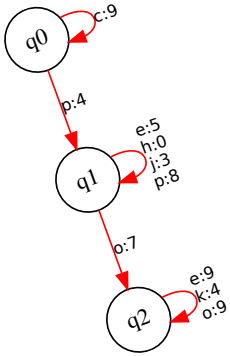




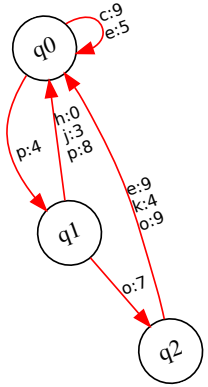
Reduction Examples



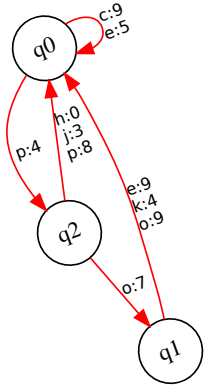
(g) Original



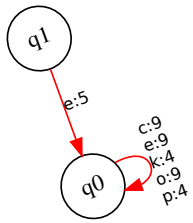
(h) Censi



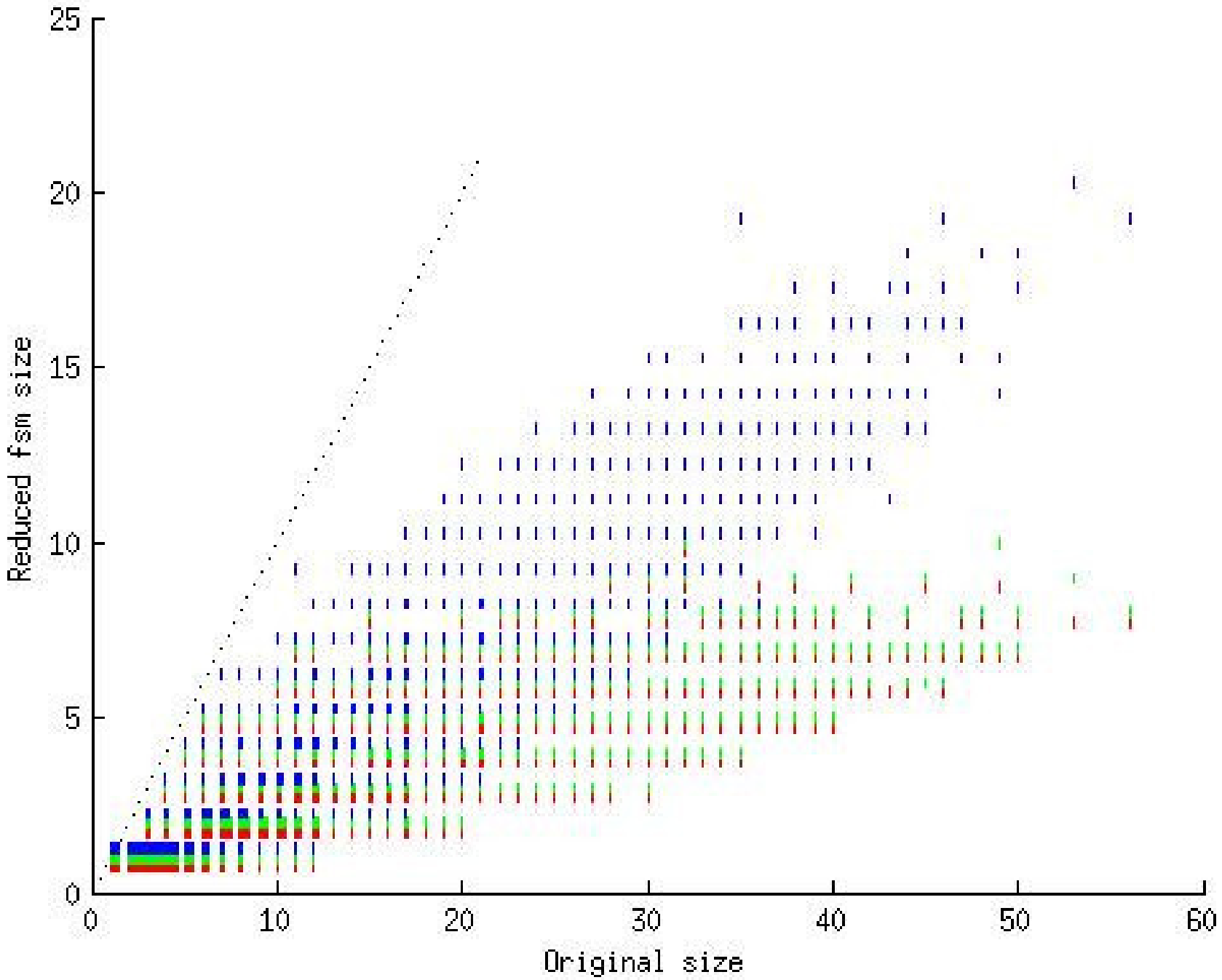
(i) Josh



(j) Alberto



(k) Exact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Original size
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