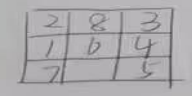
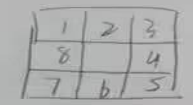
P141.

对于九宫重排问题，利用A*算法实现从  到 

解：采用错位十深的搜索方法.

第一步：定义评估函数如下：

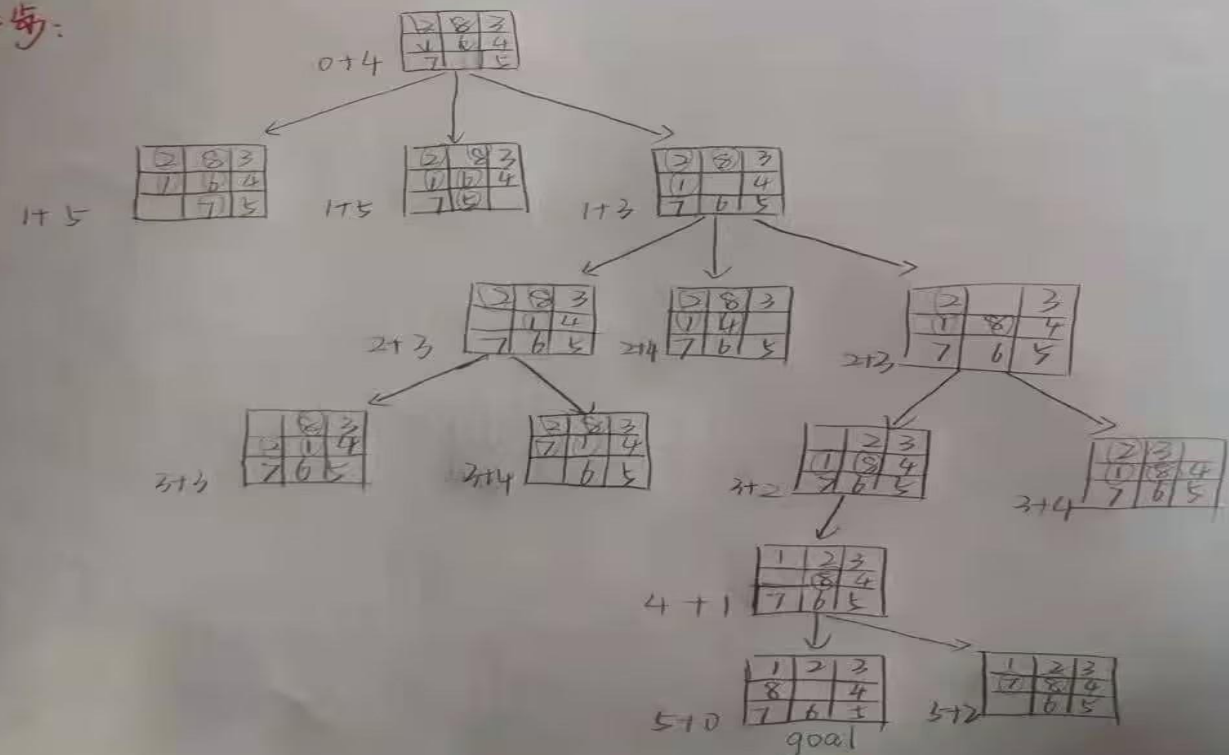
$\hat{h}(n)$ =

$\hat{g}(n)$ =

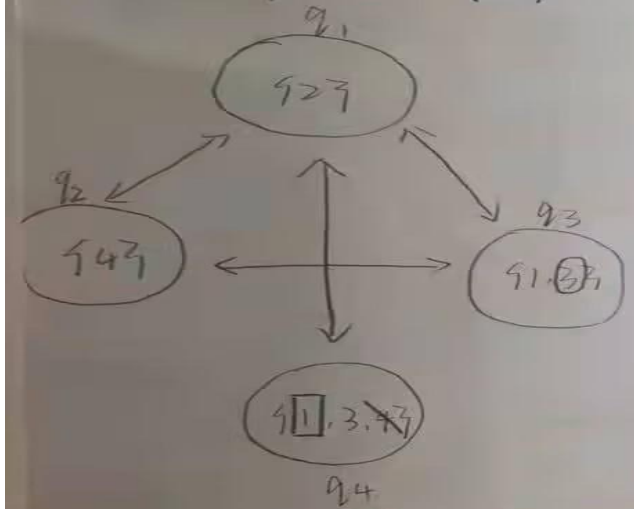
$\hat{f}(n)$:

其中：$\hat{f}(n) = \hat{h}(n) + \hat{g}(n)$

第二步：



解释：题目P187.



