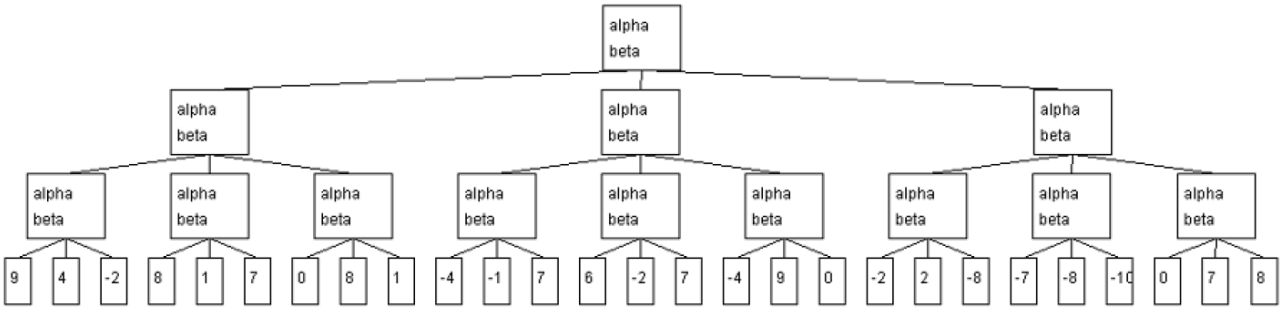
師大資工三 人工智慧 期末考(2011/6/21) Ch5~8

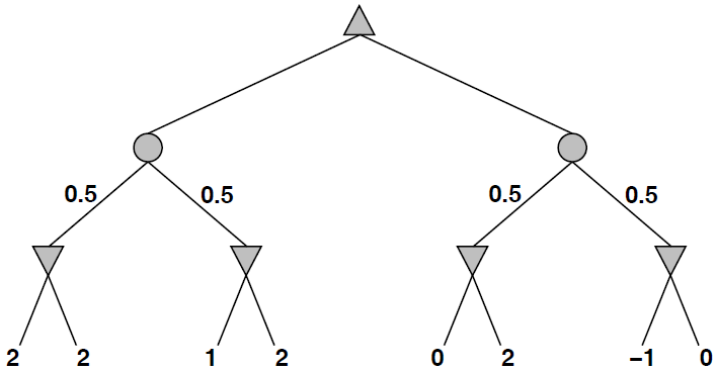
一、(15 分) Given a two-player game tree as follows. Assume that root is a MAX node.

(a) What is the best reward of the root node in this game tree? (5 分)

(b) If we perform a left-to-right alpha-beta pruning to this game tree, which nodes will be pruned? Circle all of these nodes. (10 分)



二、(15 分) This question considers pruning in games with chance nodes. Here is the complete game tree for a very simple game. Assume that the leaf nodes are to be evaluated in left-to-right order, and that before a leaf node is evaluated, we know nothing about its value—the range of possible values is $-\infty$ to ∞.



(a) Mark the value of all the internal nodes and indicate the best move at the root with an arrow.

(b) True/False: Given the values of the first six leaves, the seventh and eighth leaves are irrelevant and need not be evaluated.

(c) True/False: Given the values of the first seven leaves, the eighth leaf is irrelevant and need not be evaluated.

(d) Now suppose all the leaf node values are known to lie between –2 and 2 inclusive. After evaluating the first two leaves, what range of the following values can be deduced for the left-hand chance node?

(i) –2 to 2 (ii) 0 to 1 (iii) 0 to 2

(e) Circle all the leaves that need not be evaluated under the assumption in (d).

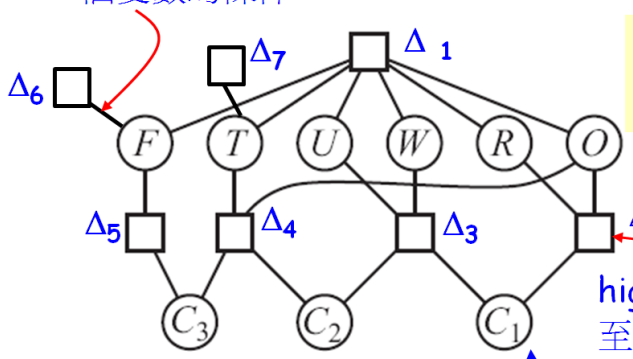
三、(12 分) Explain why it is a good heuristic to choose the variable that is most constrained but the value that is least constraining in a CSP (Constraint Satisfaction Problem) search.

