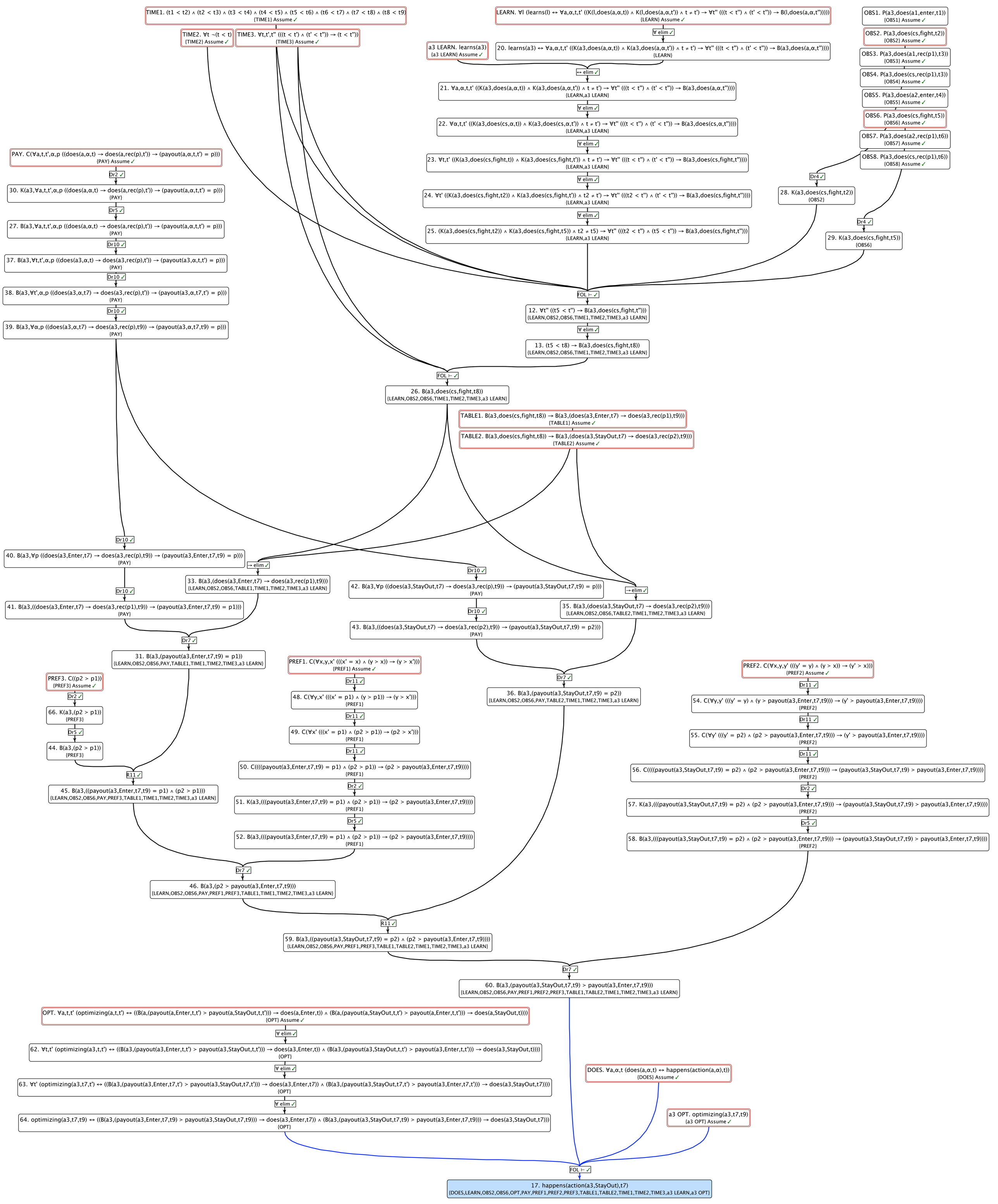
TIME1. (t1 < t2) ∧ (t2 < t3) ∧ (t3 < t4) ∧ (t4 < t5) ∧ (t5 < t6) ∧ (t6 < t7) ∧ (t7 < t8) ∧ (t8 < t9)
{TIME1} Assume ✓
TIME2. ∀t ¬(t < t)
{TIME2} Assume ✓
TIME3. ∀t,t',t'' (((t < t') ∧ (t' < t'')) → (t < t''))
{TIME3} Assume ✓
LEARN. ∀l (learns(l) ↔ ∀a,α,t,t' ((K(l,does(a,α,t)) ∧ K(l,does(a,α,t')) ∧ t ≠ t') → ∀t'' (((t < t'') ∧ (t' < t'')) → B(l,does(a,α,t''))))
{LEARN} Assume ✓
∀ elim ✓
a3 LEARN. learns(a3)
{a3 LEARN} Assume ✓
20. learns(a3) ↔ ∀a,α,t,t' ((K(a3,does(a,α,t)) ∧ K(a3,does(a,α,t')) ∧ t ≠ t') → ∀t'' (((t < t'') ∧ (t' < t'')) → B(a3,does(a,α,t''))))
{LEARN}
↔ elim ✓
21. ∀a,α,t,t' ((K(a3,does(a,α,t)) ∧ K(a3,does(a,α,t')) ∧ t ≠ t') → ∀t'' (((t < t'') ∧ (t' < t'')) → B(a3,does(a,α,t''))))
{LEARN,a3 LEARN}
∀ elim ✓
22. ∀α,t,t' ((K(a3,does(cs,α,t)) ∧ K(a3,does(cs,α,t')) ∧ t ≠ t') → ∀t'' (((t < t'') ∧ (t' < t'')) → B(a3,does(cs,α,t''))))
{LEARN,a3 LEARN}
∀ elim ✓
23. ∀t,t' ((K(a3,does(cs,fight,t)) ∧ K(a3,does(cs,fight,t')) ∧ t ≠ t') → ∀t'' (((t < t'') ∧ (t' < t'')) → B(a3,does(cs,fight,t''))))
{LEARN,a3 LEARN}
∀ elim ✓
24. ∀t' ((K(a3,does(cs,fight,t2)) ∧ K(a3,does(cs,fight,t')) ∧ t2 ≠ t') → ∀t'' (((t2 < t'') ∧ (t' < t'')) → B(a3,does(cs,fight,t''))))
{LEARN,a3 LEARN}
∀ elim ✓
25. (K(a3,does(cs,fight,t2)) ∧ K(a3,does(cs,fight,t5)) ∧ t2 ≠ t5) → ∀t'' (((t2 < t'') ∧ (t5 < t'')) → B(a3,does(cs,fight,t'')))
{LEARN,a3 LEARN}
OBS1. P(a3,does(a1,enter,t1))
{OBS1} Assume ✓
OBS2. P(a3,does(cs,fight,t2))
{OBS2} Assume ✓
OBS3. P(a3,does(a1,rec(p1),t3))
{OBS3} Assume ✓
OBS4. P(a3,does(cs,rec(p1),t3))
{OBS4} Assume ✓
OBS5. P(a3,does(a2,enter,t4))
{OBS5} Assume ✓
OBS6. P(a3,does(cs,fight,t5))
{OBS6} Assume ✓
