Príklady (ZNA všetky príklady, SZS len ak si chce opraviť počet bodov)

P1. príklad. $\mathbf{T = \{ q.0{,}6 \,;\, r.0{,}8 \,;\, p \leftarrow_L q \,\&_{G\,5,8}^{\;4}\, r.0{,}7 \}}$ je teória, kde $\&_{G\,5,8}^{\;4}$ je diskretizovaná spojka $\&_G$. Vypočítajte *pravdivosť výroku p* v teórii T.

P2. príklad. Zistite a zdôvodnite pre interpretáciu A či je/nie je *modelom programu P*.

$$\mathbf{P = \{ p(a,b).\frac{1}{2} \,;\, p(b,c).\frac{1}{3} \,;\, p(c,d).\frac{1}{4} \,;\, p(X,Z) \leftarrow_P p(X,Y) \,\&_G\, p(Y,Z).\frac{2}{3} \}.}$$

Napíšte *správnu odpoveď* na otázku **"?- p(a,c)."** vzhľadom k programu P.

$$A = \{ p(a,b).\frac{1}{2} \,;\, p(b,c).\frac{1}{3} \,;\, p(c,d).\frac{1}{4} \,;\, p(a,c).\frac{1}{2} \,;\, p(b,d).\frac{1}{6} \,;\, p(a,d).\frac{1}{9} \,;\, p(d,a).\frac{1}{9} \,;\, p(c,a).\frac{5}{12} \,;\, \}$$

P3. príklad Nadefinujte pojem "dobré auto" ako pravidlo fuzzy logického programu s použitím aspoň dvoch ľubovolných fuzzy predikátov a aspoň jednej fuzzy množiny v tele pričom použité operátory musia byť fuzzy operátory.
Toto pravidlo preveďte na príslušný SELECT v jazyku SQL.

Teória. (ZNA len znenia a všetky pomocné poddefinície, SZS aj dôkazy).

T1. Definícia *M* je model FLP *P* .....
T2. Pre I existuje C také, že a(C,I) ...
T3. T_P je monotónny ...
T4. Veta o aproximatívnej úplnosti ....

$P = \{A \leftarrow_p @(A) . 1\}$ program P

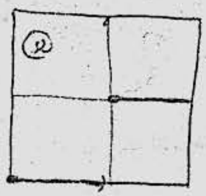
$@(0) = \frac{1}{4}$

$@(\frac{1}{4}) = \frac{3}{8}$

$@(\frac{3}{8}) = \frac{\frac{3}{4}+1}{4} = \frac{7}{16}$

$\vdots$

$T_P^n(0)(A) = \frac{1}{2} - \frac{1}{2^{n+1}}$



$P \cup \{B \leftarrow_p @(A) . 1\}$

$\&_p(\text{telo}, 1) = 1 * @(A)$ ...

$T_P(f)(B) = @(f(A))$

$T_P^{\omega}(0)(B) = 0$

$T_P^{\omega+1}(0)(B) = \frac{1}{2}$

potrebujeme predpoklad spojitosti

$A(x_1, \ldots, x_n) \leftarrow_p @(B_1(x_1), \ldots, B_n(x_n)) . 1$

fakty: $B_1(c_1^1) = y_{11}$ ... $B_n(c_1^n) = y_{n1}$

$B_1(c_2^1) = y_{12}$

$\vdots$ $\vdots$

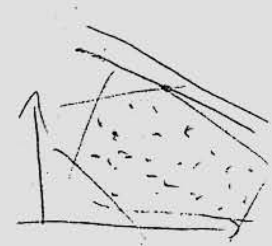
$B_1(c_m^1) = y_{1m}$ ... $B_n(c_m^n) = y_{nm}$

podobné:

- úloha lin. programovania

$\max @(y_1, \ldots, y_n) = \frac{c_1 y_1 \ldots c_n y_n}{c_1 + \ldots + c_n}$

nad množinou bodov v n-rozmernom priestore



$\boxed{6.11\ 2004}$

$\&_P(x,y) = x \cdot y$
$\vee_P(x,y) = x + y - x \cdot y$
$\&_L = \max(x+y-1, 0)$

$\to_G(x,y) = \begin{cases} 1, & \text{ak } x \leq y \\ y, & \text{inak} \end{cases}$