指q_3对q_4的影响

○ Value eliminated by first making arc (q_3, q_2)

□ Value eliminated by next making arc (q_4, q_3)

\ Value eliminated by next making arc (q_4, q_2)

省略部分题目都会给

q_i是第i列皇后的位置

解：① 第1个层次：q_1对q_2，q_3，q_4的约束

因为$q_1=2$，所以q_2只能为4（因为在1,3位置时，对角线冲突，等于2时，行冲突）

q_3为1，3，q_4为{1，3，4}

② 第2个层次：q_2对q_3的约束

因为$q_2=4$，∴q_3不能为3，因为对角线冲突，∴$q_3=1$

③ 第3个层次：q_3对q_4的约束

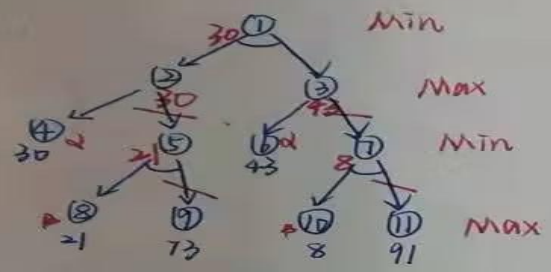
因为$q_3=1$，∴$q_4\neq 1$，否则会行冲突.

④ 第4个层次：q_2对q_4的约束

因为$q_2=4$，∴$q_4\neq 4$，否则会行冲突.