OBS7. P(a3,does(a2,rec(p1),t6))
{OBS7} Assume ✓
OBS8. P(a3,does(cs,rec(p1),t6))
{OBS8} Assume ✓
Dr4 ✓
28. K(a3,does(cs,fight,t2))
{OBS2}
Dr4 ✓
29. K(a3,does(cs,fight,t5))
{OBS6}
PAY. C(∀a,t,t',α,p ((does(a,α,t) → does(a,rec(p),t')) → (payout(a,α,t,t') = p)))
{PAY} Assume ✓
Dr2 ✓
30. K(a3,∀a,t,t',α,p ((does(a,α,t) → does(a,rec(p),t')) → (payout(a,α,t,t') = p)))
{PAY}
Dr5 ✓
27. B(a3,∀a,t,t',α,p ((does(a,α,t) → does(a,rec(p),t')) → (payout(a,α,t,t') = p)))
{PAY}
Dr10 ✓
37. B(a3,∀t,t',α,p ((does(a3,α,t) → does(a3,rec(p),t')) → (payout(a3,α,t,t') = p)))
{PAY}
Dr10 ✓
38. B(a3,∀t',α,p ((does(a3,α,t7) → does(a3,rec(p),t')) → (payout(a3,α,t7,t') = p)))
{PAY}
Dr10 ✓
39. B(a3,∀α,p ((does(a3,α,t7) → does(a3,rec(p),t9)) → (payout(a3,α,t7,t9) = p)))
{PAY}
FOL ⊢ ✓
12. ∀t'' ((t5 < t'') → B(a3,does(cs,fight,t'')))
{LEARN,OBS2,OBS6,TIME1,TIME2,TIME3,a3 LEARN}
∀ elim ✓
13. (t5 < t8) → B(a3,does(cs,fight,t8))
{LEARN,OBS2,OBS6,TIME1,TIME2,TIME3,a3 LEARN}
FOL ⊢ ✓
26. B(a3,does(cs,fight,t8))
{LEARN,OBS2,OBS6,TIME1,TIME2,TIME3,a3 LEARN}
TABLE1. B(a3,does(cs,fight,t8)) → B(a3,(does(a3,Enter,t7) → does(a3,rec(p1),t9)))
{TABLE1} Assume ✓
TABLE2. B(a3,does(cs,fight,t8)) → B(a3,(does(a3,StayOut,t7) → does(a3,rec(p2),t9)))
{TABLE2} Assume ✓
Dr10 ✓
40. B(a3,∀p ((does(a3,Enter,t7) → does(a3,rec(p),t9)) → (payout(a3,Enter,t7,t9) = p)))
{PAY}
→ elim ✓
33. B(a3,(does(a3,Enter,t7) → does(a3,rec(p1),t9)))
{LEARN,OBS2,OBS6,TABLE1,TIME1,TIME2,TIME3,a3 LEARN}
Dr10 ✓
42. B(a3,∀p ((does(a3,StayOut,t7) → does(a3,rec(p),t9)) → (payout(a3,StayOut,t7,t9) = p)))
{PAY}
→ elim ✓
35. B(a3,(does(a3,StayOut,t7) → does(a3,rec(p2),t9)))
{LEARN,OBS2,OBS6,TABLE2,TIME1,TIME2,TIME3,a3 LEARN}
Dr10 ✓