四、(10 分) 下圖是處理「TWO+TWO=FOUR」的 constraint hypergraph。請你依同樣的規則，繪出「ONE+FOUR=FIVE」的 constraint hypergraph。

Example: the cryptarithmetic 密碼算數 problem

unary constraint:一個變數的條件
e.g., $F \neq 0$

$$\begin{array}{r} T\ W\ O \\ +\ T\ W\ O \\ \hline F\ O\ U\ R \end{array}$$



constraint hypergraph

high-order constraint:
至少三個變數間的條件
e.g., $O+O=R+10\cdot C_1$

auxiliary variable

- Variables: $F, T, U, W, R, O, C_1, C_2, C_3$
- Domains: {0,1, 2, …, 9} and {0,1}
- Constraints:
  - *Alldiff* (F, T, U, W, R, O) Δ_1
  - $O+O=R+10\cdot C_1$ Δ_2
  - $C_1+W+W= U +10\cdot C_2$ Δ_3
  - $C_2+T+T= O +10\cdot C_3$ Δ_4
  - $C_3= F$ Δ_5
  - $F\neq 0$ Δ_6
  - $T\neq 0$ Δ_7

$$\begin{array}{r} \text{TWO} \\ +\ \text{TWO} \\ \hline \text{FOUR} \end{array} \quad \begin{array}{r} 734 \\ +\ 734 \\ \hline 1468 \end{array} \qquad \begin{array}{r} \text{FIVE} \\ +\ \text{FOUR} \\ \hline \text{NINE} \end{array} \quad \begin{array}{r} 1254 \\ +\ 1980 \\ \hline 3234 \end{array}$$