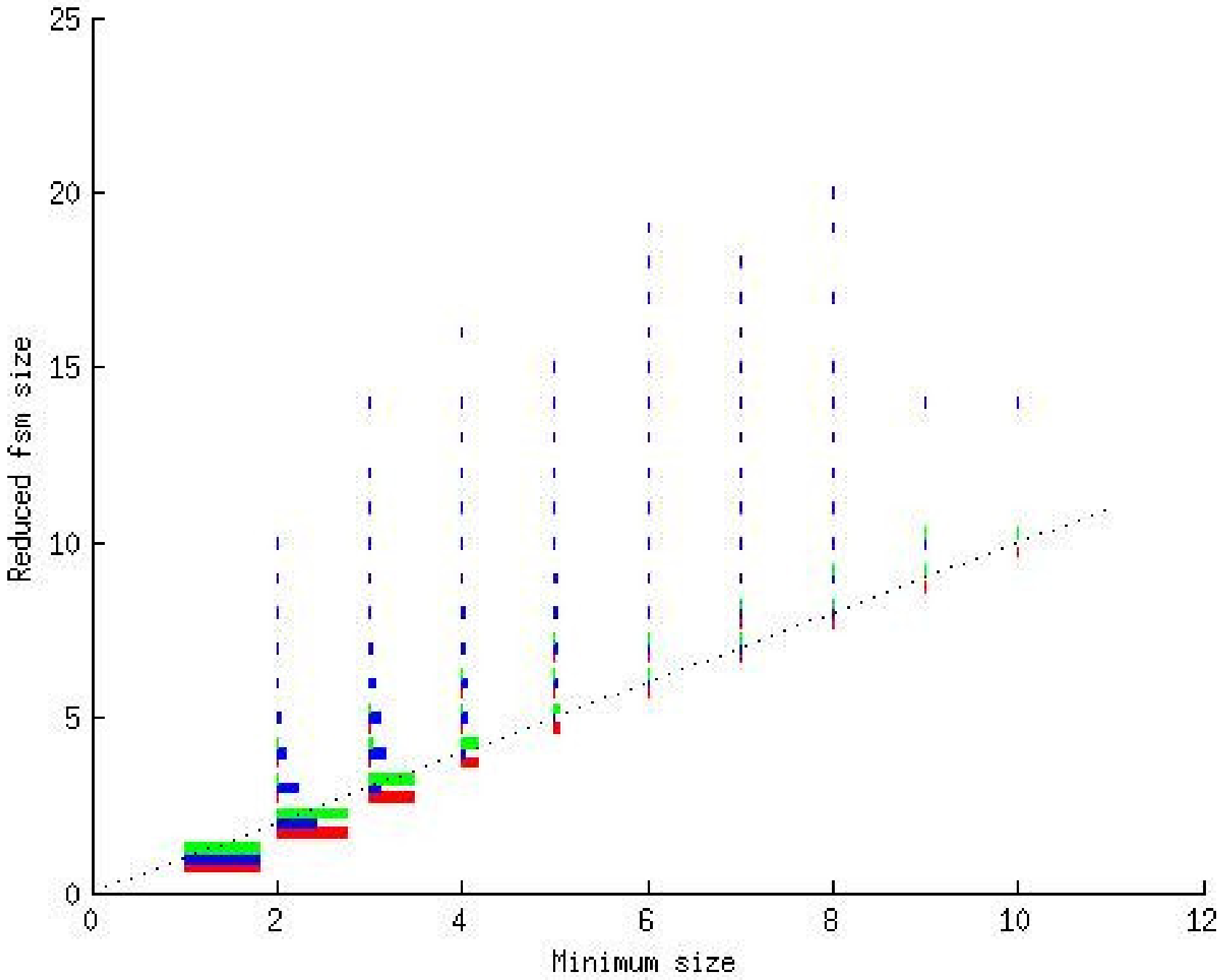
10
15
20
25
0
10
20
30
40
50
60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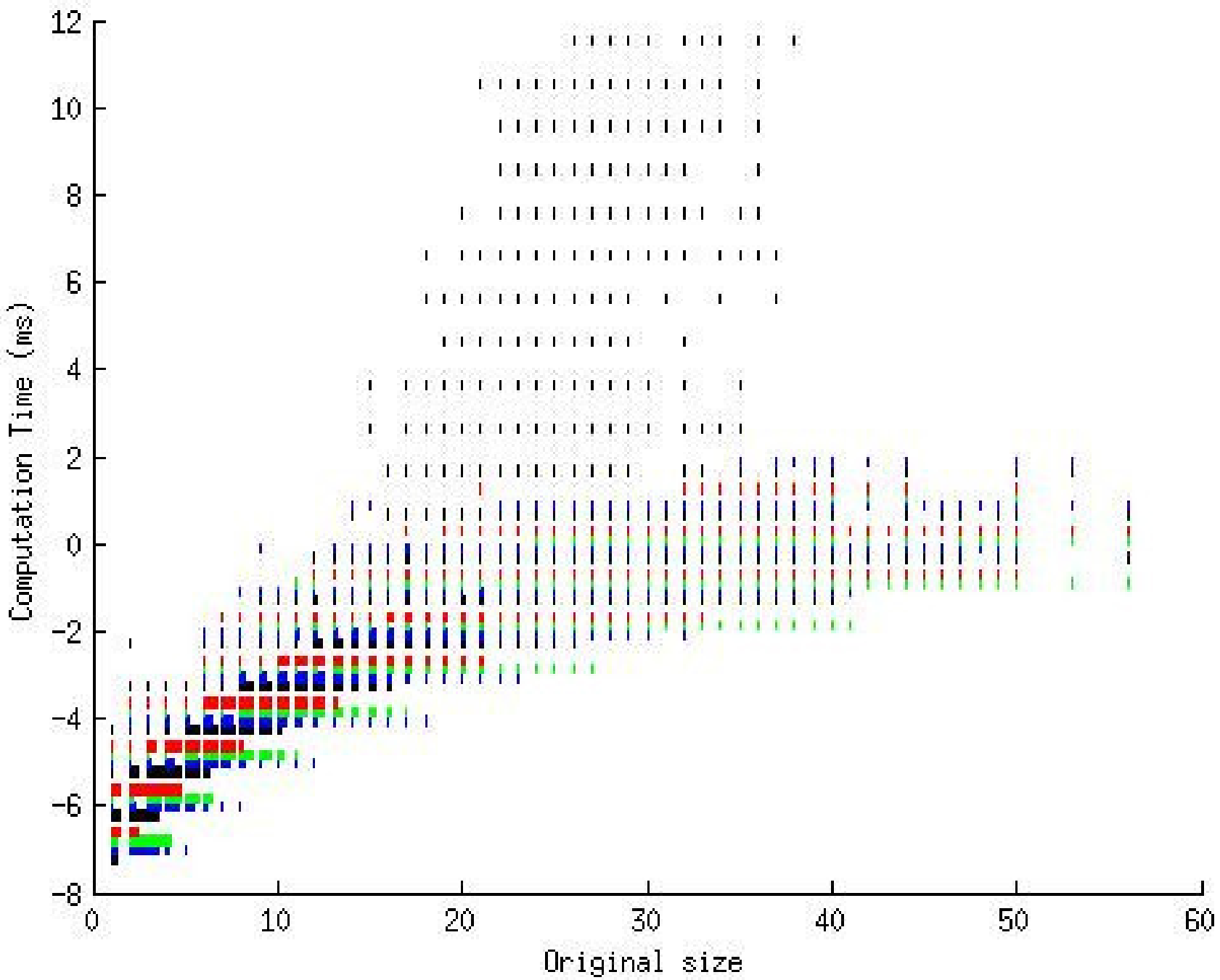
8
10
12


Computation Time (ms)
Original size