41. B(a3,((does(a3,Enter,t7) → does(a3,rec(p1),t9)) → (payout(a3,Enter,t7,t9) = p1)))
{PAY}
Dr10 ✓
43. B(a3,((does(a3,StayOut,t7) → does(a3,rec(p2),t9)) → (payout(a3,StayOut,t7,t9) = p2)))
{PAY}
Dr7 ✓
31. B(a3,(payout(a3,Enter,t7,t9) = p1))
{LEARN,OBS2,OBS6,PAY,TABLE1,TIME1,TIME2,TIME3,a3 LEARN}
Dr7 ✓
36. B(a3,(payout(a3,StayOut,t7,t9) = p2))
{LEARN,OBS2,OBS6,PAY,TABLE2,TIME1,TIME2,TIME3,a3 LEARN}
PREF1. C(∀x,y,x' (((x' = x) ∧ (y > x)) → (y > x')))
{PREF1} Assume ✓
Dr11 ✓
48. C(∀y,x' (((x' = p1) ∧ (y > p1)) → (y > x')))
{PREF1}
Dr11 ✓
49. C(∀x' (((x' = p1) ∧ (p2 > p1)) → (p2 > x')))
{PREF1}
Dr11 ✓
50. C((((payout(a3,Enter,t7,t9) = p1) ∧ (p2 > p1)) → (p2 > payout(a3,Enter,t7,t9))))
{PREF1}
Dr2 ✓
51. K(a3,(((payout(a3,Enter,t7,t9) = p1) ∧ (p2 > p1)) → (p2 > payout(a3,Enter,t7,t9))))
{PREF1}
Dr5 ✓
52. B(a3,(((payout(a3,Enter,t7,t9) = p1) ∧ (p2 > p1)) → (p2 > payout(a3,Enter,t7,t9))))
{PREF1}
PREF2. C(∀x,y,y' (((y' = y) ∧ (y > x)) → (y' > x)))
{PREF2} Assume ✓
Dr11 ✓
54. C(∀y,y' (((y' = y) ∧ (y > payout(a3,Enter,t7,t9))) → (y' > payout(a3,Enter,t7,t9))))
{PREF2}
Dr11 ✓
55. C(∀y' (((y' = p2) ∧ (p2 > payout(a3,Enter,t7,t9))) → (y' > payout(a3,Enter,t7,t9))))
{PREF2}
Dr11 ✓
56. C((((payout(a3,StayOut,t7,t9) = p2) ∧ (p2 > payout(a3,Enter,t7,t9))) → (payout(a3,StayOut,t7,t9) > payout(a3,Enter,t7,t9))))
{PREF2}
Dr2 ✓
57. K(a3,(((payout(a3,StayOut,t7,t9) = p2) ∧ (p2 > payout(a3,Enter,t7,t9))) → (payout(a3,StayOut,t7,t9) > payout(a3,Enter,t7,t9))))
{PREF2}
Dr5 ✓
58. B(a3,(((payout(a3,StayOut,t7,t9) = p2) ∧ (p2 > payout(a3,Enter,t7,t9))) → (payout(a3,StayOut,t7,t9) > payout(a3,Enter,t7,t9))))
{PREF2}
PREF3. C((p2 > p1))
{PREF3} Assume ✓
Dr2 ✓
66. K(a3,(p2 > p1))
