AI - Mid 1

- **Cognition :** Set of mental abilities and processes related to knowledge.
- **Turing Test :** Checks if a machine can pass itself as human.
- **Rational Agent :** Best, not most human.
- **Control Theory :** Self regulating AI to minimise error.
- **GPS :** General Problem Solver, first to implement human like thinking.
- **Shakey Robotics Project :** A* Search, Hough Transform, Visibility Graph Method.
- **SOAR -** Whole Agent
  Emphasis on data over algorithms.
  Learning methods gained prominence.
  Goal to handle full range capabilities of an intelligent system.
  Set of rules and learning techniques used.

- **Definition Terms:**
- Agent - Diagram
- Percept
- Percept Sequence
- Sensors and Actuators
- Agent Function and Agent Program
- Agent Architecture
- Rational Agent - Diagram
- Performance Measure - environment definition, not agent definition
- 4 things Rationality Depends on :
  - *Performance Measure*
  - *Knowledge of environment*
  - *Actions agent can perform*
  - *Percept sequence*
- *For each possible percept sequence, a rational agent should select an action that is expected to maximise its performance measure, given the evidence provided by the percept sequence and whatever built-in knowledge the agent has. - **Definition of Rational Agent from Book***
- Omniscience
- Information Gathering

- Exploration
- Learning
- Autonomy

- **Task Environment — PEAS :: Properties**
    - *Fully Observable vs Partially Observable*
    - *Single Agent vs Multi Agent (Competitive vs Cooperative)*
    - *Deterministic vs Stochastic*
    - *Episodic vs Sequential*
    - *Static vs Dynamic*
    - *Discrete vs Continuous*
    - *Known vs Unknown*
    - **Uncertain Environment -** Partially Observable and Stochastic
    - **Indeterministic Environment -** Actions characterised by *possible* outcomes, not probabilities.
    - **Semi-dynamic Environment -** Agent's performance score changes environment.

- **Agent Structure**
    - Agent Architecture, Agent Function vs Agent Program
    - **Simple Reflex based agents - Diagram**
    - Condition Action Rule
    - **Model based Reflex Agents - Diagram**
    - **Goal based Agents - Diagram**
    - **Utility based Agents - Diagram**
    - Utility
    - Utility Function
    - Expected Utility
    - **Learning Agents - Diagram**
    - Learning Element
    - Performance Element
    - Problem Generator
    - Critic
    - **Components of Agent Program**
        - Atomic Representation
        - Factored Representation — (*Variable, Attribute, Value*)
        - Structured Representation
        - *Expressiveness Axis*

- **Problem Solving Agents -** Goal based with Atomic

Representation.
- Planning Agents
- Goal Formation
- **Problem Formulation -** Deciding what actions to take given a goal.
- Search - Solution - Execution
- Open Loop Systems
- **Problem:**
  - Initial State
  - Possible Actions.
  - Transition Model (*What each action does)*
  - Goal Test
  - Path Cost
- **State Space** of a Problem - States + Actions + Transition
- Optimal Solution
- Incremental Formulation vs Complete Formulation
- Search Tree
- Expanding
- Frontier
- Redundant Path, Loopy Path
- Tree Search

- **Measuring Problem Solving Performance**
  - Completeness
  - Optimality
  - Time Complexity
  - Space Complexity

- Branching Factor
- Depth
- Search Cost
- Path Cost

- **Uninformed Search Strategy :**
  - BFS
  - Uniform Cost Search (Dijkstra) — Time Complexity
  - DFS
  - Depth Limited Search
  - Iterative Deepening Search
  - Bidirectional Search
  -

Criterion	Breadth-First	Uniform-Cost	Depth-First	Depth-Limited	Iterative Deepening	Bidirectional (if applicable)
Complete?	Yes[a]	Yes[a,b]	No	No	Yes[a]	Yes[a,d]
Time	$O(b^d)$	$O(b^{1+\lfloor C^*/\epsilon \rfloor})$	$O(b^m)$	$O(b^\ell)$	$O(b^d)$	$O(b^{d/2})$
Space	$O(b^d)$	$O(b^{1+\lfloor C^*/\epsilon \rfloor})$	$O(bm)$	$O(b\ell)$	$O(bd)$	$O(b^{d/2})$
Optimal?	Yes[c]	Yes	No	No	Yes[c]	Yes[c,d]

- **Informed Search Strategies :**
  - **Best First Search — Greedy**
    - Heuristic Function
    - Straight Line Distance
  - **A* Best First Search**
    - *Conditions for Optimality :*
      Admissible Heuristic — *Never Overestimates cost to reach the goal.*
      Consistency (*for graph search)* — Triangularity Rule for heuristic cost.
    - Proof for Optimality.
    - Absolute and Relative Error
  - **IDA***
  - **Recursive Best First Search**
  - **Simplified Memory Bound A***
    Condition for Completeness