**Chapter 1**

**Introduction to Artificial Intelligence**

**The chapter consist of Short type Questions & Answers , Descriptive Question & Answer and MCQs &answers.**

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# Short type Questions & Answers

## Q. What is artificial intelligence?

A. It is the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable.

## Q What are the capabilities that a computer should process?

The capabilities are:

   Natural language processing.

   Knowledge representation.

.Automated reasoning.

  Machine learning.

## What Is The Difference Between Strong Ai And Weak Ai?

**Answer :**

Strong AI makes the bold claim that computers can be made to think on a level (at least) equal to humans. Weak AI simply states that some "thinking-like" features can be added to computers to make them more useful tools... and this has already started to happen (witness expert systems, drive-by-wire cars and speech recognition software). What does 'think' and 'thinking-like' mean? That's a matter of much debate

## Q. Yes, but what is intelligence?

A. Intelligence is the computational part of the ability to achieve goals in the world. Varying kinds and degrees of intelligence occur in people, many animals and some machines.

## Q. Isn't there a solid definition of intelligence that doesn't depend on relating it to human intelligence?

A. Not yet. The problem is that we cannot yet characterize in general what kinds of computational procedures we want to call intelligent. We understand some of the mechanisms of intelligence and not others.

## Q. Is intelligence a single thing so that one can ask a yes or no question ``Is this machine intelligent or not?''?

A. No. Intelligence involves mechanisms, and AI research has discovered how to make computers carry out some of them and not others. If doing a task requires only mechanisms that are well understood today, computer programs can give very impressive performances on these tasks. Such programs should be considered ``somewhat intelligent''.

## Q. Isn't AI about simulating human intelligence?

A. Sometimes but not always or even usually. On the one hand, we can learn something about how to make machines solve problems by observing other people or just by observing our own methods. On the other hand, most work in AI involves studying the problems the world presents to intelligence rather than studying people or animals. AI researchers are free to use methods that are not observed in people or that involve much more computing than people can do.

## Q. What about IQ? Do computer programs have IQs?

A. No. IQ is based on the rates at which intelligence develops in children. It is the ratio of the age at which a child normally makes a certain score to the child's age. The scale is extended to adults in a suitable way. IQ correlates well with various measures of success or failure in life, but making computers that can score high on IQ tests would be weakly correlated with their usefulness. For example, the ability of a child to repeat back a long sequence of digits correlates well with other intellectual abilities, perhaps because it measures how much information the child can compute with at once. However, ``digit span'' is trivial for even extremely limited computers.

However, some of the problems on IQ tests are useful challenges for AI.

## Q. What about other comparisons between human and computer intelligence?

Arthur R. Jensen, a leading researcher in human intelligence, suggests ``as a heuristic hypothesis'' that all normal humans have the same intellectual mechanisms and that differences in intelligence are related to ``quantitative biochemical and physiological conditions''. I see them as speed, short term memory, and the ability to form accurate and retrievable long term memories.

Whether or not Jensen is right about human intelligence, the situation in AI today is the reverse.

Computer programs have plenty of speed and memory but their abilities correspond to the intellectual mechanisms that program designers understand well enough to put in programs. Some abilities that children normally don't develop till they are teenagers may be in, and some abilities possessed by two year olds are still out. The matter is further complicated by the fact that the cognitive sciences still have not succeeded in determining exactly what the human abilities are. Very likely the organization of the intellectual mechanisms for AI can usefully be different from that in people.

Whenever people do better than computers on some task or computers use a lot of computation to do as well as people, this demonstrates that the program designers lack understanding of the intellectual mechanisms required to do the task efficiently.

## Q. What is the Turing test?

A. Alan Turing's 1950 article *Computing Machinery and Intelligence* [[Tur50](http://www-formal.stanford.edu/jmc/whatisai/node5.html#Turing50)] discussed conditions for considering a machine to be intelligent. He argued that if the machine could successfully pretend to be human to a knowledgeable observer then you certainly should consider it intelligent. This test would satisfy most people but not all philosophers. The observer could interact with the machine and a human by teletype (to avoid requiring that the machine imitate the appearance or voice of the person), and the human would try to persuade the observer that it was human and the machine would try to fool the observer.