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-4
-6
-8
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10
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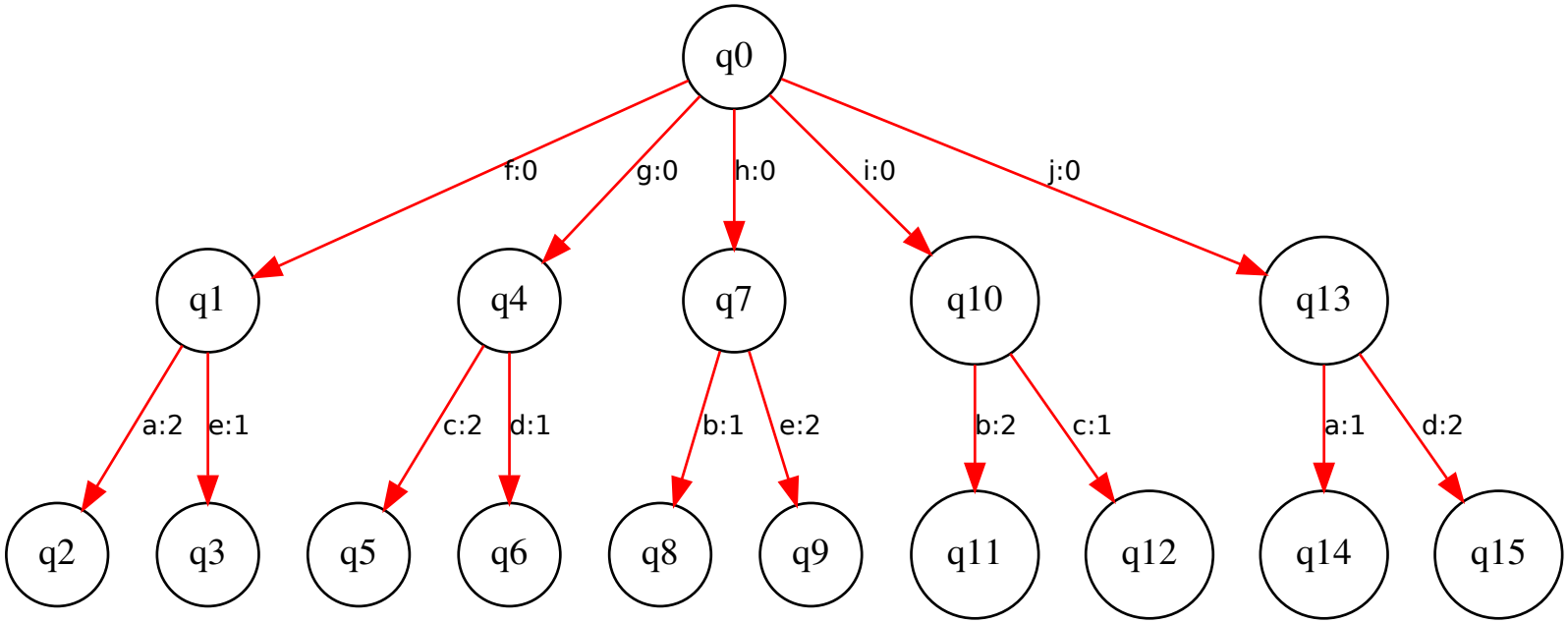
