

人工智能基础作业 8

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10.14 解:

Action(Go(x,y,r)):

PRECOND: $In(x,r) \wedge In(y,r) \wedge At(Shakey,x)$

EFFECT: $\neg(At(Shakey,x)) \wedge At(Shakey,y)$

Action(Push(b,x,y,r)):

PRECOND: $At(Shakey,x) \wedge In(x,r) \wedge In(y,r) \wedge Box(b) \wedge At(b,x)$

EFFECT: $\neg(At(Shakey,x)) \wedge At(Shakey,y) \wedge \neg(At(b,x)) \wedge At(b,y)$

Action(ClimeUp(x,b)):

PRECOND: $At(Shakey,x) \wedge Box(b) \wedge At(b,x)$

EFFCET: $On(Shakey,b) \wedge \neg(On(Shakey,Floor))$

Action(ClimeDown(b,x)):

PRECOND: $On(Shakey,b) \wedge Box(b) \wedge At(b,x)$

EFFCET: $On(Shakey,Floor) \wedge \neg(On(Shakey,b))$

Action(TurnOn(s,b)):

PRECOND: $On(Shakey,b) \wedge Box(b) \wedge Below(b,l)$

EFFCET: TurnedOn(l)

Action(TurnOff(s,b)):

PRECOND: $On(Shakey,b) \wedge Box(b) \wedge Below(b,l)$

EFFCET: $\neg(TurnedOn(l))$

12.1 解:

谓词:

Player(p): p 是一个玩家;

Mark(m): m 是一个标记;

Squares(q): q 是一个方格;

常量:

Xp, Op: 双方玩家;

X, O, Blank: 标记;

Q11,Q12,Q13,Q21,Q22,Q23,Q31,Q32,Q33: 方格;

S0: 初始情景;

永久有效的谓词:

MarkOf(p): 玩家 p 的得分;

Wining(q1,q2,q3): 按 q1,q2,q3 的序列强制赢得比赛;

Opponent(p): 玩家 p 的对手;

情景演算:

Result(a,s);

Poss(a,s);

状态:

TurnAt(s): 当前轮到谁下棋;

Marked(q,s): 情景 s 下方格 q 中的标记;

Wins(p,s): 玩家 p 在情景 s 下获胜;

动作:

Play(p,q): 玩家 p 在 q 出落子;

永久有效的公理:

A1. $\text{MarkOf}(Xp) = X$

A2. $\text{MarkOf}(Op) = O$

A3. $\text{OpponentOf}(Xp) = Op$

A4. $\text{OpponentOf}(Op) = Xp$

A5. $\forall p \text{ Player}(p) \iff p = Xp \vee p = Op$

A6. $\forall m \text{ Mark}(m) \iff m = X \vee m = O \vee m = \text{Blank}$

A7. $\forall q \text{ Square}(q) \iff q = Q11 \vee q = Q12 \dots \vee q = Q33$

A8. $\forall q1, q2, q3 \text{ WinPosition}(q1, q2, q3) \iff [q1 = Q11 \wedge q2 = Q12 \wedge q3 = Q13] \vee [q1 = Q21 \wedge q2 = Q22 \wedge q3 = Q23] \vee [q1 = Q31 \wedge q2 = Q32 \wedge q3 = Q33] \vee [q1 = Q11 \wedge q2 = Q21 \wedge q3 = Q31 \dots]$

A9. $\forall p, s \text{ Wins}(p, s) \iff \exists q1, q2, q3 \text{ WinPosition}(q1, q2, q3) \wedge \text{MarkAt}(q1) = \text{MarkAt}(q2) = \text{MarkAt}(q3) = \text{MarkOf}(p)$

A10. $\forall p, q \text{ Player}(p) \wedge \text{Square}(q) \Rightarrow \text{MarkAt}(q, \text{Result}(\text{Play}(p, q), s)) = \text{MarkOf}(p).$

A11. $\forall p, a, s \text{ TurnAt}(p, s) \Rightarrow \text{TurnAt}(\text{Opponent}(p), \text{Result}(a, s)).$