博弈问题（极大极小值）

题目：



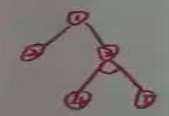
① 写出各节点的数（带∪的代表Min）

∴ ⑩为30
⑨为30
⑧为43
⑦为21
⑥为8

② 选出路径

⑩ → ⑨ → ⑧

③ 减支（减支不可能存在于1、2层）

（原则：如  ，如果⑨的β值（即⑧的值）小于等于⑩的α值（即⑨的值）

则⑨一⑤枝可减）

① ⑩-⑪枝可减（最简单）：因为⑩的β值为8，⑪的α值为43，α>β ∴ 7-11可减剪。

② ⑤-⑭枝可减（最简单）：因为⑨的β值为21，⑭的α值为30，α>β ∴ 5-9可减剪。

③ ⑨-⑩枝可剪：因为⑨的α值为43，⑩的β值为30，α>β ∴ 3-7可剪。

④ ⑧-⑬枝可剪：因为⑧的α值为30，⑬的β值为30，α=β ∴ 2-5可剪

综上所述，可剪枝有4个，分别为⑩-⑪、⑨-⑭、⑨-⑩、⑧-⑬。

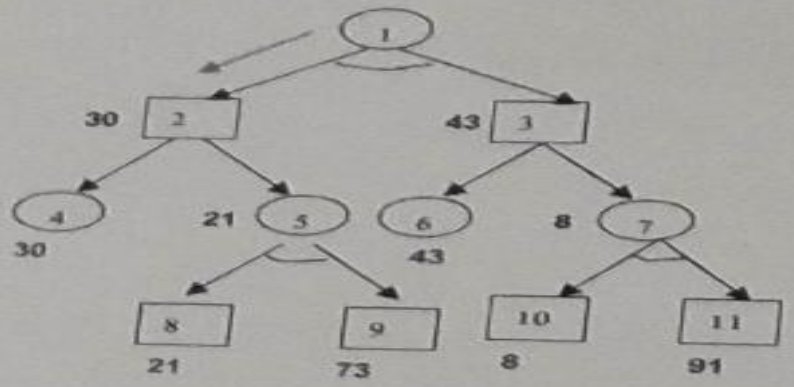
知识点：

① α值只有MAX有，指Max层节点左边的第一个子节点

② β值只有MIN有，指MIN层节点左边的第一个子节点

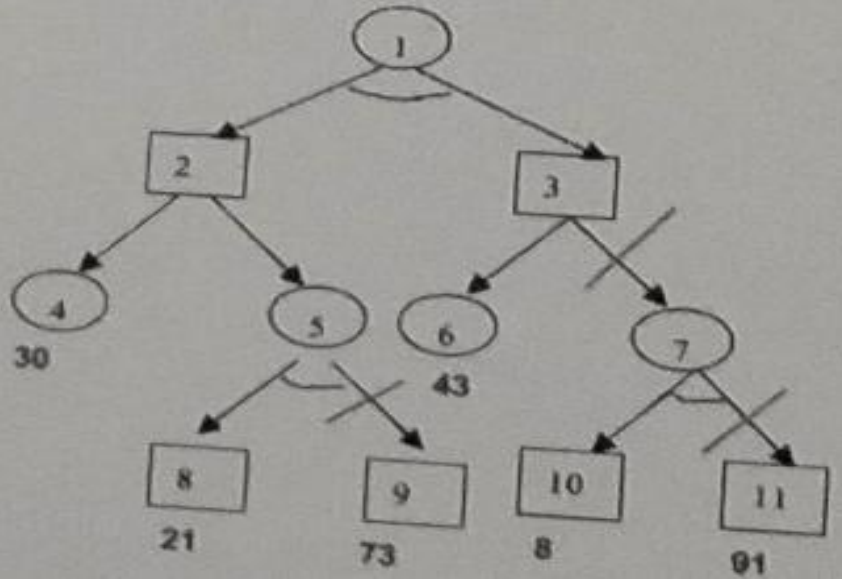
1) What move should the first player choose?

A: Based on the minimax procedure, there is the following graph, and the first player should choose the left move. (10 points)



2. What nodes should not need to be examined using the alpha-beta algorithm-assuming that nodes are examined in left-to-right order?

A: Based on the Alpha-Beta Procedure, there are 3 procedures, as shown in the following graph, where nodes 9 and 11 are alpha procedure, node 7 is the beta procedure. (20 points)



5. Consider the f...

16章 { 证明
提取问题答案 (学会下面5个例题那句)

例1<证明>

Facts: (1) Fido is a dog
(2) All dogs are animals
(3) All animals will die

we wish to prove the "Fido will die"

证明: 定义谓词(2分) D(x): x是狗
A(x): x是动物
Die(x): x会死

step 1: (5分) wffs
(1) D(Fido)
(2) ∀X (D(x) → A(x))
(3) ∀X (A(x) → Die(x))

step 2: (5分) wffs - clauses
(1) D(Fido)
(2) ¬D(x) ∨ A(x)
(3) ¬A(x) ∨ Die(x)
(4) ¬Die(Fido)
引入结论的否定

step 3: 初始子句 (5分)
D(Fido) ①
¬D(x) ∨ A(x) ②
¬A(x) ∨ Die(x) ③
¬Die(Fido) ④

step 4: 归结过程
⑤ A(Fido) ①+②
⑥ Die(Fido) ⑤+③
⑦ empty clause ⑥+④

用Fido代替x
¬Fido/x ⑤ (5分)
一定记住要写一个分
¬Fido/x ⑥

∴ Fido will die. 证毕.

例12（证明）

facts： 1) whoever reads is literate

2) Dolphins are not literate

3) some Dolphins are intelligent

prove： some who are intelligent cannot read.

证明：定义谓词： R(x)：x会阅读　　L(x)：x是有文化的（literate）

D(x)：x是海豚　　I(x)：x是智能的（intelligent）

step1： wffs

1) $\forall x(R(x) \to L(x))$

2) $\forall x(D(x) \to \neg L(x))$

3) $\exists x(D(x) \wedge I(x))$

step2： wffs → clauses

1) $\neg R(x) \vee L(x)$

2) $\neg D(x) \vee \neg L(x)$

3) $D(x) \wedge I(x)$

4) ~~$I(x) \wedge R(x)$~~ $\neg I(x) \vee R(x)$

原结论 $\exists x(I(x) \wedge \neg R(x))$ 否定

step3： 初始子句

1) $\neg R(x) \vee L(x)$

2) $\neg D(x) \vee \neg L(x)$

3) $D(x)$ ~~$\wedge I(x)$~~

4) $I(x)$

5) $R(x) \vee \neg I(x)$

~~step4：归结过程~~

~~6) $\neg L(x)$　　3) 与2~~

~~7) $\neg R(x)$　　6) 与1~~

~~8) empty clause　　7) 与4~~

∴ some who are intelligent cannot read. 证毕.

step4：归结过程.

6) $R(x)$　　4) 与1

7) $L(x)$　　1) 与6

8) $\neg D(x)$　　7) 与2

9) empty clause　　8) 与3

∴

例3 格言问题.(提取问题答案) ☆重点

题目在 P200 P249. 答案在 P260

问: A在哪个房间.

