**Assignment : 1**

**NAME : MUHAMMAD AZIZ**

**F/NAME : AHMED KHAN**

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* 1. **Define in your own words: (a) intelligence, (b) artificial intelligence, (c) agent, (d) rationality, (e) logical reasoning?**

ANS.

(a) **Intelligence** – means to have the knowledge to learn and understand different situations.  
(b) **artificial intelligence** – the ability of a computer or robot to act like a human and make decisions based on pre-defined rules.  
(c) **agent** – is the entity that is doing the actions, it can interact with the environment, change it, and learn from it.  
(d) **rationality** – is the ability of doing the right thing based on what it already knows or has learned from the environment.  
(e) **logical reasoning** – is the process using arguments, statements, premises, and axioms to determine whether a statement is true or false.

**1.3 Are reﬂex actions (such as ﬂinching from a hot stove) rational? Are they intelligent?**

ANS. - Yes, reflex actions such as flinching from a hot stove are rational because it is the right thing to do. We don’t think before we flinch from a hot stove because it suppose to be quick, thinking will defeat the purpose of flinching.  
- No, I believe that reflex actions are not intelligent because you don’t have to put any thought into them, we do them automatically.

**1.4 There are well-known classes of problems that are intractably difficult for computers, and other classes that are provably undecidable by any compute. Does this mean that AI is impossible?**

ANS. No. It is not impossible to understand and make this algorithm a success. It may only take a longer duration to reach success but it does not that it is impossible. Problems may become more difficult to understand and debug but there is enough time, duration, resources and support, the algorithm, can be developed.

**1.5. The neural structure of the sea slug Aplysia has been widely studied (first by Nobel Laureate Eric Kandel) because it has only about 20,000 neurons, most of them large and easily manipulated. Assuming that the cycle time for an Aplysia neuron is roughly the same as for a human neuron, how does this computational power, in terms of memory updates per second, compare with the high-end computer described in Figure 1.3?**

ANS. The sea slug Aplysia has roughly the same cycle time as a human brain (10^3). So the computational power in terms of memory updates per second = 20,000 / 10^3 = 2 x 10^7 memory updates per second. The computational power of the high-end computer is 10^14 memory updates per second, so a high-end computer is twice as fast.

**1.6 How could introspection – reporting on one’s own inner thoughts – be inaccurate? Could I be wrong about what I am thinking? Discuss.**

Cognitive bias can lead to inaccurate introspection and irrationality. The thoughts that a person has about their surroundings are then subjective instead of objective. While you believe that you may not be wrong about what you are thinking, you very well could be, because you interpreted the environment without thinking about it. It is possible to overcome cognitive bias by using controlled processing instead of automatic processing.

**1.7 To what extent are the following computer systems instances of artificial intelligence • Supermarket Bar Code Scanners**  • **Voice-Activated Telephone Menus • Spelling and grammar correction features in Microsoft Word**  **• Internet routing algorithms that respond dynamically to the state of the network**

ANS. The following items contain at least some artificial intelligence.

**• Supermarket Bar Code Scanners** are tied into a database with records for each item in a specific store. The scanner itself just reads the code and fins the corresponding item in the database and comes up with the correct price. The scanner itself has to be able to recognize that there is a bar code present, scan it, and display the information to the cashier and the customer.

**• Spelling and grammar correction features in Microsoft Word** Microsoft is taking on rival Grammarly with a new feature in its Word software, using AI to suggest writing improvements beyond simple grammar and spelling corrections.Now Microsoft is adapting Ideas to Microsoft Word, offering ideas to enhance each user’s own writing style. The computing giant announced the changes at its Microsoft Build developer showcase in Seattle on Monday. Although Word already corrects misspelled words and suggests changes to grammar, Ideas summarises the word length and how long it will take to read the document.

• **Voice-Activated Telephone Menus** are in a way, similar to Web Search Engines. The phone is programmed to hear a voice, listen for key words, and perform an action based on those words. For example, I take out my phone and say “Galaxy, call home.” My phone picks up that I’m addressing it by saying Galaxy, it knows to open the phone app when I say call, and it knows which contact to call when I saw home. If I had multiple numbers for home it would ask me to clarify which number I want to call.

**• Internet routing algorithms that respond dynamically to the state of the network** respond on their own to what’s happening in their environment. If there is too much traffic, it can decided whether or not to open up more space. Internet Routing Algorithms know what ports are accessible and which ones are not. Yes it is programmed to do so but it reacts on its own. There’s no one scanning a box of cereal, searching the web for Iron Man, or someone telling there phone to call home.