$\&_G = \min(x,y)$

① vyhodnotenie výrazu

$(p \,\&_L\, q) \to_G (r \vee_P q)$

$p \cdot \frac{1}{2}$
$q \cdot \frac{1}{4}$
$r \cdot \frac{1}{8}$

$\to_G (\&_L(p,q), \vee_P(r,q))$

$\to_G (\&_L(\frac{1}{2}, \frac{1}{4}), \vee_P(\frac{1}{8}, \frac{1}{4})) = 1$

$\&_L(\frac{1}{2}, \frac{1}{4}) = \max(\frac{1}{2} + \frac{1}{4} - 1, 0) = 0$

$\vee_P(\frac{1}{8}, \frac{1}{4}) = \frac{1}{8} + \frac{1}{4} - \frac{1}{8 \cdot 4} = \frac{3}{8} - \frac{1}{8 \cdot 4} = \frac{12-1}{32} = \frac{11}{32}$

---

② MP

$$\frac{(B, b), \ (H \Leftarrow_* B, r)}{H, \ \&_*(b, r)}$$

$q(x) \cdot \frac{1}{2}$
$r(x,y) \cdot \frac{1}{3}$
$p(x,y) \Leftarrow_L q(x) \,\&_G\, r(x,y) \cdot \frac{1}{3}$

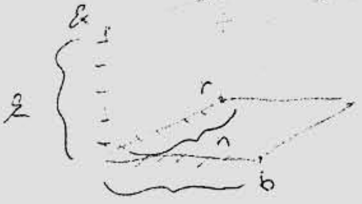
$\&_L(\frac{1}{3}, \&_G(\frac{1}{2}, \frac{1}{3})) = \max(\underbrace{\frac{1}{2} + \min(\frac{1}{2}, \frac{1}{3}) - 1}_{-\frac{1}{6}}, 0) = 0$

---

③ konjunktor

$$C^{k}_{m,n}(b,r)_p = \frac{\lceil k \cdot \left(\frac{\lceil m \cdot b \rceil}{m} \cdot \frac{\lceil n \cdot r \rceil}{n} \right) \rceil}{k}$$

nech je to Gödelov konjunktor,



$m = 2$ $\quad b = 0.4$
$n = 4$ $\quad r = 0.1$
$k = 6$

$$C^{6}_{2,4}(0.4, 0.1)_G = \frac{\lceil 6 \cdot \min\left(\frac{\lceil 2 \cdot 0.4 \rceil}{2}, \frac{\lceil 4 \cdot 0.1 \rceil}{4} \right) \rceil}{6} =$$

$$= \frac{\lceil 6 \cdot \min\left(\frac{1}{2}, \frac{1}{4} \right) \rceil}{6} = \frac{\lceil 6 \cdot \frac{1}{4} \rceil}{6} = \frac{2}{6} = \frac{1}{3}$$

MP:

$$\bar{f}(\forall\ A \Leftarrow @(B_1,\dots,B_n)) \geq r \implies \bar{f}.(\forall A\theta) \geq C_{\to}(@(b_1,\dots,b_n), r) \quad 1)$$

⋮

pre každé zo 4 pravidiel treba dokázať, že zachováva $\leq$

2) triviálne

3) ak je niečo v EDB, model musí byť lepší

Korektnosť MP –

$$\bar{f}(B) \geq b \ \wedge\ \bar{f}(B \to H) > r \implies \bar{f}(H) \geq C_{\to}(b, r).$$

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① $(p \to_G q) \to_L (r \vee_p q)$

$\to_L(x,y) = \min(1, 1-x+y)$

$\to_G(x,y) = \min(1, \frac{y}{x})$

$\vee_p(x,y) = x+y-x\cdot y$

$p = \frac{1}{2}$

$q = \frac{1}{4}$

$r = \frac{3}{4}$

$\frac{3}{4}+\frac{1}{4}-\frac{3\cdot 1}{4\cdot 4}$

$\min\left(1, \frac{\frac{1}{4}}{\frac{1}{2}}\right)$ $\quad \frac{1}{2} \quad 1-\frac{3}{16} = \frac{13}{16}$

$\min\left(1,\ 1-\min\left(1,\frac{\frac{1}{4}}{\frac{1}{2}}\right)+\left(\frac{3}{4}+\frac{1}{4}-\frac{3}{4}\cdot\frac{1}{4}\right)\right)$

$\min\left(1,\ 1-\frac{1}{2}+\frac{13}{16}\right)$

$\min\left(1,\ \frac{16-8+13}{16}\right) = \min\left(1, \frac{21}{16}\right) = 1$

---

② MP $\quad q(x).\frac{1}{4}$

$p(x) \leftarrow_L q(x).\frac{1}{3}$

$?- p(x)$

$p(x).\ \max\left(0, \frac{1}{4}+\frac{1}{3}-1\right) = 0$

---

③ $C^{k}_{m,n}(b,r)_{G} = \dfrac{\lceil k\cdot(\min(\frac{\lceil m\cdot b\rceil}{m}, \frac{\lceil n\cdot r\rceil}{m}))\rceil}{k}$