解: ① 定义谓词: P(x): x是格言 , In(x,27): x在27号房间

In(x,28): x在28号房间 S(x,y): x比y小

② 1. ∀(x,y)[P(x) ∧ P(y) ∧ In(x,27) ∧ In(y,28) → S(x,y)]

若x是格言, y也是个格言, x在27号房间, y在28号房间, 可以推出 x比y小

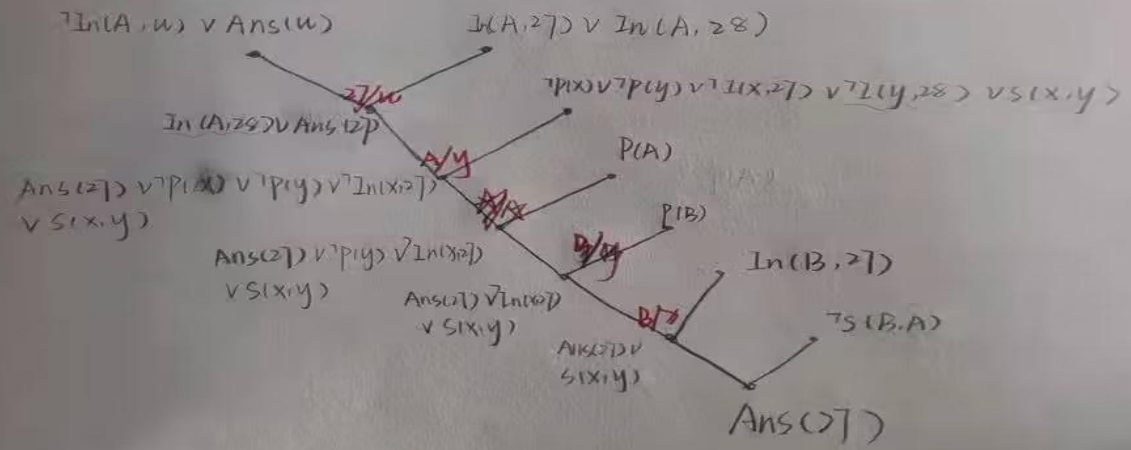
2. ¬P(x) ∨ ¬P(y) ∨ ¬In(x,27) ∨ ¬In(y,28) ∨ S(x,y)]

3. P(A) 4. P(B) 5. In(A,27) ∨ In(A,28)

6. In(B,27) 7. ¬S(B,A)

③ 使用问题提取.

假设 ¬In(A,w) ∨ Ans(w)



∴ A在27号房间

题目：如何学习"圆"这个概念。

英文题目：Learning the concept of 'circle' with the deletion candidate algorithm.

size：lg sm　　shape：cir，squ，tri

解：①第1步：　G={(x,y)}

~~S={(lg,cir),(sm,cir),(sm,cir),(sm,s),(lg,squ),(sm,squ),(lg,tri),(lg,tri)}~~

S={(lg,cir),(lg,squ),(lg,tri),(sm,cir),(sm,squ),(sm,tri)}

②第2步：取(sm,cir)作为正例

G={(x,y)}

S={(sm,cir)}

③第3步：取(lg,squ)作为反例

S={(sm,cir)}

G={(sm,y),(x,cir)}

(从G中删除掉包含反例的项，再选能覆盖正例的)

~~G={(lg,y)~~ (sm,y) (x,cir),~~(x,squ)~~,(x,tri)}

④第4步：取(lg,cir)作为一个正例

G={(x,cir)}

S={(x,cir)}

G=S

(S要做最小泛化且G一定包含S)

这两句考试的时候也要有

☆ 模拟退火算法（背过）
(Simulated Annealing Algorithm)