{PREF3}
Dr5 ✓
44. B(a3,(p2 > p1))
{PREF3}
R11 ✓
45. B(a3,((payout(a3,Enter,t7,t9) = p1) ∧ (p2 > p1)))
{LEARN,OBS2,OBS6,PAY,PREF3,TABLE1,TIME1,TIME2,TIME3,a3 LEARN}
Dr7 ✓
46. B(a3,(p2 > payout(a3,Enter,t7,t9)))
{LEARN,OBS2,OBS6,PAY,PREF1,PREF3,TABLE1,TIME1,TIME2,TIME3,a3 LEARN}
R11 ✓
59. B(a3,((payout(a3,StayOut,t7,t9) = p2) ∧ (p2 > payout(a3,Enter,t7,t9))))
{LEARN,OBS2,OBS6,PAY,PREF1,PREF3,TABLE1,TABLE2,TIME1,TIME2,TIME3,a3 LEARN}
Dr7 ✓
60. B(a3,(payout(a3,StayOut,t7,t9) > payout(a3,Enter,t7,t9)))
{LEARN,OBS2,OBS6,PAY,PREF1,PREF2,PREF3,TABLE1,TABLE2,TIME1,TIME2,TIME3,a3 LEARN}
OPT. ∀a,t,t' (optimizing(a,t,t') ↔ ((B(a,(payout(a,Enter,t,t') > payout(a,StayOut,t,t'))) → does(a,Enter,t)) ∧ (B(a,(payout(a,StayOut,t,t') > payout(a,Enter,t,t'))) → does(a,StayOut,t))))
{OPT} Assume ✓
∀ elim ✓
62. ∀t,t' (optimizing(a3,t,t') ↔ ((B(a3,(payout(a3,Enter,t,t') > payout(a3,StayOut,t,t'))) → does(a3,Enter,t)) ∧ (B(a3,(payout(a3,StayOut,t,t') > payout(a3,Enter,t,t'))) → does(a3,StayOut,t))))
{OPT}
∀ elim ✓
63. ∀t' (optimizing(a3,t7,t') ↔ ((B(a3,(payout(a3,Enter,t7,t') > payout(a3,StayOut,t7,t'))) → does(a3,Enter,t7)) ∧ (B(a3,(payout(a3,StayOut,t7,t') > payout(a3,Enter,t7,t'))) → does(a3,StayOut,t7))))
{OPT}
∀ elim ✓
64. optimizing(a3,t7,t9) ↔ ((B(a3,(payout(a3,Enter,t7,t9) > payout(a3,StayOut,t7,t9))) → does(a3,Enter,t7)) ∧ (B(a3,(payout(a3,StayOut,t7,t9) > payout(a3,Enter,t7,t9))) → does(a3,StayOut,t7)))
{OPT}
DOES. ∀a,α,t (does(a,α,t) ↔ happens(action(a,α),t))
{DOES} Assume ✓
a3 OPT. optimizing(a3,t7,t9)
{a3 OPT} Assume ✓
FOL ⊢ ✓
17. happens(action(a3,StayOut),t7)
{DOES,LEARN,OBS2,OBS6,OPT,PAY,PREF1,PREF2,PREF3,TABLE1,TABLE2,TIME1,TIME2,TIME3,a3 LEARN,a3 OPT}