

Boolean value expression($\mathcal{B} : E_B \mapsto \mathbb{B}$)

1. $\mathcal{B}(\langle bvep_1 \rangle) \triangleq \mathcal{B}(\langle bvep_1 \rangle \text{ or } \langle bvep_2 \rangle) | \mathcal{B}(\langle bvep_1 \rangle \text{ and } \langle bvep_2 \rangle) | \mathcal{B}(\langle bvep_1 \rangle \text{ xor } \langle bvep_2 \rangle) | \mathcal{B}(\text{not } \langle bvep \rangle) | \mathcal{B}(\langle vexp \rangle \text{ is true}) | \mathcal{B}(\langle bvep \rangle \text{ is false}) | \mathcal{B}(\langle bvep \rangle \text{ is unknown}) | \mathcal{B}(\langle bvep \rangle \text{ is not true}) | \mathcal{B}(\langle bvep \rangle \text{ is not false}) | \mathcal{B}(\langle bvep \rangle \text{ is not unknown}) | \mathcal{B}(\langle nvep_1 \rangle = \langle nvep_2 \rangle) | \mathcal{B}(\langle nvep_1 \rangle \neq \langle nvep_2 \rangle) | \mathcal{B}(\langle nvep_1 \rangle > \langle nvep_2 \rangle) | \mathcal{B}(\langle nvep_1 \rangle < \langle nvep_2 \rangle) | \mathcal{B}(\langle nvep_1 \rangle \geq \langle nvep_2 \rangle) | \mathcal{B}(\langle nvep_1 \rangle \leq \langle nvep_2 \rangle) | \mathcal{B}(\langle nvep \rangle \text{ between } \langle nvep_1 \rangle \text{ and } \langle nvep_2 \rangle) | \mathcal{B}(\text{exists } \langle subquery \rangle) | \mathcal{B}(\langle bvep \rangle \text{ is null}) | \mathcal{B}(\langle bvep \rangle \text{ is not null})$
2. $\mathcal{B}(\langle bvep_1 \rangle \text{ or } \langle bvep_2 \rangle) \triangleq \mathcal{B}(\langle bvep_1 \rangle) \vee \mathcal{B}(\langle bvep_2 \rangle)$
3. $\mathcal{B}(\langle bvep_1 \rangle \text{ and } \langle bvep_2 \rangle) \triangleq \mathcal{B}(\langle bvep_1 \rangle) \wedge \mathcal{B}(\langle bvep_2 \rangle)$
4. $\mathcal{B}(\langle bvep_1 \rangle \text{ xor } \langle bvep_2 \rangle) \triangleq \mathcal{B}(\langle bvep_1 \rangle) \oplus \mathcal{B}(\langle bvep_2 \rangle)$
5. $\mathcal{B}(\text{not } \langle bvep \rangle) \triangleq \neg \mathcal{B}(\langle bvep \rangle)$
6. $\mathcal{B}(\langle vexp \rangle \text{ is true}) \triangleq \mathcal{B}(\langle vexp \rangle) = \text{true}$
7. $\mathcal{B}(\langle bvep \rangle \text{ is false}) \triangleq \mathcal{B}(\langle bvep \rangle) = \text{false}$
8. $\mathcal{B}(\langle bvep \rangle \text{ is unknown}) \triangleq \mathcal{B}(\langle bvep \rangle) = \text{null}$
9. $\mathcal{B}(\langle bvep \rangle \text{ is not true}) \triangleq \mathcal{B}(\langle bvep \rangle) \neq \text{true}$
10. $\mathcal{B}(\langle bvep \rangle \text{ is not false}) \triangleq \mathcal{B}(\langle bvep \rangle) \neq \text{false}$
11. $\mathcal{B}(\langle bvep \rangle \text{ is not unknown}) \triangleq \mathcal{B}(\langle bvep \rangle) \neq \text{null}$
12. $\mathcal{B}(\langle nvep_1 \rangle = \langle nvep_2 \rangle) \triangleq \mathcal{N}(\langle nvep_1 \rangle) = \mathcal{N}(\langle nvep_2 \rangle)$
13. $\mathcal{B}(\langle nvep_1 \rangle \neq \langle nvep_2 \rangle) \triangleq \mathcal{N}(\langle nvep_1 \rangle) \neq \mathcal{N}(\langle nvep_2 \rangle)$
14. $\mathcal{B}(\langle nvep_1 \rangle > \langle nvep_2 \rangle) \triangleq \mathcal{N}(\langle nvep_1 \rangle) > \mathcal{N}(\langle nvep_2 \rangle)$
15. $\mathcal{B}(\langle nvep_1 \rangle < \langle nvep_2 \rangle) \triangleq \mathcal{N}(\langle nvep_1 \rangle) < \mathcal{N}(\langle nvep_2 \rangle)$