① 当 $T \to \infty$ 时，此时最不稳定，系统处于各状态下的概率是均等的

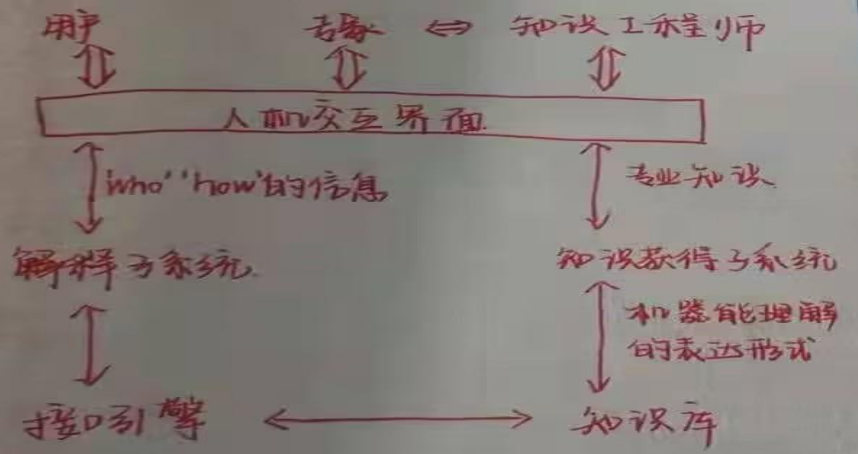
② 当 T 缓慢下降时，系统落于能量低的情况下的概率增大.

③ 当 $T_1 = T_2$ 时，在相同的温度下，系统处于能量小的状态的概率大于系统处于能量大的状态的概率.

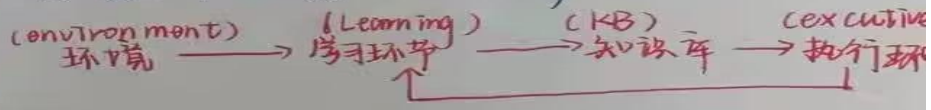
④ $T \to 0$，系统等概率落于能量较低情况下的概率相同.

二选一，必考

基于知识的基本框架 (knowledge frame)



积极学习框架 (Learning frame)



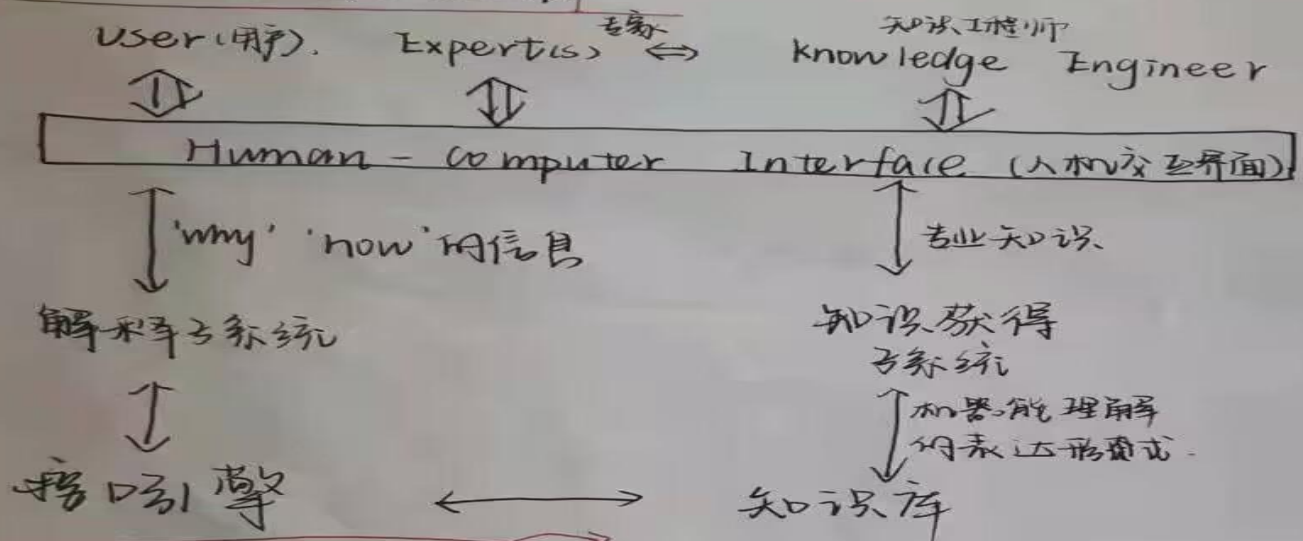
环境：外部信息的来源

学习环节：系统的学习机构

知识库：代表系统已经具有的知识

执行环节：基于学习后获得自己新的知识库，是该模型的核心。是解决实际问题和反馈信息，指导下一步学习.

