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| --- | --- | --- | --- |
| P | Q |  |  |
| T | T | F | F |
| T | F | T | T |
| F | T | T | T |
| F | F | T | T |

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| --- | --- | --- | --- | --- | --- | --- | --- |
| P | Q |  |  | ( |  |  |  |
| T | T | F | T | F | F | F | F |
| T | F | T | T | T | T | F | T |
| F | T | T | T | T | F | T | T |
| F | F | T | F | F | F | F | F |

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| --- | --- | --- | --- | --- |
| Smoke | Fire |  |  |  |
| T | T | F | T | T |
| T | F | T | T | T |
| F | T | F | F | F |
| F | F | F | T | T |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Smoke | Fire | Heat |  |  |  |
| T | T | T | F | F | T |
| T | T | F | F | F | T |
| T | F | T | T | F | T |
| T | F | F | T | F | T |
| F | T | T | F | F | T |
| F | T | F | F | T | T |
| F | F | T | F | F | F |
| F | F | F | F | T | T |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Smoke | Fire | Heat |  |  |  |
| T | T | T | F | T | T |
| T | T | F | F | T | T |
| T | F | T | T | F | T |
| T | F | F | F | T | T |
| F | T | T | F | T | T |
| F | T | F | F | T | T |
| F | F | T | F | T | T |
| F | F | F | F | T | T |

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1. *If the unicorn is mythical, then it is immortal, but if it is not mythical, then it is a mortal mammal. If the unicorn is either immortal or a mammal, then it is horned. The unicorn is magical if it is horned.*

Mythical: the unicorn is mythical

Immortal: the unicorn is immortal

Mammal: the unicorn is a mammal

Horned: the unicorn is horned

Magical: the unicorn is magical

(a)

(b) CNF:

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(c)

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| --- | --- | --- |
| Sentence # | Sentence | Inferred using: |
| 8 |  | Resolution of 2, 7 |
| 9 |  | Resolution of 3, 7 |
| 10 |  | Resolution of 5, 9 |
| 11 |  | Resolution of 6, 10 |

|  |  |  |
| --- | --- | --- |
| Sentence # | Sentence | Inferred using: |
| 8 |  | Resolution of 6, 7 |
| 9 |  | Resolution of 5, 8 |
| 10 |  | Resolution of 4, 8 |
| 11 |  | Resolution of 3, 9 |
| 12 |  | Resolution of 1, 10 |

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| Sentence # | Sentence | Inferred using: |
| 8 |  | Resolution of 5, 7 |
| 9 |  | Resolution of 4, 7 |
| 10 |  | Resolution of 3, 8 |
| 11 |  | Resolution of 1, 9 |

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| --- | --- | --- |
|  | Figure 1 | Figure 2 |
| Decomposable | Yes, all the gates are decomposable | Yes, all the gates are decomposable |
| Deterministic | No, the top-most OR gate is not deterministic since the initialization of A=1, B=1, C=1, D=1 causes both children to be true | No, there is an OR gate with inputs (, ( |
| Smooth | No, the left-most AND gate has inputs and | Yes, all the gates are smooth |





|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| A | B |  |  |  |
| T | T | F | F | F |
| T | F | F | T | T |
| F | T | T | F | T |
| F | F | F | F | F |

(a) Satisfiable truth assignments: A=T, B=T; A=F, B=T

= 0.03 + 0.27 = 0.34

(b) The count on the root is the same as the Weighted Model Count for a decomposable, deterministic and NNF circuit.

(c)

AND gates:

OR gates:

0.34

AND gates:

= 0.17

0.33

OR gate: