

1]

2] PEAS description of wumpus world

1) Performance measure:-

- +1000 reward points if agent comes out of cave with the gold
- -1000 points penalty for being eaten by wumpus
- -1 for each action and -10 for using an arrow
- The game ends if either agent dies or came out of the cave

2) Environment:-

- A 4×4 grid of rooms
- The agent initially in room square $[1,1]$, facing towards right
- Location of wumpus and gold are chosen randomly except the first square $[1,1]$
- Each square of the cave can be a pit with probability 0.2 except the first square.

3) Actuators:-

- Left turn
- Right turn
- move forward
- Grab
- Release
- shoot

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4) Sensors:-

- The agent will perceive the stench if he is in the room adjacent to the wumpus (Not diagonally)
- The agent will perceive breeze if he is in the room directly adjacent to the pit
- The agent will perceive the glitter in the room where the gold is present.
- The agent will perceive the bump if he walks into a wall.
- When the wumpus is shot, it emits a horrible scream which can be perceived anywhere in the cave
- These percepts can be represented as five element list, in which we will have different indicators for each sensor.
- Example if agent perceives stench, breeze, but no glitter, no bump, and no scream then it can be represented as [Stench, Breeze, None, None, None]



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Q. 17
37

1) States :- A state description specifies the location of each of eight tiles and blank in one of the nine squares

2) Initial state :-

Any state can be designated as initial state. Note that any given goal can be reached from exactly half of the possible initial states

3) Successor function :-

This generates the legal states that result from trying the four action (blank moves, left, up or down)

4) Goal ^{test} state :-

This checks whether the legal state matches the goal configuration

5) Path cost :-

Each step cost 1, so the path cost is number of steps in the path

17	12	14	10	11	12
15		16	13	14	15
18	13	11	16	17	18
Start state			Goal state		



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The 8-puzzle belongs to the family of sliding blocks puzzle which are often used as test problem for new search algorithm in AI. This general class is known to be as NP-complete so one does not expect to find methods significantly better in worst case than search algorithm described. The 8 puzzle has $9! = 2181, 440$ reachable states and is easily solved.



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Q.2]

2]

Step 1:

The given facts are:

- 1) It is a crime for an American to sell weapons to the enemy nation.

$$\text{American}(x) \wedge \text{weapon}(y) \wedge \text{sell}(\text{m}, y, z) \wedge \text{enemy}(z, \text{America}) \Rightarrow \text{criminal}(x)$$

- 2) Country Nono is an Enemy of America
 $\text{Enemy}(\text{Nono}, \text{America})$

- 3) Nono has some missiles
 $\rightarrow \text{Owns}(\text{Nono}, x)$
 $\rightarrow \text{missile}(x)$

- 4) All the missiles were sold to Nono by colonel West.

$$\text{missile}(x) \wedge \text{Owns}(\text{Nono}, x) \Rightarrow \text{sell}(\text{West}, x, \text{Nono})$$

- 5) missile is a weapon.

$$\text{missile}(x) \Rightarrow \text{Weapon}(x)$$

- 6) Colonel West is America
 $\text{America}(\text{West})$

Step 2:

Let's convert them to CNF

- 1) $\sim \text{American}(x) \vee \sim \text{Weapon}(y) \vee \sim \text{sell}(x, y, z) \vee \sim \text{enemy}(z, \text{America}) \vee \text{criminal}(x)$

- 2) $\text{Enemy}(\text{Nono}, \text{America})$

- 3) $\text{Owns}(\text{Nono}, x)$

- 4) $\text{missile}(x)$

- 5) $\sim \text{missile}(x) \vee \sim \text{Owns}(\text{Nono}, x) \vee \text{sell}(\text{West}, x, \text{Nono})$

- 6) $\sim \text{missile}(x) \vee \text{Weapon}(x)$



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Q. 2)

2]

2] American(west)

Step 3:

To prove that West is criminal using resolution.

$\neg(\text{criminal}(\text{West})) \quad \neg \text{American}(x) \vee \neg \text{Weapon}(y)$
 $\vee \neg \text{sell}(x, y, z) \vee$
 $\neg \text{enemy}(z, \text{America}) \vee \text{criminal}(x)$

x/west
 $\neg \text{American}(\text{west}) \vee \neg \text{Weapon}(y)$
 $\neg \text{sell}(\text{west}, y, z) \vee \neg \text{enemy}(z, \text{America})$
 $\text{enemy}(\text{None}, \text{America})$
 z/None

$\neg \text{American}(\text{west}) \vee \neg \text{Weapon}(y)$
 $\vee \neg \text{sell}(\text{west}, y, \text{None})$
 $\text{American}(\text{west})$

$\neg \text{Weapon}(y) \vee \neg \text{sell}(\text{west}, y, \text{None})$
 $\neg \text{missile}(x)$
 $\vee \neg \text{own}(\text{None}, x)$
 $\vee \text{sell}(\text{west}, x, \text{None})$

$\neg \text{Weapon}(y) \vee \neg \text{missile}(y) \vee$
 $\neg \text{own}(\text{None}, y)$
 $\text{missile}(x)$
 $\text{Weapon}(x) \vee \neg \text{missile}(x)$
 $\neg \text{missile}(y) \vee \neg \text{own}(\text{None}, y)$
 $\neg \text{own}(\text{None}, y)$
 $\text{own}(\text{None}, x)$

$\text{missile}(x)$
 $\text{own}(\text{None}, x)$

Nil



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Hence our assumption was wrong. Hence proved West is criminal