1 True or False? You don't need to explain your answers.

1. $h(n) = 0$ is an admissible heuristic of the 8-queens problem.

   True, $h(n) \leq c(n)$ for all n, where $c(n)$ is the actual cost to reach the goal state form node n.

2. Assume that a rook can move on a chesssboard one square at a time in vertically or horizontally, but cannot jump over other pieces. Manhattan distance is an admissible heuristic for the problem of moving the rook form square A to square B in the smallest number of moves.

   True, since the Manhattan distance will always be lower or equal to the actual cost to reach the goal state then the Manhattan distance is an admissible heuristic for the problem of moving the rook from square A to square B in the smallest number of moves.

2 The heuristic path algorithm is a best-first search in which the evaluation function is $f(n) = (2 - w) \cdot g(n) + w \cdot h(n)$. What kind of search does this perform for $w = 0, w = 1$, and $w = 2$?

$$\begin{cases} w = 0 & 2 \cdot g(n) \quad (UCS) \\ w = 1 & g(n) + h(n) \quad (A^*) \\ w = 2 & 2 \cdot h(n) \quad (Greedy) \end{cases}$$

3 Give the name of the algorithm that results from each of the following cases:

1. Local beam search with $k = 1$.

   This will be hill-climbing search

2. Simulated annealing with $T = \infty$ at all times.

   This will in general be a random-walk

4 Imagine that, one of the friends wants to avoid the other. The problem then becomes a two-player pursuit-evasion game. We assume now that the players take turns moving. The game ends only when the players are on the same node; The terminal payoff to the pursuer is minus the total move taken.

1. What is the terminal payoff at the node (1)?

   The terminal payoff at node (1) is -4.

2. What are the positions of the two players at the node (2) and $(2)'s$ children?

   node (2) will be labeled as be. It's child will be bd.

3. Can we assume the terminal payoff at the node (2) is less than < -4? Answer yes or no, then explain your answers

   Yes it's only child will be bd which forces the move to go on to there. This is the initial state with 4 moves hence the cost currently is -4. Any solution then must be less than -4.

4. Assume the terminal payoff at the node (4) is less than -4. Do we need to expand the nodes (5) and (6)? Answer yes or no, then explain your answers.

   No, with alpha-beta pruning the solution will max player will prefer the left branch of the root and thus nodes (5) and (6) will never be explored.

5 True or False? You don't need to explain your answers.

1. $(A \wedge B) \models (A \iff B)$

   True

$A \wedge B$	$A \iff B$
T	T

2. $(C \vee (\neg A \wedge \neg B)) \equiv ((A \implies C) \wedge (B \implies C))$

   True

$$
\begin{aligned}
((A \implies C) \vee (B \implies C)) = &\quad (\neg A \vee C) \wedge (\neg B \vee C)) \\
= &\quad (C \vee (\neg A \wedge \neg B))
\end{aligned}
$$

3. $(A \vee B) \wedge (\neg C \vee \neg D \vee E) \models (A \vee B)$

   True

4. $(A \vee B) \wedge \neg(A \implies B)$ is satisfiable.

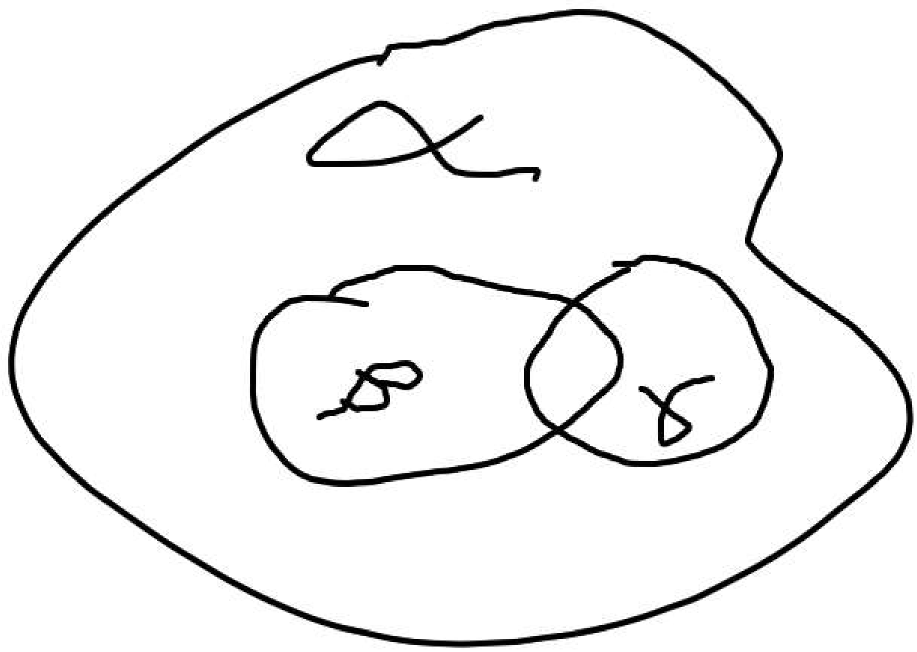
   True

$$
(A \vee B) \wedge \neg(\neg A \vee B) = \quad (A \vee B) \wedge (A \wedge \neg B)
$$

Which is satisfiable when $A = 1$ and $B = 0$.

6 Prove using **Venn diagram**, or find the counterexample to the following assertion:

$$
\alpha \models (\beta \wedge \gamma) \;\; then \;\; \alpha \models \beta \;\; and \;\; \alpha \models \gamma
$$


α
β
γ