基于知识的基本框架 Knowledge frame



积极学习框架 Learning frame

环境 ⟶ 学习环节 ⟶ 知识库 ⟶ 执行环节

环境：外部信息的来源

知识库：代表系统已经具有的知识

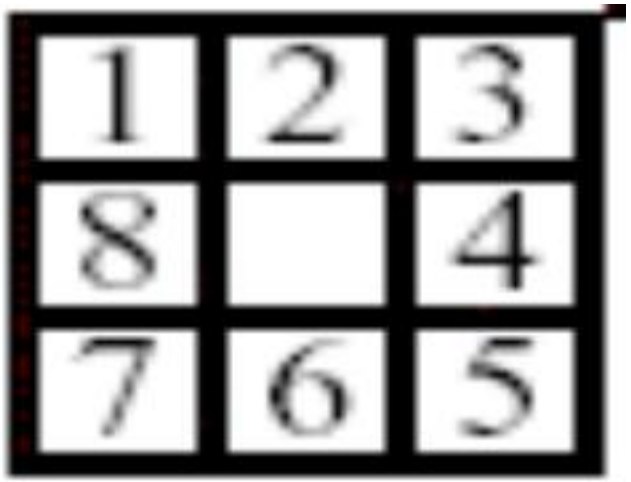
学习环节：系统的学习机构

执行环节：基于学习后得到的新的知识库，是该模型的核心。
（解决实际问题及反馈信息，指导下一步学习）

- 二(20)、 Using Resolution Refutation to prove the following problem
- Facts:
- 1) Whoever reads is literate.
- 2) Dolphins are not literate.
- 3) Some dolphins are intelligent.
- Prove: Some who are intelligent cannot read.

- 三(20)、Consider the following properties and values of the building block world:
- Color = { yellow, blue, green} Shape = {conical, spherical, rectangle}
- Hardness = { hard, soft } Size = {large, small }
- Learning the concept of "yellow" with the deletion candidate algorithm.
- Examples:
- 1. (yellow, conical, soft, large, +) 2. (blue, rectangle, soft, small, -)
- 3. (yellow, spherical, soft, small, +) 4. (yellow, conical, hard, large, +).
- 5. (yellow, rectangle, soft, large, +) 6. (green, spherical, hard, large, -)

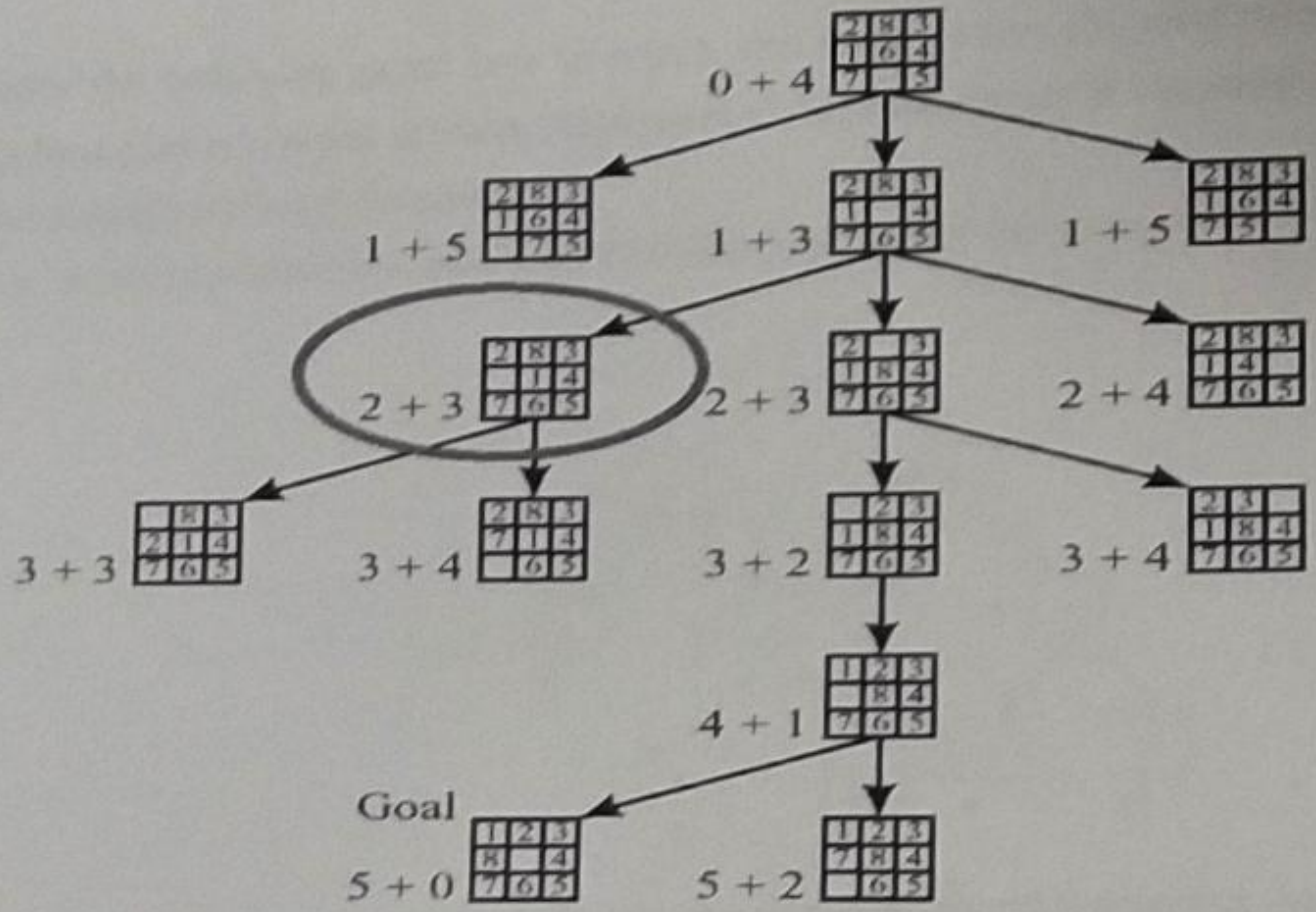
- Using A * algorithm to convert the initial state to the target state.
- The initial state The target state
-



