Logic Exercises

6.5

* Solve the Cryptoarithmetic problem in figure 6.2 by hand, using the strategy of back tracking with forward checking and the MRV and least-constraining heuristics
  + The Problem

TWO Used Numbers{}

+TWO Set O = 1 possible domain for O: {1, 2, 3, 4, 5, 6, 7, 8, 9}

FOUR

TW1 Used Numbers{1, 2}

+TW1 \* the sum of the Ws needs to carry over a 1

F1U2 Possible choices for W:{5, 6, 7, 8, 9}

The sum of T+T needs to end in 1 and have 2 digits

No possible choices for W that fit the constraints

O cannot equal 1\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

TW2 Used Numbers{2,4}

+ TW2 O = 2

F2U4 Possible domain for W:{3}

The sum of w cannot be the sum of two digits because O is even

W cannot equal 1 because U cannot equal 2

T32 Used numbers{2, 3, 4, 6,}

+T32 Sum of T+T needs to be 2 digits

F264 Sum of T+T need to have the last digit equal 2

Possible Values of T{0, 1}

F can’t equal 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

TW3 Possible values of O: {3, 4, 5, 6, 7, 8, 9}

+TW3 Set O = 3

F3U6 Possible Values of W: { 5, 7, 8, 9}

+1

T53 Used Numbers:{3,6}

+T53 W = 5

F306 Possible values for T:{6} – not valid

No leading 0s

Last value in the sum of T+T needs to = 3

O cannot equal 3

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Possible values for O:{4, 5, 6, 7, 8, 9}

O = 4

TW4 Possible Values for T:{7}

+TW4 \* the values for W must be less than 10

F4U8 Possible values for W:{3}

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

734 \* fits constraints

+734 O = 4, R = 8, W = 3, U = 6, T = 7, F = 1

1468

8.24

* Represent the following sentences in first-order logic, using a consistent vocabulary (which you must define)
  + Some students took French in spring 2001
    - F = Took French
    - ꓱx F
  + Every student who takes French passes it
    - Pf = Passes French
    - ꓯx F(x) » Pf(x)
  + Only one student took Greek in spring 2001
    - G = Greek
    - ꓱ1 G
  + The best score in Greek is always higher than the best score in French
    - s = BestScore
    - ꓯs G(s) > F(s)
  + Every person who buys a policy is smart
    - p = person
    - S = isSmart
    - Bp = Buys a Policy
    - ꓯp Bp(p) »S(p)
  + No person buys an expensive policy
    - Ep =Buys Expensive Policy
    - ¬ꓱp Ep(p)
  + There is an agent who sells policies only to people who are not insured
    - Ni = not insured
    - Sp = sells Policy
    - a = agent
    - ꓱa Sp(Ni)
  + There is a barber who shaves all men in town who do not shave themselves
    - b = barber
    - S = shaves
    - M = men
    - Themself
    - ꓱb S(M ¬S(Themself)
  + A person in the UK, each of whose parents is a UK citizen or a UK resident, is a UK citizen by birth
    - CitUK = UK citizen
    - ResUK = UK Resident
    - InUk = in the UK
    - Parent = Has Parent
    - ꓯx,y InUK(x Parent(ResUK(y) V Parent (CitUK(y)) » CitUK(x)
  + A person born outside the UK, one of whose parents is a UK citizen by birth, is a UK citizen by descent
    - OutUK = outside the UK
    - ꓯx,y OutUK(x Parent(CitUK(y))) » CitUK(x)
  + Politicians can fool some of the people all of the time, and they can fool all of the people some of the time, but they can’t fool all of the people all of the time
    - Fool = Fool a person
    - x = Politician
    - Time = Time
    - ꓯx ꓱp x(Fool(p) ꓯTime) ˄ x(Fool(ꓯp) ꓱTime)
  + All Greeks speak the same language.
    - g = Greek person
    - Speak = Speak
    - l = Language
    - ꓯg Speak(l)