**1.8 Many of the computational models of cognitive activities that have been proposed involve quite complex mathematical operations, such as convolving an image with a Gaussian of finding a minimum of the entropy function. Most humans (and certainly all animals) never learn this kind of mathematics at all, almost no one learns it before college, and almost no one can compute the convolution of a function with a Gaussian in their head. What sense does it make to say that the “vision system” is doing this kind of mathematics, were as the actual person has no idea how to do it?**

ANS. It’s a theory, there is no way of proving or disproving. Maybe it’s just a reflex, like you breath automatically sure you could hold your breath till you pass out, but then you’d start breathing again.

**1.9 Some authors have claimed that perception and motor skills are the most important part of intelligence, and that "higher level" capacities are necessarily parasitic-simple add-ons to these underlying facilities. Certainly, most of evolution and a large part of the brain have been devoted to perception and motor skills, whereas AI has found tasks such as game playing and logical inference to be easier, in many ways, than perceiving and acting in the real world. Do you think that Al's traditional focus on higher-level cognitive abilities is misplaced?**

ANS. Of course, perception and motor skills are important, vision and robots are good.

However, given awareness, the agent still has to "determine" what action to take (either by reasoning or reacting). This applies not only to the real world, but also to artificial microworlds such as chess. Whatever systems of perception and movement are "tied" to the agent's program, calculating the appropriate actions remains an important part of AI. On the other hand, it is also true that interest in the microcosm has excluded AI from this exciting environment.

**1.10** **Is AI a science, or is it engineering? Or neither or both? Explain.**

ANS. AI is both science and engineering. Observing and experimenting, which are at the core of any science, allows us to study artificial intelligence. From what we learn by observation and experimentation, we are able to engineer new systems that encompass what we learn and that may even be capable of learning themselves.

**1.11 “Surely computers cannot be intelligent—they can do only what their programmers tell them.” Is the latter statement true, and does it imply the former?**

ANS. The latter statement is true, in a sense. Yes computers only do what they’re told, but they also learn from what they do. After a certain period of time they know what works and what doesn’t. You can look at two children the same way. Child A is brought up in a good home, enrolled in school, taught right from wrong. Child B is raised in a less than favorable neighborhood, not enrolled in school, and does not have much parental guidance. Child A has a completely different view of the world from Child B. Children can only do what their parents (programmers) tell them to do. But does that mean Child B will never succeed in anything or that Child. A will always do great things? The answer is no, There are outside factors that affect children (programs). The program performs its tasks and takes in knowledge and learns as it goes.

**1.12 “Surely animals cannot be intelligent—they can do only what their genes tell them.” Is the latter statement true, and does it imply the former?**

ANS. The latter statement is blatantly false. Mostly because I don’t believe we’ve even begun to really understand animals. Yes we can watch them, study their behavior and habits, but that doesn’t mean we know why they do the things they do. Yes, there are certain animals that are smarter than others. For example, a dolphin is smarter than a sloth. Dolphins can learn commands and remember people they interact with frequently, while sloths sometimes mistake their arms for a branch and fall out of trees. Just as intelligence varies from person to person, it varies from animal to animal, not only between different species, but also within. There could be two dolphins of the exact same species and one is more intelligent than the other.

**1.13** **“Surely animals, humans, and computers cannot be intelligent – they can do only what their constituent atoms are told to do by the laws of physics.” Is the latter statement true, and does it imply the former?**

ANS. The latter statement is true. Obviously, atoms cannot go against the laws of physics. However, the former statement is not an implication of the latter. Animals, humans, and computers can be intelligent, but they cannot go against the laws of physics. There is a set of bounds in which they can work within, where they are rational and intelligent, but still abiding by the laws of physics

**1.14 Examine the AI literature to discover whether the following tasks can currently be solved by computers:**

**A) Playing a decent game of table tennis (Ping-Pong).**

**B) Driving in the center of Cairo, Egypt.**

**C) Driving in Victorville, California.**

**D) Buying a week’s worth of groceries at the market.**

**E) Buying a week’s worth of groceries on the Web.F) Playing a decent game of bridge at a competitive level.**

**G) Discovering and proving new mathematical theorems.**

**H) Writing an intentionally funny story.**

**I) Giving competent legal advice in a specialized area of law.**

**J) Translating spoken English into spoken Swedish in real time.**

**K) Performing a complex surgical operation.**

**For the currently infeasible tasks, try to find out what the difficulties are and predict when, if ever, they will be overcome.**

Ans.

A) Playing a decent game of table tennis (Ping-Pong) – This is solvable by computers. A robot arm can be fitted with a ping pong paddle and motion sensors to move to wherever the ball is.

B) Driving in the center of Cairo, Egypt – This is solvable by computers. Google is working on a self-driving car. It requires a ton of motion sensors in order to respond to its surroundings. One issue would be refilling the gas tank.

C) Driving in Victorville, California -This is solvable by computers. Google is working on a self-driving car. It requires a ton of

motion sensors in order to respond to its surroundings. One issue would be refilling the gas tank.