2. Using A * algorithm to convert the initial state to the target state. (20 points)

A: 1) Define the evaluation function as follows: f(n)=d(n)+h(n), where d(n) is the length of the shortest path from the start node to n, h(n) reprensents the number of tiles out of place(comapred eith goal). (5 points)

2) Based on the evaluation function, there is the following searching graph:



(20 points)

- 五(20)、Select your two favorite AI pieces, explain why you like them and how you apply them to solve specific problems.

- 1) 人工智能　2) 知识表示与获取　3) 启发式搜索
- 4) 专家系统　5) 常识知识

- 人工智能、机器学习、启发式修补、知识、知识获取
- 知识表示、信息、数据、深度学习、专家系统
- 盲目搜索、评估函数、完备性、可靠性、可采纳性
- 一致性、信息性、构造性方法 （约束传播）、函数优化
- 模拟退火算法、基于知识系统
- 对抗搜索/博弈搜索、极小极大化过程
- 命题演算、谓词演算、归结反演
- 常识知识表示、语义、语法、答案提取
- 置换、合一

- Artificial Intelligence Deep Learning Constraint Propagation Predicate Calculus Machine Learningexpert Systems Repair Approach
- Representing Commonsense Knowledge
- Heuristic Search evaluation function function optimization Semantics Knowledge evaluation criteria
- simulated Annealing syntax Knowledge Acquisition Consistency Knowledge Based Systems Completeness
- Knowledge representation Admissibility adversarial search Soundness Information Informative Minimax Procedure Resolution Refutation Data Constructive method Propositional Calculus answer extraction
- Substitution unification version space method