$C^{6}_{2,4}(0{,}4;1) = \dfrac{\lceil 6\cdot(\min(\frac{\lceil 2\cdot 0{,}4\rceil}{2}, \frac{\lceil 4\cdot 1\rceil}{4}))\rceil}{6} = \dfrac{\lceil 6\cdot \min(\frac{1}{2}, 1)\rceil}{6} =$

$= \dfrac{\lceil 6\cdot\frac{1}{2}\rceil}{6} = \frac{3}{6} = \frac{1}{2}$

④ T_P operator

$q(a) \cdot \frac{1}{2}$ $\qquad$ $p(a,c) \cdot \frac{1}{4}$

$q(b) \cdot \frac{2}{3}$ $\qquad$ $p(b,c) \cdot \frac{1}{3}$

$p(a,b) \cdot \frac{1}{4}$ $\qquad$ $p(c,d) \cdot \frac{1}{2}$

$p(x,z) \leftarrow_L p(x,y) \&_L p(y,z) \cdot \frac{1}{2}$

$q(y) \leftarrow_G q(x) \&_P p(x,y) \cdot \frac{1}{3}$

$T_P(f)(A)$ – akú max. hodnotu má atóm A v interpretácii f

$T_P^0(\emptyset) = \phi$

$T_P^1(\emptyset) = \{ q(a) \cdot \frac{1}{2}, q(b) \cdot \frac{2}{3}, p(a,b) \cdot \frac{1}{4}, p(a,c) \cdot \frac{1}{4}, p(b,c) \cdot \frac{1}{3}, p(c,d) \cdot \frac{1}{2} \}$

$T_P^2(\emptyset) = \{ q(a) \cdot \frac{1}{2}, q(b) \cdot \frac{2}{3}, p(a,b) \cdot \frac{1}{4}, p(a,c) \cdot \frac{1}{4}, p(a,d) \cdot 0, p(b,c) \cdot \frac{1}{3},$
$\quad p(b,d) \cdot 0, p(c,d) \cdot \frac{1}{2}, \underline{q(c) \cdot \frac{2}{9}} \}$

$T_P^3(\emptyset) = T_P^2(\emptyset) \cup \{ q(d) \cdot \frac{1}{9} \}$

$\underline{T_P^4(\emptyset) = T_P^3(\emptyset)}$

$T_P(\emptyset)(q(a)) = \max \{ \frac{1}{2}, \sup \{0\} \} = \frac{1}{2}$

$T_P(\emptyset)(q(b)) = \max \{ \frac{2}{3}, \sup \{ \&_G [(q(a) \cdot \frac{1}{2} \cdot p(a,b) \cdot \frac{1}{4}), \frac{1}{3}] \} \} =$
$= \max \{ \frac{2}{3}, \min (\frac{1}{8}, \frac{1}{3}) \} = \max \{ \frac{2}{3}, \frac{1}{8} \} = \frac{2}{3}$

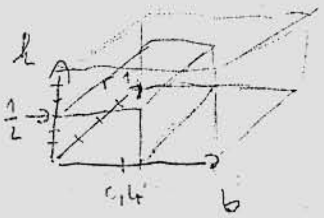
$T_P(\emptyset)(p(a,c)) = \max \{ \frac{1}{4}, \sup \{ \&_L (\frac{1}{2}, (p(a,b) \&_L p(b,c))) \} \} =$
$= \max \{ \frac{1}{4}, \max (0, \frac{1}{2} + (\max (0, \frac{1}{4} + \frac{1}{3} - 1)) - 1) \} =$
$= \frac{1}{4}$

$T_P(\emptyset)(p(a,d)) = \&_L (\frac{1}{2}, \&_L (p(a,c), p(c,d))) =$
$= \&_L (\frac{1}{2}, \&_L (\frac{1}{4}, \frac{1}{2})) = 0$

$q(c) = \sup \{ \&_G (\frac{1}{3}, \&_P (q(a), p(a,c))),$
$\quad \&_G (\frac{1}{3}, \&_P (q(b), p(b,c))) \} =$
$= \sup \{ \&_G (\frac{1}{3}, (\frac{1}{2} \cdot \frac{1}{4})), \&_G (\frac{1}{3}, (\frac{2}{3} \cdot \frac{1}{3})) \}$
$\sup \{ \min (\frac{1}{3}, \frac{1}{8}), \min (\frac{1}{3}, \frac{2}{9}) \} = \sup \{ \frac{1}{8}, \frac{2}{9} \} = \frac{2}{9}$