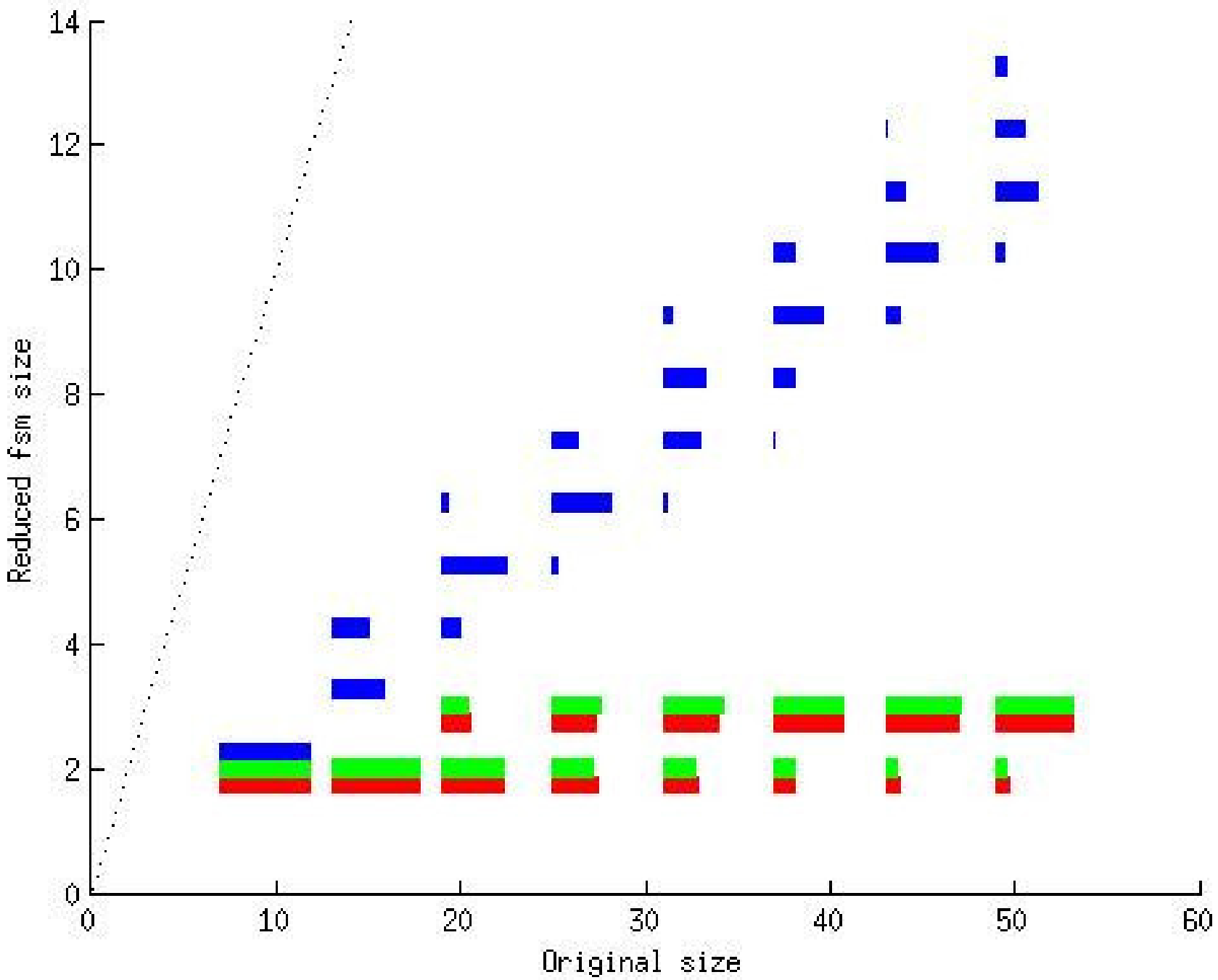
30
40
50
60

Pathological Tree



Each of the states at depth 1 is incompatible with exactly two others. This creates a distinction graph consisting of disjoint rings.


