Knowledge Representation and Inference I (1987/88)

Tutorial exercises for Friday 13 Nov or Tue 17 Nov 1987

You need not hand these in beforehand; just attempt them, bring your efforts to the tutorial, because you will be asked to talk about them.

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1. Look at this cryptarithmetic puzzle. Each letter stands for a different digit:

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    A B C D E F
+ G E C A E F
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C E G B H C H
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(a) solve it.
(b) Assume a blind search is made, with every letter being assigned values 0 to 9 (i.e. ignoring the non-duplication condition). The tree has ten branches from each node; at the first level, the value of A is chosen, at the second the value of B is chosen, and so on. The non-duplication condition is ignored. What is the depth of the tree? Estimate the number of nodes visited in a depth-first search, and in a breadth-first search. What search procedure would be best?
(c) Now assume the tree takes account of the non-duplication condition. Estimate the size of the tree.
(d) in (a), you presumably made some easy deductions about constraints on the values of certain letters, e.g. H is F+F or F+F-10. Estimate how these would affect the size of the tree.
(e) Suggest a better way of constructing the tree than assigning digits to letters in alphabetic order.

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2. OPS5: warm-up exercises for a more serious exercise to follow:
*** YOU WILL NEED TO READ THE NOTES ON OPS5 (class handout) ***
(a) Create left-hand side expressions which will match
    (i) a number between -10 and 10
    (ii) any number
    (iii) any one of DOG CAT RABBIT TORTOISE
    (iv) a number divisible by 10
(b) Assuming the declaration
    (literalize Person name age sex mother father spouse marital-status)
create fragments of a left-hand side of a rule that will express the relation
    (i) <X> is a sibling of <Y>
    (ii) <X> is the paternal grandmother of <Y>
    (iii) <X> is an uncle of <Y>
(c) With the same 'literalize' declaration as above, write a rule that will find the youngest person known to the system, print that person's name and age and how much younger that person is than the next youngest.

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3. Justin Eidelburger, the notorious AI consultant, is exploring the idea of marketing a perfect noughts-and-crosses-playing program. Estimate the minimum memory required by such a program (eg would it run on an old Sinclair home computer?). It is NOT your job to set him straight about the marketability of such a product...