Sub:	Artificial Intelligence					Sub Code:	BCS 515 B	Branch:	CSE
Date:	1/12/2025	Duration:	90 mins	Max Marks:	50	Sem / Sec:	5 A,B,C		

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Internal Assessment Test 2 – NOV-DEC 2025

Sub:	**Artificial Intelligence**				Sub Code:	BCS515B	Branch:	CSE	
Date:	1/12/2025	90 mins	Max Marks:	50	Sem/Sec:	V/ A/B/C		OBE	
	Answer any FIVE FULL Questions						MARKS	CO	RBT
1	Considering Wumpus world example give the characteristics and simple knowledge base using propositional logic and Prove that Wumpus is in the room (1, 3).						10	CO1	L2
2	Considering the digital circuit example illustrate the seven steps in knowledge engineering process						10	CO2	L3
3	Define Classical Planning. With the blocks world example explain the same in detail.						(5+5)	CO1	L2
4	Explain the two approaches to searching for a plan in detail.						10	CO2	L2
5	Describe the differences and similarities between problem solving and planning						(5+5)	CO2	L2
6	Write appropriate quantifiers for the following (i) Some students read well (ii) Some students like some books (iii) Some students like all books (iv) All students like some books (v) All students like no books						10	CO2	L3

CI CCI HoD

Answer 1 (A) Characteristics of Wumpus World

1. **Environment Type:**
    - Partially observable
    - Stochastic (if agent bumps, shoots arrow, etc.)
    - Sequential

- Static (world doesn’t change unless agent acts)
- Discrete

2. **Percepts:**
   - **Stench** → Wumpus is nearby
   - **Breeze** → Pit nearby
   - **Glitter** → Gold in current cell
   - **Bump** → Wall encountered
   - **Scream** → Wumpus killed
3. **Actions:**
   - Move forward, Turn left/right
   - Grab, Shoot, Climb
4. **Performance Measure:**
   - +1000 for gold
   - -1000 for death
   - -1 per step
   - -10 for using arrow

(B) Propositional Logic Knowledge Base

Let

- **Stench(i,j)** = stench in cell (i,j)
- **W(i,j)** = Wumpus in cell (i,j)

