1. What is AI? Explain its definition based on its categories.

AI is a branch of science that deals with building helping machines to find solutions of complex problems in a human-like fashion. It involves borrowing characteristics from human intelligence and applying them as algorithms in a computer friendly way to solve tasks requiring reasoning, learning, problem solving, perception and language understanding.

AI can be defined on the basis of following categories:

1. Thinking humanly: The cognitive modelling approach

This approach attempts to model how humans think and make decisions to develop computer programs that mimic the human cognitive process, which is done by three ways:

1. Through introspection: trying to catch our own thoughts as the go by
2. Through psychological experiments: observing a person in action
3. Through brain imaging: observing the brain in action

This sufficiently precise theory of the mind can be expressed as a computer program. If the program’s I/O behaviour matches corresponding human behaviour, we can say that the program is operating like a human mind. Example: Building AI that solves problems using techniques derived from studies of how humans solve similar problems.

1. Thinking rationally: The “laws of thought” approach

This approach is based on formal logic and aims to create machines that reason using logical rules to arrive at correct conclusions. It uses syllogisms and mathematical logic like the Greek philosopher Aristotle’s syllogism that argument structures always yield correct conclusion when given correct. Example: Ram is man; all men are mortal. Therefore, Ram is mortal.

The obstacles to this approach are:

1. It is difficult to convert informal knowledge into formal terms using logical notations, especially when the knowledge isn’t 100% certain.
2. There is big difference between solving a problem in principle and in practise. A computer has limited computational resources which may be exhausted unless given guidance as to which reasoning steps to try first.

Example: Logic-based expert systems that use if-then rules to diagnose problems or provide recommendations.

1. Acting humanly: The Turing Test approach (Chinese room argument)

The Turing Test (Alan Turing,1950) says that a computer passes the test if a human interrogator, after posing some written questions, can’t tell whether the written response comes from a person or a computer. The test if for a program to have a conversation with a n interrogator for 5 minutes. The interrogator then guesses if conversation is with a program or a person. The program passes the test if it fools the interrogator 30% of the time.

To pass the Turing test, a computer must have the following capabilities:

1. Natural language processing: to communicate in English
2. Knowledge representation: to store what it knows or hears
3. Automated reasoning: to used store information to answers questions and draw new conclusions
4. Machien learning: to adapt to new circumstances and detect, extrapolate patterns

Example: Chatbots that mimic human conversation.

1. Acting rationally: The rational agent approach

A rational agent is an agent that acts to achieve the best outcome or the best expected outcome when there is uncertainty. The goal of this approach is to build agents that maximize performance using the best possible decision in each situation.

Acting rationally means doing things that lead to best results. Sometimes this means thinking logically (like solving a math problem). But sometimes it may mean just doing something that works best is enough. Example: touching a hot stove and pulling our hand away reflexively is a smart(rational) action if even we didn’t reason about it, we just did it to quickly avoid harm.

This approach is better than others because it is more:

1. Flexible: acting rationally doesn’t only mean using logic, there are also other ways
2. Scientific: it is easier to study and improve with science as its based on what actually works not just how humans think or behave.

Example: Autonomous vehicles making real-time decisions based on sensor data to avoid obstacles and reach destinations efficiently.

1. Explain in detail about history of AI.
2. Explain in detail about application of AI.