Reduced fsm size
Original size
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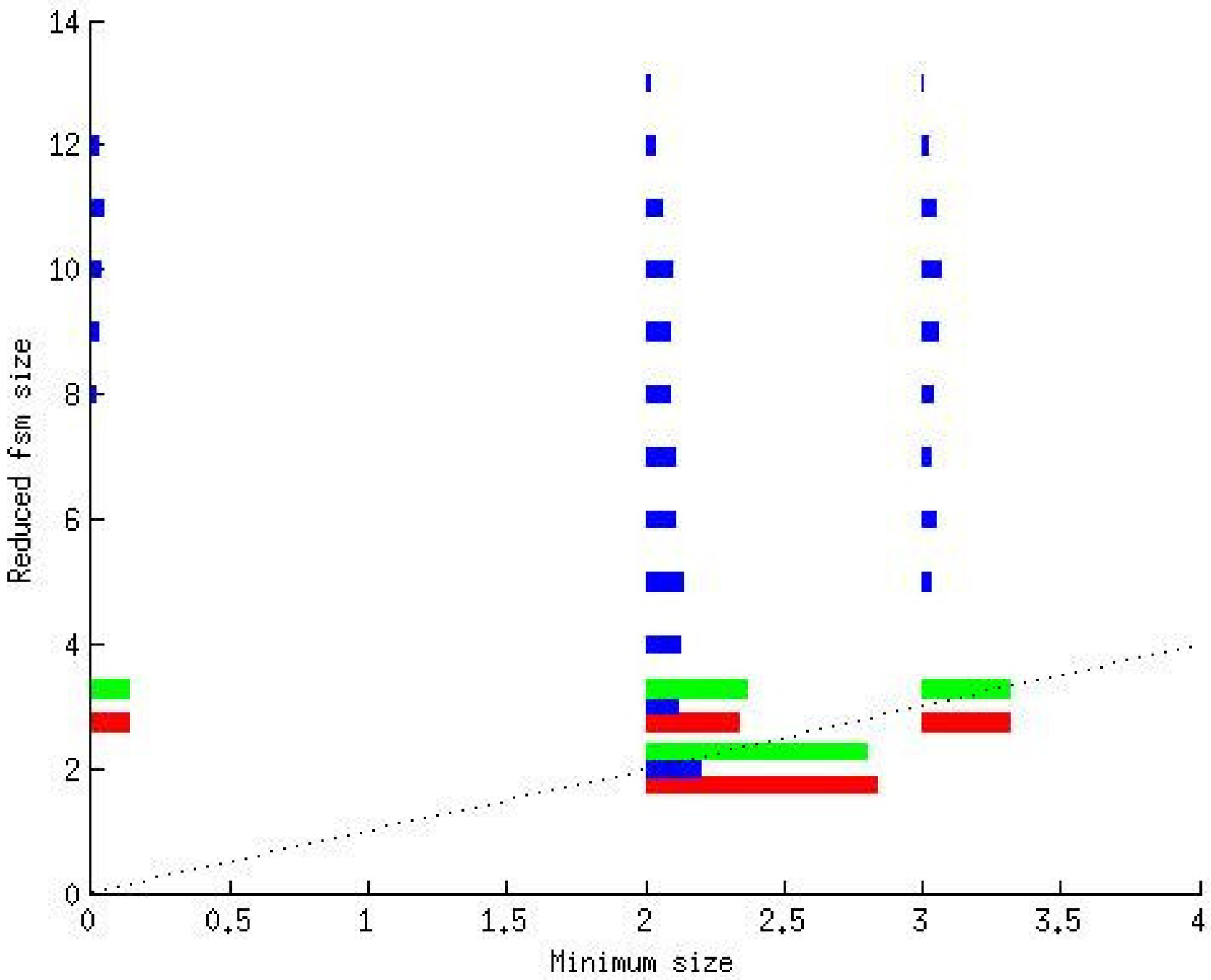
Reduced fsm size
Minimum size
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