The Turing test is a one-sided test. A machine that passes the test should certainly be considered intelligent, but a machine could still be considered intelligent without knowing enough about humans to imitate a human.

Daniel Dennett's book *Brainchildren* [[Den98](http://www-formal.stanford.edu/jmc/whatisai/node5.html#Dennett98)] has an excellent discussion of the Turing test and the various partial Turing tests that have been implemented, i.e. with restrictions on the observer's knowledge of AI and the subject matter of questioning. It turns out that some people are easily led into believing that a rather dumb program is intelligent.

## Q. Does AI aim at human-level intelligence?

A. Yes. The ultimate effort is to make computer programs that can solve problems and achieve goals in the world as well as humans. However, many people involved in particular research areas are much less ambitious.

## Q. How far is AI from reaching human-level intelligence? When will it happen?

A. A few people think that human-level intelligence can be achieved by writing large numbers of programs of the kind people are now writing and assembling vast knowledge bases of facts in the languages now used for expressing knowledge.

However, most AI researchers believe that new fundamental ideas are required, and therefore it cannot be predicted when human-level intelligence will be achieved.

## Q. Are computers the right kind of machine to be made intelligent?

A. Computers can be programmed to simulate any kind of machine.

Many researchers invented non-computer machines, hoping that they would be intelligent in different ways than the computer programs could be. However, they usually simulate their invented machines on a computer and come to doubt that the new machine is worth building. Because many billions of dollars that have been spent in making computers faster and faster, another kind of machine would have to be very fast to perform better than a program on a computer simulating the machine.

## Q. Are computers fast enough to be intelligent?

A. Some people think much faster computers are required as well as new ideas. My own opinion is that the computers of 30 years ago were fast enough if only we knew how to program them. Of course, quite apart from the ambitions of AI researchers, computers will keep getting faster.

## Q. What about parallel machines?

A. Machines with many processors are much faster than single processors can be. Parallelism itself presents no advantages, and parallel machines are somewhat awkward to program. When extreme speed is required, it is necessary to face this awkwardness.

## Q. What about making a ``child machine'' that could improve by reading and by learning from experience?

A. This idea has been proposed many times, starting in the 1940s. Eventually, it will be made to work. However, AI programs haven't yet reached the level of being able to learn much of what a child learns from physical experience. Nor do present programs understand language well enough to learn much by reading.

## Q. Might an AI system be able to bootstrap itself to higher and higher level intelligence by thinking about AI?

A. I think yes, but we aren't yet at a level of AI at which this process can begin.

# Descriptive Question & Answer

## Q What is AI? List down all components of AI

A. According to the father of Artificial Intelligence, John McCarthy, AI is The science and engineering of

making intelligent machines, especially intelligent computer programs.

The study of mental faculties through the use of computational models.

—Charniak and McDermott, 1985

A field of study that seeks to explain and emulate intelligent behaviour in terms of computational

processes.

—Schalkoff, 1990

The study of how to make computer do things at which, at the moment, people are better.

—Rich and Knight, 1991

Definition of AI vary along two main dimensions:

1. Thought process and reasoning

2. Behavior

Some definitions measure success in terms of human performance, whereas some measure against ideal

concept of intelligence, that is, rationality.