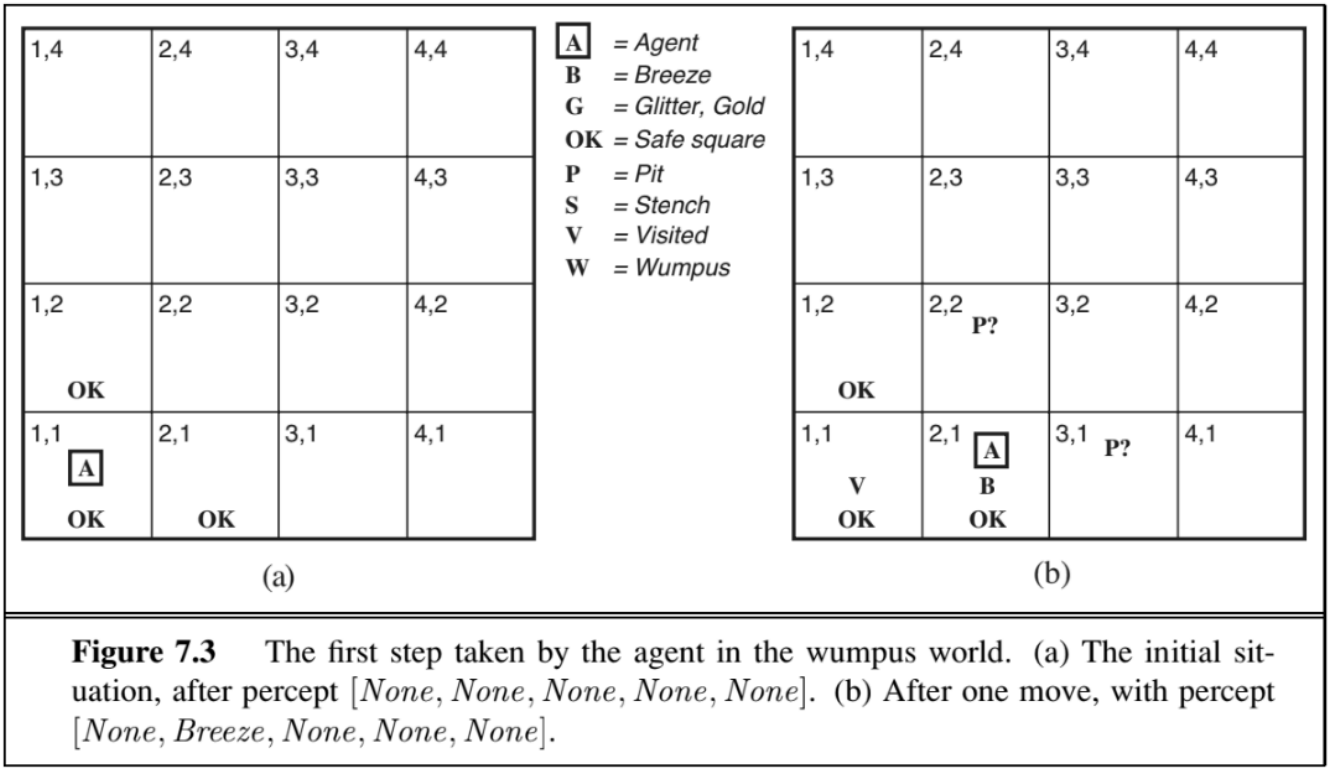

Figure 7.3 The first step taken by the agent in the wumpus world. (a) The initial situation, after percept $[None, None, None, None, None]$. (b) After one move, with percept $[None, Breeze, None, None, None]$.