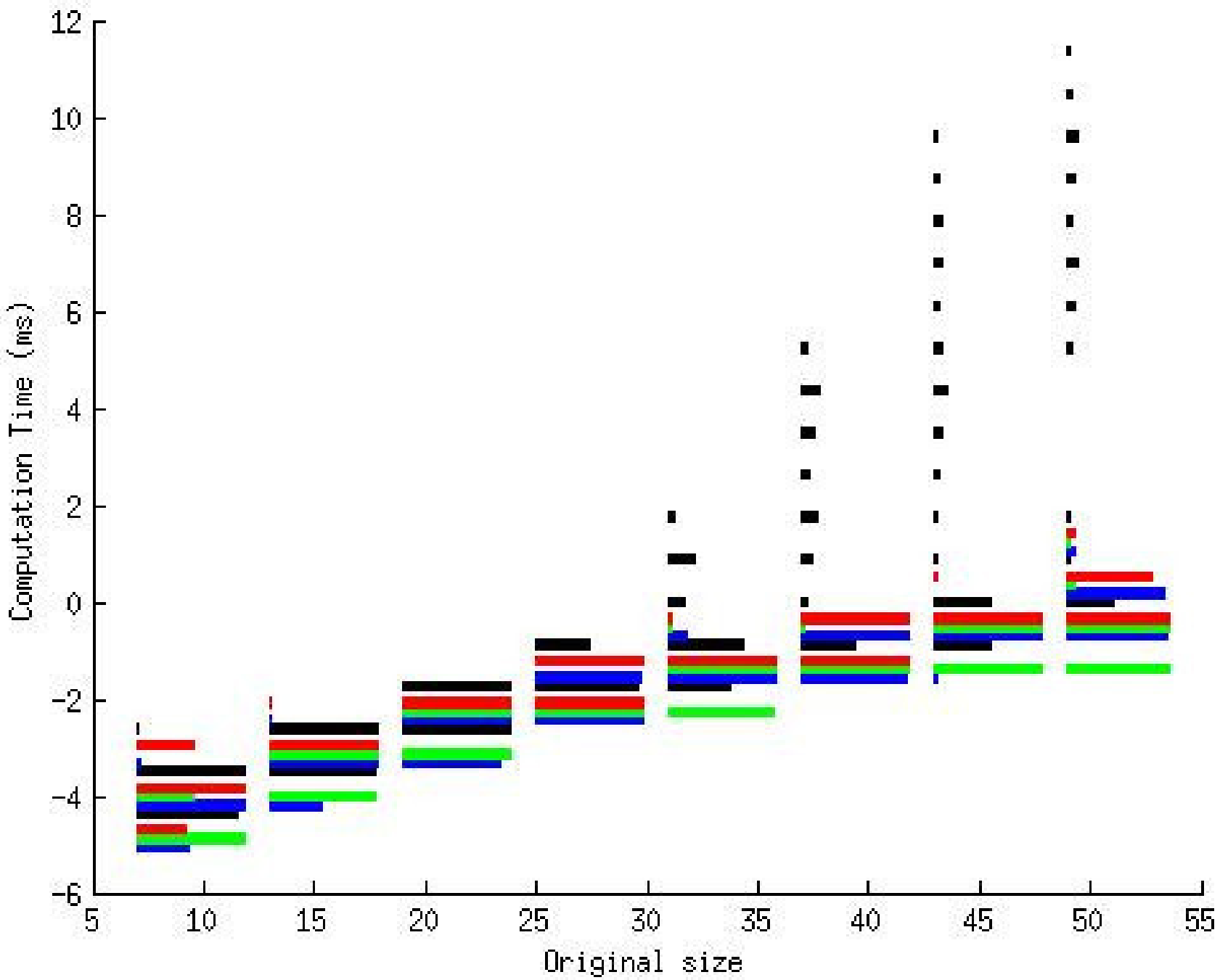
2.5
3
3.5
4


Computation Time (ms)
Original size
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-4
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