人工智能基础hw3

牛庆源 PB21111733

6.5 同时用带有前向检验、MRV和最少约束值启发式的回溯算法手工求解图6.2中的密码算数问题。

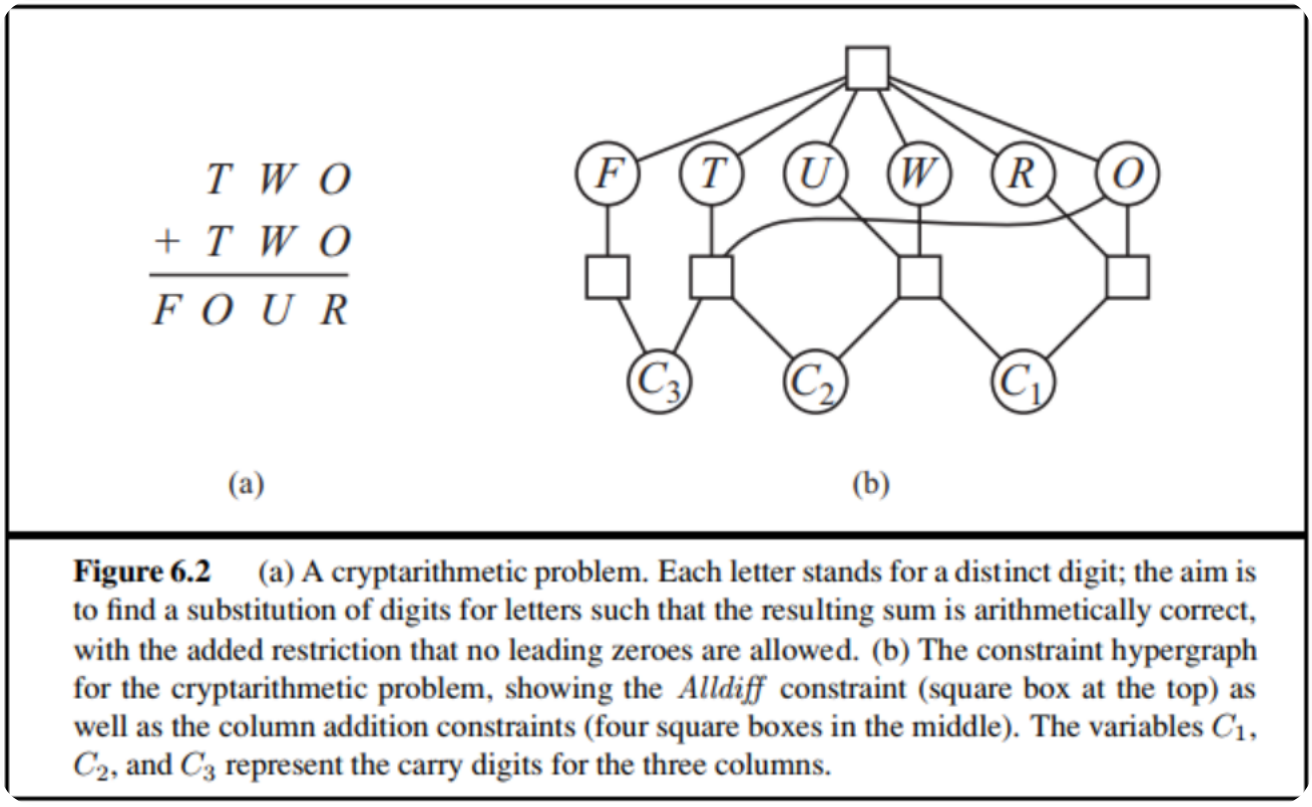

Figure 6.2 (a) A cryptarithmetic problem. Each letter stands for a distinct digit; the aim is to find a substitution of digits for letters such that the resulting sum is arithmetically correct, with the added restriction that no leading zeroes are allowed. (b) The constraint hypergraph for the cryptarithmetic problem, showing the *Alldiff* constraint (square box at the top) as well as the column addition constraints (four square boxes in the middle). The variables C_1, C_2, and C_3 represent the carry digits for the three columns.