A system is rational if it does right things. This gives four possible goals to peruse AI:

1. System that reasons (thinks) like human

2. System that reasons (thinks) rationally

3. System that acts like human

4. System that acts rationally

**Components of AI :**

In AI, the intelligence is intangible which is composed of mainly five techniques as follows:

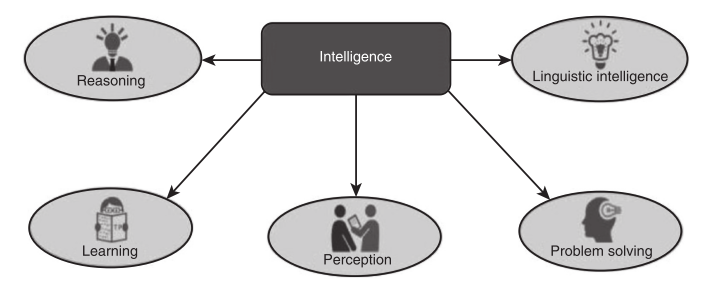
1. Reasoning

2. Learning

3. Problem solving

4. Perception

5. Linguistic intelligence



1 Reasoning

Reasoning is the set of processes that enables an intelligent system to help or to provide basis for actions, making decisions, and prediction. Reasoning is of two types: Inductive Reasoning and Deductive Reasoning.

Inductive reasoning conducts specific observations to make broad, general statements, for example:

“Rashmi is a teacher.

All teachers are studious.

Therefore, Rashmi is studious.”

Deductive reasoning which starts with a general statement and checks the possibilities to reach a specific or a logical conclusion, for example:

“All men of age above 60 years are grandfathers.

Akash is 65 years.

Therefore, Akash is a grandfather.”

2 Learning

Learning is the process of gaining knowledge by understanding, practising, being taught, or experiencing one thing. Learning enhances the awareness of any topic. The flexibility of learning is possessed by humans, some animals, and AI-enabled systems.

3 Problem Solving

Problem solving is the method during which one perceives and tries to make a desired answer from a present state of affairs by taking some path, that is blocked by known or unknown hurdles. Drawback solving also includes deciding that is the method of choosing the most effective appropriate alternative out of multiple alternatives to succeed in the specified goal are available.

4 Perception

Perception is the method of acquiring, decoding, selecting, and organizing sensory data. Perception presumes sensing. In humans, perception is aided by sensory organs. Within the domain of AI, perception mechanism puts the info acquired by the sensors along in a very meaningful manner.

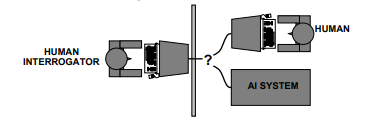
5 Linguistic Intelligence

Linguistic intelligence is one’s ability to use, comprehend, speak, and write the verbal and written language.It is important in interpersonal communication.

## Q Suppose you are a designing a machine to pass the truing test. What are the capabilities such machine must have? Explain

The test projected by Ellen Alan Mathison Turing was designed to produce satisfactory

operational definition of intelligence. Alan Mathison Turing outlined intelligent behavior, as the ability to realize human-level performance altogether in cognitive tasks, capable to fool the interrogator



**Figure**  Turing’s test.

The test proposed by Turing is that the computer should be interrogated by a human via a teletype. The computeris said to have passed the test if the interrogator cannot tell if there is a computer or a human at the other end as shown in Fig.

For programming a computer to pass the test, it would need to possess the following capabilities:

Here are the six features that would be required for a machine to pass the Turing test.

* **Natural Language Processing -**To be able to communicate in a commonly agreed language.
* **Knowledge representation -**To store the known information.
* **Automated Reasoning -**To use the stored information to answer questions and to draw new conclusions.
* **Machine Learning -**Yoadapy to new circumstances and to detect and extrapolate patterns.
* **Computer Vision -**To perceive objects
* **Robotics -**To manipulate objects and move about.

The last two points are required to pass the so-called ‘Total Turing Test’; it involves the physical interaction of the interrogator and the machine.

## Q Write a short note on : Application of Artificial Intelligence

1. Game playing: IBM’s Deep Blue defeated the world chess champion Garry Kasparov in 1997. The value of IBM’s stock increased by $18 billion.

2. Mathematics: Proved a mathematical conjecture (Robbins conjecture) unsolved for decades.

3. Autonomous control: The ALVINN computer vision system was trained to steer car to keep it following a lane. It was placed in CMU’s NAVLAB computer-controlled minivan and used to navigate across the United States from Pittsburgh to San Diego. For 2,850 miles, it was in control of the vehicle 98% percent of the time. NAVLAB has video cameras that transmit road images to ALVIN, which then computes the best direction to steer, based on the experience from previous training run.