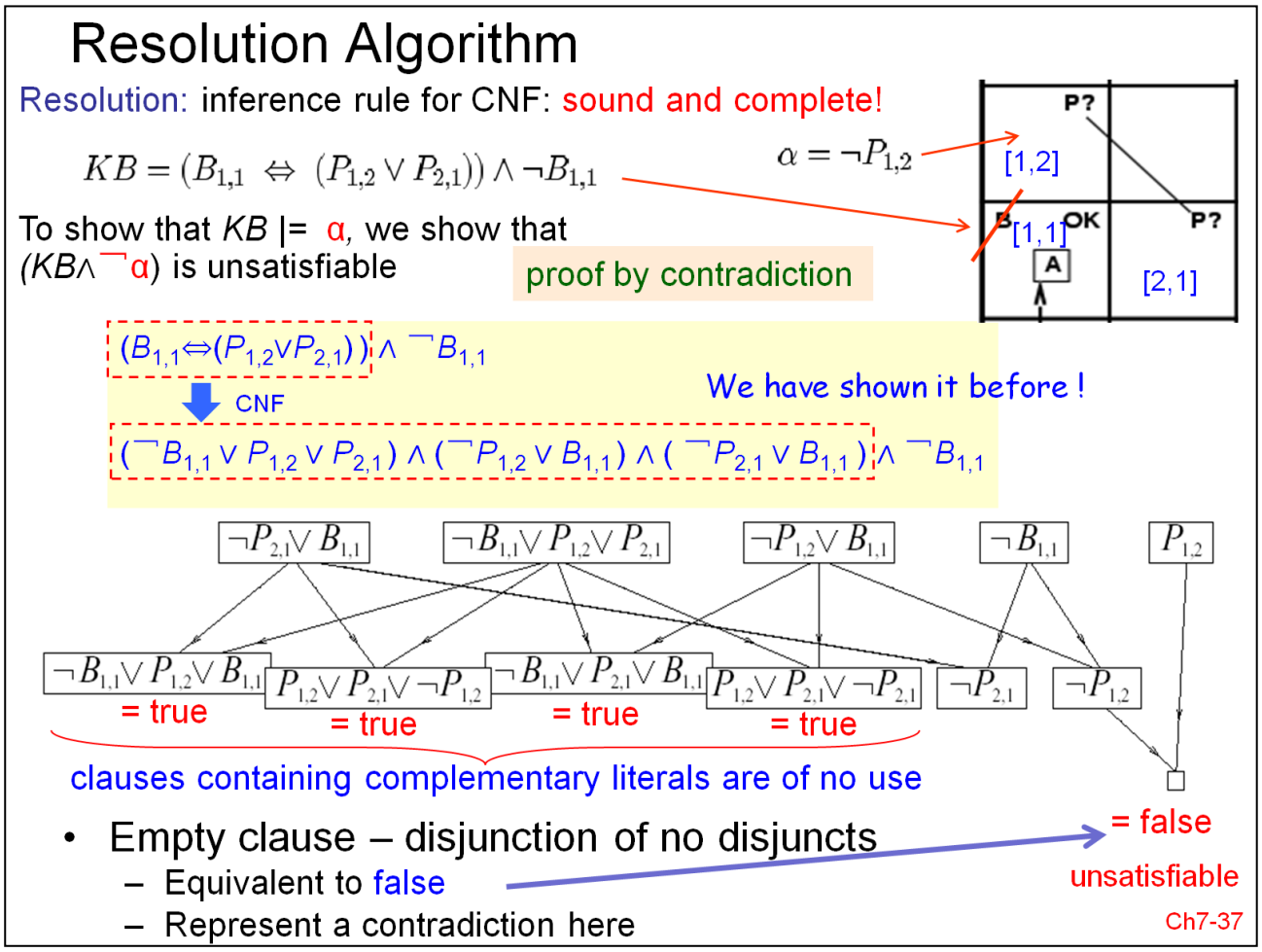
數字字謎的解謎與字謎產生器的研究

Ch6-5

五、(15 分) Which of the following statements are correct?

(a) False |= True.
(b) True |= False.
(c) (A ∧ B) |= (A ⇔ B).
(d) A ⇔ B |= A ∨ B.
(e) A ⇔ B |= ¬A ∨ B.

六、(10 分) 下圖是使用 Resolution Algorithm 證明[1, 2] is safe 的示意圖。請你依同樣的作法，繪出「證明[2, 1] is safe」的示意圖。



七、(21 分) Consider a vocabulary with the following symbols:

Occupation(p,o): A predicate that means that Person p has occupation o.

Customer(p1,p2): A predicate that means that Person p1 is a customer of Person p2.

Boss(p1,p2): A predicate that means that Person p1 is a boss of Person p2.

Doctor, Surgeon, Teacher, Lawyer, Actor: Constants that denote occupations.

Emily, Joe: Constants that denote Persons.

We can use these symbols to represent some assertions. Here are a few examples:

Occupation(Paul,Teacher) means "Paul is a Teacher."

Boss(Dino,Paul) means "Dino is a boss of Paul."

Occupation(Bob,Lawyer) ∧ Occupation(Bob,Teacher) means "Bob is a Lawyer and a Teacher."

∀x Occupation(x,Teacher) ⇒ Occupation(x,Actor) means "Every teacher is an actor."

Please use these symbols to write the assertions in parts a through g in first order logic.

(a) Emily is either a surgeon or a lawyer.

(b) Joe is an actor, but he also holds another job.

(c) All surgeons are doctors.

(d) Joe does not have a lawyer (meaning that he is not a customer of any lawyer.)

(e) Emily has a boss who is a lawyer.

(f) There exists a lawyer all of whose customers are doctors.

(g) Every surgeon has a lawyer.

八、(15 分) Which of the following are valid (necessarily true) sentences?

(a) $(\exists x\ x=x) \Rightarrow (\forall y\ \exists z\ y=z)$.

(b) $\forall x\ P(x) \vee \neg P(x)$.

(c) $\forall x\ Smart(x) \vee (x=x)$.