16. $\mathcal{B}(\langle nvep_1 \rangle \geq \langle nvep_2 \rangle) \triangleq \mathcal{N}(\langle nvep_1 \rangle) \geq \mathcal{N}(\langle nvep_2 \rangle)$
17. $\mathcal{B}(\langle nvep_1 \rangle \leq \langle nvep_2 \rangle) \triangleq \mathcal{N}(\langle nvep_1 \rangle) \leq \mathcal{N}(\langle nvep_2 \rangle)$
18. $\mathcal{B}(\langle nvep \rangle \text{ between } \langle nvep_1 \rangle \text{ and } \langle nvep_2 \rangle) \triangleq (\mathcal{N}(\langle nvep \rangle) \leq \mathcal{N}(\langle nvep_2 \rangle)) \wedge (\mathcal{N}(\langle nvep \rangle) \geq \mathcal{N}(\langle nvep_1 \rangle))$
19. $\mathcal{B}(\langle vexp \rangle \text{ in } (\langle vexp_1 \rangle, \langle vexp_2 \rangle, \dots)) \triangleq \langle vexp \rangle \in (\langle vexp_1 \rangle, \langle vexp_2 \rangle, \dots)$
20. $\mathcal{B}(\text{exists } \langle subquery \rangle) \triangleq \mathcal{H}[\langle subquery \rangle] \neq \emptyset$
21. $\mathcal{B}(\langle bvep \rangle \text{ is null}) \triangleq \mathcal{B}(\langle bvep \rangle) = \text{null}$
22. $\mathcal{B}(\langle bvep \rangle \text{ is not null}) \triangleq \mathcal{B}(\langle bvep \rangle) \neq \text{null}$
23. $\mathcal{B}(\langle vexp \rangle) \triangleq \mathcal{B}(\langle nvep \rangle) | \mathcal{B}(\langle svep \rangle) | \mathcal{B}(\langle caseexp \rangle) | \mathcal{B}(\langle castexp \rangle) | \mathcal{B}(\langle cname \rangle) | \mathcal{B}(\text{null})$
24. $\mathcal{B}(\langle nvep \rangle) \triangleq \mathcal{B}(\text{cast}(\langle nvep \rangle \text{ as boolean}))$
25. $\mathcal{B}(\langle svep \rangle) \triangleq \mathcal{B}(\text{cast}(\langle svep \rangle \text{ as boolean}))$
26. $\mathcal{B}(\langle caseexp \rangle) \triangleq \mathcal{B}(\text{case when } \langle bvep \rangle \text{ then } \langle vexp_1 \rangle \text{ else } \langle vexp_2 \rangle)$
27. $\mathcal{B}(\text{case when } \langle bvep \rangle \text{ then } \langle vexp_1 \rangle \text{ else } \langle vexp_2 \rangle) \triangleq \begin{cases} \mathcal{B}(\langle vexp_1 \rangle); & \mathcal{B}(\langle bvep \rangle) = \text{true} \\ \mathcal{B}(\langle vexp_2 \rangle); & \mathcal{B}(\langle bvep \rangle) = \text{false} \end{cases}$
28. $\mathcal{B}(\langle castexp \rangle) \triangleq \mathcal{B}(\text{cast}(\langle nvep \rangle \text{ as boolean})) | \mathcal{B}(\text{cast}(\langle svep \rangle \text{ as boolean}))$
29. $\mathcal{B}(\text{cast}(\langle nvep \rangle \text{ as boolean})) \triangleq \begin{cases} \text{null}; & \mathcal{N}(\langle nvep \rangle) = \text{null} \\ \text{false}; & \mathcal{N}(\langle nvep \rangle) = 0 \\ \text{true}; & \text{otherwise} \end{cases}$
30. $\mathcal{B}(\text{cast}(\langle svep \rangle \text{ as boolean})) \triangleq \begin{cases} \text{null}; & \mathcal{S}(\langle svep \rangle) = \text{null} \\ \text{false}; & \mathcal{S}(\langle svep \rangle) = \text{"0"} | \text{"false"} | \text{""} \\ \text{true}; & \text{otherwise} \end{cases}$
31. $\mathcal{B}(\langle cname \rangle) \triangleq \mathcal{B}(\text{cast}(\mathcal{S}(\langle cname \rangle) \text{ as boolean}))$
32. $\mathcal{B}(\text{true}) \triangleq \text{true}$
33. $\mathcal{B}(\text{false}) \triangleq \text{false}$
34. $\mathcal{B}(\text{null}) \triangleq \text{null}$

Fig. 4: The full list semantic definition of boolean expression