4. Diagnosis: Medical diagnosis programs based on probabilistic analysis have been able to perform at the level of an expert physician in several areas of medicine.

5. Logistics planning: During the 1991 Gulf War, the U.S. forces deployed an AI logistics planning scheduling program (DART) to do automated logistics planning and scheduling for transportation that involved up to 50,000 vehicles, cargo, and people.

6. Autonomous planning and scheduling: NASA’s on-board autonomous planning program controlled the scheduling of operations for a spacecraft.

7. Language understanding and problem solving: Proverb is a computer program that solves crossword puzzles better than most humans.

8. Robotics: Many surgeons now use robot assistance like (HipNav) in microsurgery.

9. Natural Language Generation: NLG is a technique to produce text from computer data. It is currently used in report generation, customer service, and summarizing business intelligence insights.

10. Speech recognition: Speech recognition transcribes and transforms human speech into format useful for computer applications, which is used in interactive voice response systems and mobile applications.

11. Virtual agents: This technique has become so famous that companies call it “The current darling of the media,” from simple chatbots to advanced systems that can network with humans. Virtual agents are currently used in customer service and support and as a smart home manager.

12. Machine-learning platforms: ML provides algorithms, APIs, development and training toolkits, data, as well as computing power to design, train, and deploy models into applications, processes, and other

machines. It is currently used in a wide range of enterprise applications, mostly involving prediction or classification.

13. AI-optimized hardware: Graphics processing units (GPUs) and appliances are specifically designed and architected to efficiently run AI-oriented computational jobs. Currently, it is primarily making a difference in deep learning applications.

14. Decision management: Engines that insert rules and logic into AI systems and used for initial setup/ training and ongoing maintenance and tuning. As amateur technology, it is used in a wide variety of enterprise applications, assisting in or performing automated decision-making.

15. Deep learning platforms: Deep learning is special type of machine learning which have concept of neural network, it is used in pattern recognization and other many applications.

16. Biometrics: Biometric is bridge between human and machine which is not only using image or touch characteristics but also involves speech and other human body part recognizations.

17. Robotic process automation: AI is also used to create the automated machine which works same as human and also supports in many business functions.

18. Text analytics and NLP: Natural language processing (NLP) uses text analytics by making easier the comprehension of sentence structure and meaning, sentiment, and intent by statistical and machine learning methods.

## Q Areas and Task Domain of Artificial Intelligence(AI)

TASK DOMAIN OF AI

 Areas of Artificial Intelligence

- Perception

·       Machine Vision: It is easy to interface a TV camera to a computer and get an image into memory; the problem is *understanding*what the image represents. Vision takes *lots* of computation; in humans, roughly 10% of all calories consumed are burned in vision computation.

·       Speech Understanding: Speech understanding is available now. Some systems must be trained for the individual user and require pauses between words. Understanding continuous speech with a larger vocabulary is harder.

·       Touch(*tactile* or *haptic*) Sensation: Important for robot assembly tasks.

-  Robotics Although industrial robots have been expensive, robot hardware can be cheap: Radio Shack has sold a working robot arm and hand for $15. The limiting factor in application of robotics is not the cost of the robot hardware itself. What is needed is perception and intelligence to tell the robot what to do; ``blind'' robots are limited to very well-structured tasks (like spray painting car bodies).

-   Planning Planning attempts to order actions to achieve goals. Planning applications include logistics, manufacturing scheduling, planning manufacturing steps to construct a desired product. There are huge amounts of money to be saved through better planning.

-  Expert Systems Expert Systems attempt to capture the knowledge of a human expert and make it available through a computer program. There have been many successful and economically valuable applications of expert systems. Expert systems provide the following benefits

• Reducing skill level needed to operate complex de vices.