1. 由于$C_3 = F$且$F \neq 0$可以得到$C_3 = F = 1$。
2. 取$C_2 = 0$，由$C_1 + W + W = U + 10 \times C_2$即$C_1 + W + W = U$。
3. 取$C_1 = 0$，由$O + O = R + 10 \times C_1$即$O + O = R < 10$。又由于$T + T = O + 10$ 和 $alldiff$ 可知$O = 2/4$，取$O = 4$，则有$R = 8$和$T = 7$。
4. 由C_1和C_2取0，可以得到$W + W = U$，由$alldiff$可以得到$W = 3$且$U = 6$。
5. 该问题的解为：$F = 1$，$R = 8$，$T = 7$，$W = 3$，$U = 6$。

6.11 用AC-3算法说明弧相容对图6.1中问题能够检测出部分赋值 WA = green，　V = red 的不相容。

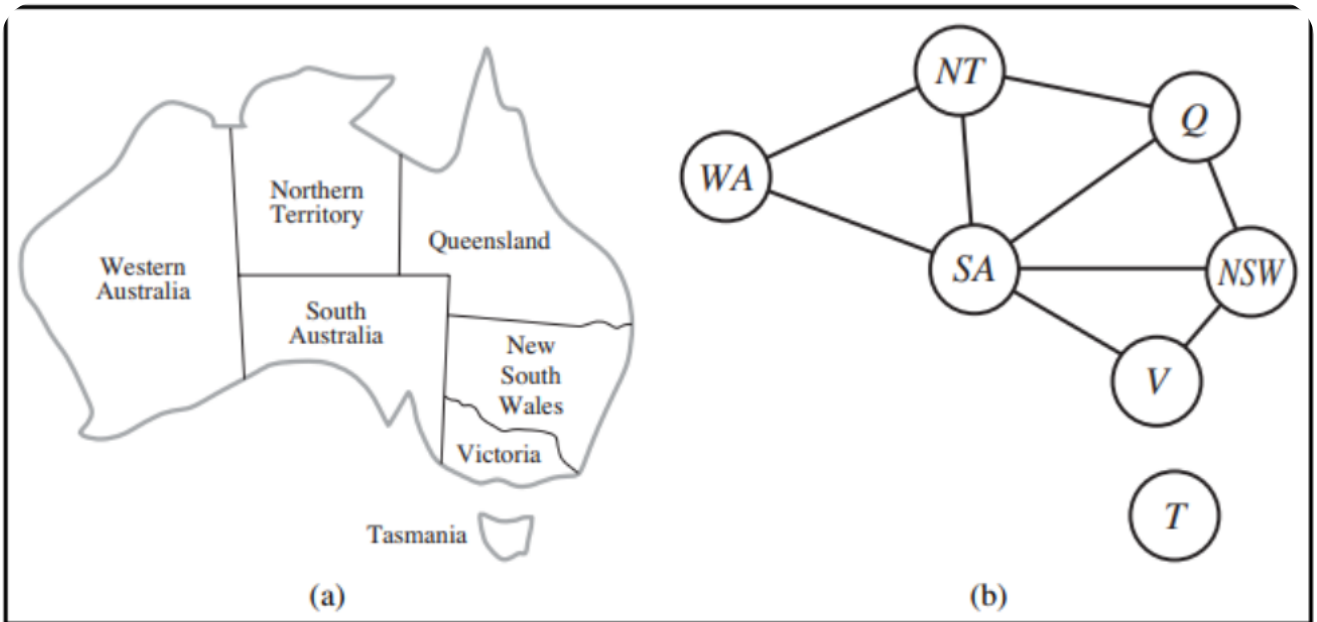

Figure 6.1　(a) The principal states and territories of Australia. Coloring this map can be viewed as a constraint satisfaction problem (CSP). The goal is to assign colors to each region so that no neighboring regions have the same color. (b) The map-coloring problem represented as a constraint graph.

1. 着色WA = green, V = red。
2. 移除WA-SA，SA≠green。
3. 移除V-SA，SA≠red，SA=blue。
4. 移除WA-NT，NT≠green。
5. 移除NT-SA，NT≠blue。
6. 移除NSW-V，NSW≠red。
7. 移除NSW-SA，NSW≠blue,NSW=green。
8. 移除NSW-Q，Q≠green。
9. 移除SA-Q，Q≠blue，Q=red。
10. 移除NT-Q，NT≠red。
11. 则由4.5.10.NT没有可以选择的染色。
12. 得出 WA = green，V = red 不相容。

6.12用AC-3算法求解树结构CSP在最坏情况下的复杂度是多少?

最坏情况为遍历所有端点的每种取值。时间复杂度为$O(ED^2)$，其中E为边数，D为取值域最大的大小。