A12. $\text{Poss}(\text{Play}(p, q), s) \Rightarrow \text{TurnAt}(s) = p \wedge \text{MarkAt}(q, s) = \text{Blank}.$

A13. $X \neq O \neq \text{Blank}$

12.7 解:

a. $\forall w, s \ w \in \text{Water} \Rightarrow (\text{Centigrade}(0) < \text{Temperature}(w, s) < \text{Centigrade}(100)) \Leftrightarrow T(w \in \text{Liquid}, s)$

b. $\forall w, s \ w \in \text{Water} \Rightarrow (\text{Centigrade}(100) = \text{Temperature}(w, s)) \Leftrightarrow T(\text{Boil}(w), s)$

c. $\exists b \forall w \ w \in \text{Water} \wedge b \in \text{WaterBottles} \wedge \text{Has}(\text{John}, b, \text{Now}) \wedge \text{Inside}(w, b, \text{Now}) \Rightarrow T(w \in \text{Ice}, \text{Now})$

d. $\text{Perrier} \subset \text{Water}$

e. $\exists b \forall w \ w \in \text{Water} \wedge b \in \text{WaterBottles} \wedge \text{Has}(\text{John}, b, \text{Now}) \wedge \text{Inside}(w, b, \text{Now}) \Rightarrow w \in \text{Perrier}$

f. **RTLiquidSubstance** 表示室温下为液体的物质:

$\forall w \ w \in \text{RTLiquidSubstance} \Rightarrow \exists fp \ \text{FreezingPoint}(w, fp)$

g. $\forall w, a \ w \in \text{Water} \wedge a \in \text{Alcohol} \wedge \text{Volume}(w) = \text{Liters}(1) \wedge \text{Volume}(a) = \text{Liters}(1) \Rightarrow \text{Mass}(w) > \text{Mass}(a)$

12.11 解:

A1. $\text{Initiates}(e, \text{HaveArrow}(a), t) \Leftrightarrow e = \text{Start}$

A2. $\text{Terminates}(e, \text{HaveArrow}(a), t) \Leftrightarrow e \in \text{Shootings}(a)$

A3. $T(\text{TurnRight}(a), i) \Leftrightarrow$

$[\exists h \text{ Meets}(h, i) \wedge T(\text{FacingSouth}(a), h) \Rightarrow$

$\text{Clipped}(\text{FacingSouth}(a), i) \wedge \text{Restored}(\text{FacingWest}(a), i)] \vee$

$[\exists h \text{ Meets}(h, i) \wedge T(\text{FacingWest}(a), h) \Rightarrow$

$\text{Clipped}(\text{FacingWest}(a), i) \wedge \text{Restored}(\text{FacingNorth}(a), i)] \vee$

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A4. $T(\text{TurnLeft}(a), i)$ 与 A3 类似

A5. $T(\text{GetGold}(a), i) \Leftrightarrow$

$[\exists h T(\text{HandEmpty}(a), h) \Rightarrow$

$\text{Clipped}(\text{HandEmpty}(a), i) \wedge \text{Restored}(\text{HandGold}(a), i)]$

A6. $T(\text{Shoot}(a), i) \Leftrightarrow$

$[\exists h T(\text{HandArrow}(a), h) \Rightarrow$

$\text{Clipped}(\text{HandArrow}(a), i) \wedge \text{Restored}(\text{ArrowOff}(a), i)]$

12.12 解:

Starts(p,q): 事件 p 以事件 q 的开头;

Finish(p,q): 事件 p 以事件 q 的结尾;

During(p,q): 事件 p 在事件 q 期间;

Meets(p,q): 事件 p 结束后事件 q 接着开始;

Overlap(p,q): 事件 p 和事件 q 有重叠;

Before(p,q): 事件 p 在事件 q 之前;

各事件间的关系为:

Starts(IK,LK).

Finishes(PK,LK).

During(LK,LJ).

Meets(LK, PJ).

Overlap(LK,LO).

Before(IK, PK).

During(IK,LJ).

Before(IK, PJ).

Before(IK,LO).

During(PK,LJ).

Meets(PK, PJ).

During(PK,LO).

During(PJ,LJ).

Overlap(LJ,LO).

During(PJ,LO).