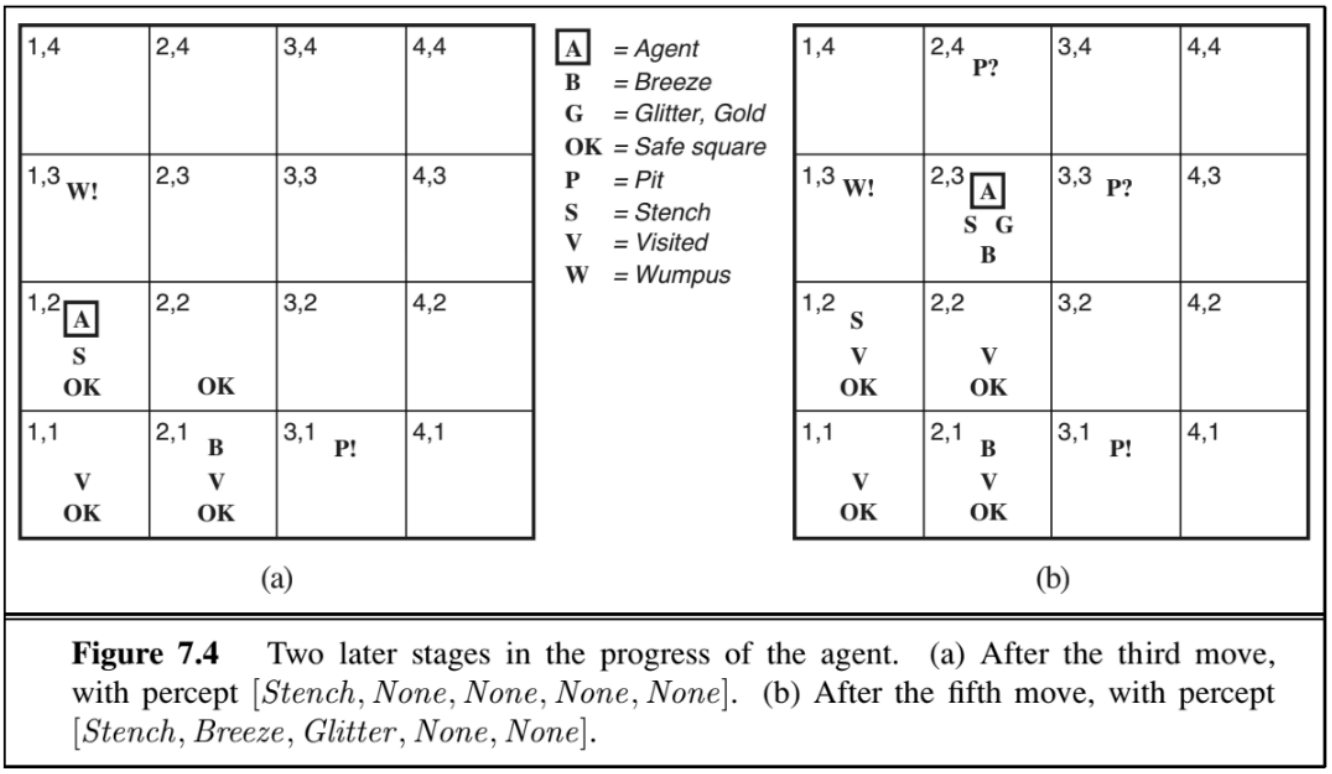

Figure 7.4 Two later stages in the progress of the agent. (a) After the third move, with percept $[Stench, None, None, None, None]$. (b) After the fifth move, with percept $[Stench, Breeze, Glitter, None, None]$.

Answer 2. Seven Steps in Knowledge Engineering – Digital Circuit Example

Marks: 10

1. Identify the Task

Goal: Diagnose faults in a digital circuit using a knowledge base.

2. Assemble the Relevant Knowledge

Gather Boolean logic rules, gate behaviors (AND, OR, NOT), truth tables.

3. Decide on Vocabulary (Predicates, Functions, Constants)

Use **Propositional logic / Logic circuits**.

Example:

Output=A∧BOutput = A \land BOutput=A∧B

4. Encode general knowledge about the domain

Create rules:

- If AND gate receives (1,1) → output 1
- If any input is 0 → output 0
- Fault rules (stuck-at-0, stuck-at-1)

5. Encode a description of the specific problem instance

Give sample inputs and check if diagnoses match expected outputs.

6. Pose queries to the inference procedure and get answers

If output is wrong → update rules.

7. Debug the Knowledge Base

Add new gate types, update rules for new fault types.

Answer 3.

Marks: 5 + 5

(A) Classical Planning Definition (5 marks)

A planning problem where:

- World is **fully observable**
- Deterministic
- Time progresses in discrete steps
- Actions have preconditions and effects
- Goal states are defined explicitly

A classical planning problem contains:

1. **Initial State**

2. **Goal State**

3. **Actions** (preconditions + effects)

(B) Blocks World Example (5 marks)

Initial State:
A on B, B on table, C on table

Goal:
C on A

Actions (STRIPS Representation)

Action: Move(x, y, z)

- Precondition: Clear(x), Clear(z), On(x,y)
- Effect: ¬On(x,y), On(x,z), Clear(y), ¬Clear(z)

Plan Example

1. Move A from B → Table
2. Move C → A

Goal achieved.

Answer 4: Two Approaches to Searching for a Plan

Marks: 10

1. Forward State-Space Search

- Start from **initial state**
- Apply actions
- Explore reachable states
- Stop when **goal state** reached
- Similar to BFS/DFS in state graph

Advantages:

- Natural

- Easy for small state spaces

Disadvantages:

- Branching factor high

2. Backward Search

- Start from **goal**
- Pick a subgoal
- Choose action that achieves it
- Regress goal through action preconditions
- Continue till initial state satisfies all preconditions

Advantages:

- Efficient when goals are few
- Reduced search space

Disadvantages:

- Requires invertible actions

Answer 5. Problem Solving vs Planning (5 + 5 marks)

Similarities (5 marks)

1. Both aim to reach a goal state
2. Both use search
3. Both need actions/operators
4. Both use heuristics
5. Both evaluate cost and optimality

Differences (5 marks)

Problem Solving	**Planning**

Abstract world	Structured world
Operators not explicit	Actions have preconditions & effects
Search on states	Search on actions
No focus on time	Time is explicit
No action reasoning	Requires action sequencing

Answer 6

Let us suppose

- S(x): x is a student
- B(y): y is a book
- ReadWell(x): x reads well
- Likes(x,y): x likes book y

(i) Some students read well

$\exists x\,[S(x) \wedge ReadWell(x)]$

(ii) Some students like some books

$\exists x \exists y\,[S(x) \wedge B(y) \wedge Likes(x,y)]$

(iii) Some students like all books

$\exists x\,[S(x) \wedge \forall y(B(y) \rightarrow Likes(x,y))]$

(iv) All students like some books

$\forall x\,[S(x) \rightarrow \exists y(B(y) \wedge Likes(x,y))]$

(v) All students like no books

$\forall x\,[S(x) \rightarrow \forall y(B(y) \rightarrow \neg Likes(x,y))]$