$T_P(\emptyset)(q(d)) = \sup \{ 0, \min (\frac{1}{3}, \frac{2}{9} \cdot \frac{1}{2}) \} = \sup \{ 0, \min (\frac{1}{3}, \frac{1}{9}) \} =$
$= \sup \{ 0, \frac{1}{9} \} = \underline{\underline{\frac{1}{9}}}$

výsledok $\frac{1}{2}$



(4) $q(a) \cdot \frac{1}{2}$

$p(a,b) \cdot \frac{1}{4}$

$p(b,c) \cdot \frac{3}{4}$

$p(a,c) \cdot \frac{1}{4}$

$q(x) \,\&_P\, p(x,y) \rightarrow_L q(y) \cdot \frac{1}{2}$

$p(x,y) \,\&_G\, p(y,z) \rightarrow_L p(x,z) \cdot \frac{1}{2}$

$Tp^0(\emptyset) = 0$

$Tp^1(\emptyset) = \{ q(a)\cdot\frac{1}{2},\ p(a,b)\cdot\frac{1}{4},\ p(b,c)\cdot\frac{3}{4},\ p(a,c)\cdot\frac{1}{4} \}$

$Tp^2(\emptyset) = Tp^1(\emptyset) \cup \{ \overset{p(a,c)\cdot}{} \max(\frac{1}{4}, \sup\{ \overbrace{\max(0, \underbrace{\min(p(a,b)\,\frac{1}{4},\ p(b,c)\,\frac{3}{4})}_{\cdot\frac{1}{4}} + \frac{1}{2} - 1)}^{0} \}$

$q(b) \cdot \overset{\max(0,\sup\{}{\max}(0, \overbrace{(q(a)\cdot\frac{1}{2} \cdot p(a,b)\cdot\frac{1}{4})}^{\frac{1}{8}} + \frac{1}{2} - 1)^{0} \}, * \} =$

$= \{ q(a)\cdot\frac{1}{2},\ p(a,b)\cdot\frac{1}{4},\ p(b,c)\cdot\frac{3}{4},\ p(a,c)\cdot\frac{1}{4},\ q(b).0 \},\ q(c).0 \}$

$\cancel{q(a) \,\&_P\, p(a,b) \rightarrow_L q(b) \cdot \frac{1}{2}}$

$\cancel{\max(0, \frac{1}{2}\cdot\frac{1}{4} + \frac{1}{2} - 1) \cdot \frac{1}{2}}$ $\qquad Tp^2(0) = Tp^1(0)$

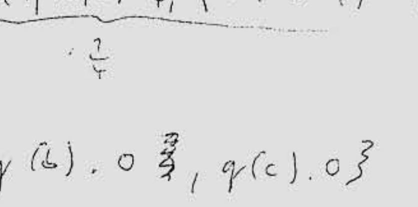
$* \quad q(c) \cdot \max(0, \sup\{ \max(0, q(a)\cdot\frac{1}{2} \cdot p(a,c)\cdot\frac{1}{4}) + \frac{1}{2} - 1) \} = q(c).0$

(5) dobrý-pes(meno) $\leftarrow_P$ (má-marád(meno) $\vee_G$ nemá-rád-svetr(meno)) $\&_L$ dobrá-rasa(meno)

dobrá-rasa(meno) $\leftarrow_G$ (aká-rasa(rasa, meno) $\&_P$ konečná-veľkosť(rasa, výška))

$\&_G$ malý(výška). 0,8

malý(x) = $\max(0; \min(1; \frac{3}{2} - \frac{x}{40}))$



EDB: má-marád(meno, FH)

nemá-rád-svetr(meno, FH)

aká-rasa(rasa, meno, FH)

konečná-veľkosť(rasa, výška, FH)

IDB: dobrá-rasa

```
CREATE VIEW dobrá-rasa (meno, PH) AS
    SELECT aká-rasa.meno, min( min((aká-rasa.PH * konciná-veľkosť.PH),
    (max (0, min (1, 3/2 - konciná-veľkosť.výška / ve)))), 0,8)
    FROM aká-rasa, konciná-veľkosť;
    WHERE aká-rasa.rasa = konciná-veľkosť.rasa


Q:  SELECT A.meno, (max (0, max (A.PH, B.PH) + C.PH - 1) * 0,9)
                               VG
    FROM má-ma-rád AS A, nemá-rád-svetlo AS B, dobrá-rasa AS C
    WHERE (A.meno = B.meno) AND (B.meno = C.meno) ?
```

Na dodinách zvykne byť taký futzy pes .. Najlepšie je, keď vidíte takej babku s tým súdkom na nohách ... (porvíth)

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dobra-rasa(meno) $\Leftarrow_G$ ako-rasa(rasa, meno) & φ .0,8

koncinná-veľkosť(rasa, výška)