D) Buying a week’s worth of groceries at the market – This would be a challenge for computers right now. The computer would have to know what it (or you) wants, it would have to be able to identify foods without bar codes such as apples.

E) Buying a week’s worth of groceries on the Web – This is solvable by computers. All you need to do is tell your computer what you want, what size (if any), how many, etc. You would also need your payment information accessible to your computer so it can complete the transaction for you. Aside from picking up your groceries, everything is done for you.

F) Playing a decent game of bridge at a competitive level – This is solvable by computers. There are already computers that can play chess at a competitive level, and since bridge isn’t as complicated as chess it shouldn’t be too hard for a computer.

G) Discovering and proving new mathematical theorems – This would be a challenge for computers right now. Computers can solve mathematical theorems, but discovering them is a whole different story. A computer would have to be self aware to discover anything.

H) Writing an intentionally funny story -This would be a challenge for computers right now. Computers don’t know the concept of comedy. You can input jokes into a computer, but it won’t know how to

write a funny story with new material.

I) Giving competent legal advice in a specialized area of law – This would be a challenge for computers right now. They would need to know every aspect of the case and that specific area of the law. It’s easier for a computer to give quantitative advice than qualitative advice

J) Translating spoken English into spoken Swedish in real time – This is solvable by computers.

K) Performing a complex surgical operation – This would be a challenge for computers right now.

**1.15 Various subfields of AI have held contents by defining a standard task and inviting researchers to do their field. Example include the DARPA Grand Challenge for robotic cars. The International Planning Competition, the Robocup robotic soccer league, the TREC information retrieval event, and contents in machine translation, speech recognition. Investigate five of these contests, and describe the progress made over the years. To when degree have the contests advanced toe state of the art in AI? Do what degree do they hurt the field by drawing energy away from new ideas?**

ANS. The following are the investigations of the five contests:

(1). Robot car DARPA Grand Challenge:An institution called DARPA (Defense Advanced Research Projects Agency) allows safedriving without human assistance. Research continues to strengthen the standards for testingwhether self-driving cars obey traffic rules and can drive like or better than humans. Assignnew tasks to competing teams. With standard advancements, robot cars are enhanced withnew features and functions.It organizes a sweepstakes competition for American automobiles.The progress made at DARPA is as follows.

(1) On March 13, 2004, the first convention was held in the Mojave Desert region of theUnited States. It was a race that ran 240km (about 150 miles). No robot has completed thepass and received the award

2) in the second competition, chaired by Fahiem Bacchus, 17 planners competed. The increase in participation and the ambitions for larger scale testing required that the event be spread over a much longer period. In fact, testing was spread over a couple of months, with only one final test being carried out at the conference site (AIPS'00 in Breckenridge). In the second competition there was a more formal split between systems, with a small number using hand-coded control knowledge and others being fully-automated. There was also a split between STRIPS and ADL capable systems. The larger number of competitors included a wider range of approaches: as well as Graphplan-based systems, forward heuristic search and a SATsolver, there were several planners based on model-checking approaches using BDDs, and one using planning-by-rewriting. Again, it proved difficult to compare planners unequivocally, but several important observations could be made: the advantages of hand-coded control rules in most domains could be seen clearly (as would be expected), although there remained an important question about the difficulty of generating and writing the rules. Of the fully-automated planners, the forward heuristic search approach proved to be particularly successful, dominating performance in most domains. Pure Graphplan-based planning seemed to have reached its zenith between the first two competitions and no longer appeared competitive.

3) The third competition (and most recent at the time of writing) was held in association with AIPS'02 at Toulouse. Fourteen planners participated. The primary objective of the competition was to help to push forward research into temporal and resource-intensive planning. Extensions were made to PDDL to support the modelling of temporal and numeric domain features. These resulted in the PDDL2.1 language.The extensive changes to PDDL2.1 and the ambitious objectives of the competition help to account for the fact that fewer people participated in 2002 than in 2000. Once again, the real testing and gathering of data took place over the two months prior to the conference. Although initial results were presented at the conference, no detailed analysis took place at the conference itself. The rest of this paper examines the objectives of the third competition, the results and some future challenges for the series.

**4) Optima primed**

In control theory, control of a dynamic system — such as a robot, an airplane, or a power grid — is often treated as an [optimization](http://newsoffice.mit.edu/2015/optimizing-optimization-algorithms-0121) problem. The trick is to contrive a mathematical function whose minimum value represents a desired state of the system. Control is then a matter of finding that minimum and figuring out how to continuously nudge the system back toward it.

Optimization problems can be enormously complex, so they’re frequently used for offline analysis — for example, to determine how well much simpler control algorithms will work. But from the get-go, Tedrake decided that the MIT team’s control algorithms would solve optimization problems on the fly. That required innovation on multiple fronts