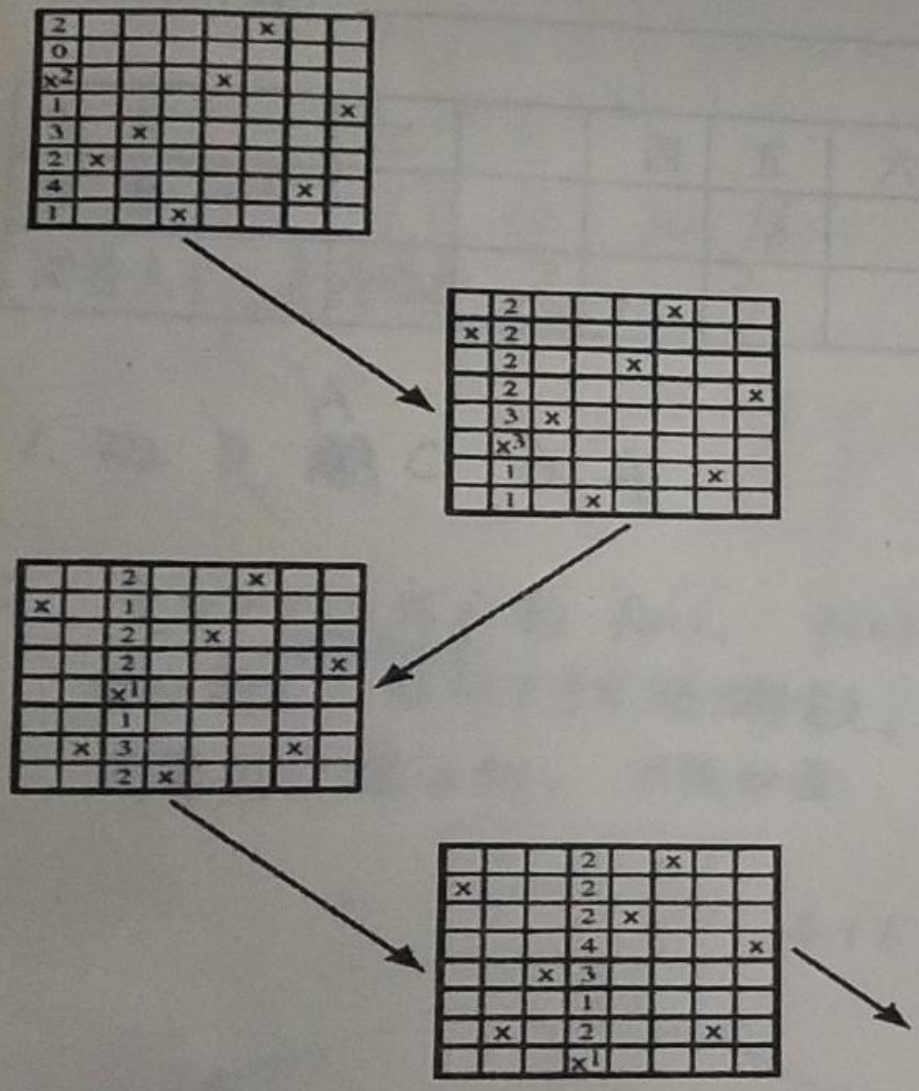
- 知识获取
- 函数优化
- 模拟退火算法
- 命题演算
- 谓词演算
- 归结反演
- 常识知识表示
- 语义、语法
- 置换、合一
- 约束传播　对抗搜索/博弈搜索
- 泛化、特化
- 推理、知识工程师、知识库、推理库、专家性
- 决策树

启发式搜索 (Heuristic Search)
启发式修补 (Heuristic repair).
评估函数 (evaluation function).
函数优化 (Function optimization)
合一 (unification)
置换 (substitution)
文字
泛化 (generalization)
特化 (specialization)
模拟退火 (simulated annealing).
推理 (inference).
知识工程师 (knowledge engineer).
知识库 (knowledge base)
推理库 (inference library).
专家性 (expertise).
决策树 (decision tree).
命题演算 (propositional calculus).
博弈搜索 (Game Search)
谓词演算 (predicate calculus)

专家系统 Expert System
博弈搜索 ~~adversarial~~ adversarial search
归结反演 resolution refutation
文字 literal
句子 clause
基于知识系统 knowledge base system
盲目搜索 ~~uniformed~~ uninformed search
可采纳性 admissibility
一致性 consistency
信息性 information
深度学习 deep learning
自然语言处理 NLP (Natural ~~Langle~~ Language Processing)
谓词演算 predicate calculus
完备性 completeness
可靠性 soundness
合式公式 well-formed formula (wff)
答案提取 answer extraction

- 文字 (Literal)
- 子句（Clause）
- 答案提取
- 合式公式（Well-Formed Formula）
- 自然语言处理
- 表示
- 构造性方法
- 归结反演
- 对抗搜索

5. Consider the following figure about the Eight-Queens Problem. (20 points)



1) Describe the basic idea about Heuristic Repair, which is an approach to setting up a problem for solution by graph-search methods.

2) Provide the three repair steps for the Eight-Queens Problem.

Min-conflicts heuristic: choose a value that results in a minimum number of conflicts with other variables.

选择一个与其他变量发生冲突次数最少的值。

Complete search of most game graphs is impossible.

- 注意： ξ_i 一定不能在τ I中出现。
- Knowledge base of propositional calculus atoms
  - The atoms are called *premisses* instead of facts.

1) **What is a learning system?** 4 characteristics:

(1) **Purpose:** must know what it is learning.

(2) **Structure:** The knowledge representation and knowledge organization form can be modified and improved.

(3) **Effectiveness:** The new knowledge acquired by the system must be beneficial to improving the behavior of the system.

(4) **Openness:** the ability of a system to evolve over time in its actual use or interaction with its environment.