• Diagnostic advice for device repair.

• Interpretation of complex data.

• ``Cloning'' of scarce expertise.

• Capturing knowledge of expert who is about to ret ire.

• Combining knowledge of multiple experts.

- Theorem Proving Proving mathematical theorems might seem to be mainly of academic interest.However, many practical problems can be cast in terms of theorems. A general theorem prover can therefore be widely applicable.

Examples:

•  Automatic construction of compiler code generators from a description of a CPU's instruction set.

•  J Moore and colleagues proved correctness of the floating-point division algorithm on AMD CPU chip.

- Symbolic Mathematics Symbolic mathematics refers to manipulation of *formulas*, rather than arithmetic on numeric values.

•  Algebra

•  Differential and Integral Calculus

Symbolic manipulation is often used in conjunction with ordinary scientific computation as a generator of programs used to actually do the calculations. Symbolic manipulation programs are an important component of scientific and engineering workstations.

- Game Playing Games are good vehicles for research because they are well formalized, small, and self-contained. They are therefore easily programmed. Games can be good models of competitive situations, so principles discovered in game-playing programs may be applicable to practical problems.

## Q Define in your own words: i) Intelligence , ii) Artificial Intelligence

1. **Intelligence** : Intelligence is the process or a part of the power to attain goals within the world. Different types and degrees of intelligence occur in folks (people), several animals, and a few machines. Intelligence is employed to resolve issues or solve problems. To begin the discussion, initially we would discuss what is normally a problem and the way it is solved.
2. **Artificial Intelligence:**

Artificial Intelligence (AI) can be defined as an approach of creating an automatic robot, or a system, or a software, having intelligence same as humans and perform task with the same efficiency as human do.

In Information Communication Technology, AI has done some amazing changes which we didn’t even think of. Nearly everywhere we look today, we see intelligent systems talking to us like “Hello .......Siri :)” or offering recommendations through Netflix and Amazon or by providing financial advice by Schwab’s Intelligent Portfolio, even for winning game shows IBM’s Watson helps and more interesting is watching sci-fi movies which uses AI.

According to the father of Artificial Intelligence, John McCarthy, AI is The science and engineering of making intelligent machines, especially intelligent computer programs.

# MCQs & Answers

**1.** What is AI?

(a) Putting your intelligence into computer

(b) Playing a game

(c) Putting more memory into computer

(d) Programming with your own intelligence

(e) Making a machine intelligent

**2.** Which programming language is not the

commonly used for AI?

(a) LISP (b) Perl

(c) PROLOG (d) Java

(e) Java script

**3.** LISP was developed by:

(a) Marvin Minsky

(b) Alan Turing

(c) John McCarthy

(d) Allen Newell and Herbert Simon

4. In LISP, the function returns the list that results after the first element is removed (the rest f the list), is

(a) car

(b) last

(c) cons

(d) cdr

5. Output segments of Artificial Intelligence programming contain(s)

1. Printed language and synthesized speech
2. Manipulation of physical object
3. Locomotion
4. All of the mentioned

6. LISP was created by:

1. John McCarthy
2. Marvin Minsky
3. Alan Turing
4. Allen Newell and Herbert Simon

7. An Artificial Intelligence system developed by Terry A. Winograd to permit an interactive dialogue about a domain he called blocks-world.

1. SHRDLU
2. SIMD
3. BACON
4. STUDENT

8. MLMenu, a natural language interface for the TI Explorer, is similar to:

(a) Ethernet

(b) NaturalLink

(c) PROLOG

(d) The Personal Consultant

9. Strong Artificial Intelligence is

(a) the embodiment of human intellectual capabilities within a computer

(b) a set of computer programs that produce output that would be considered to reflect intelligence if it were generated by humans

(c) the study of mental faculties through the use of mental models implemented on a computer

(d) all of the mentioned

**Answers**

**1. (e) 2. (b) 3. (c) 4. (d) 5. (d) 6. (a) 7. (a) 8. (b) 9. (a)**