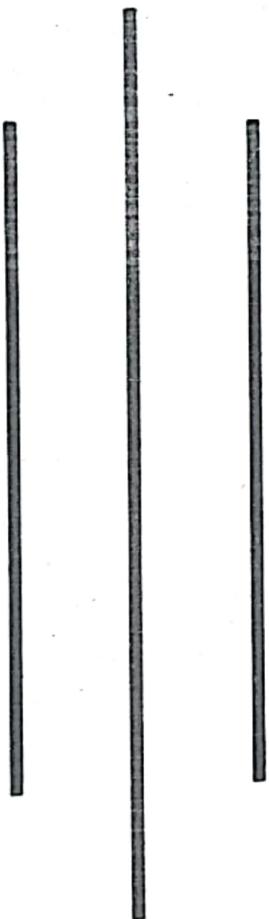




ARTIFICIAL INTELLIGENCE



SUGAM STATIONARY SUPPLIERS & PHOTOCOPY
SERVICE PH. NO. 9841599592 (NCIT COLLEGE)

2020

Artificial Intelligence (3 - 1 - 2)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:

The main objectives of this course are:

- To provide basic knowledge of Artificial Intelligence
- To familiarize students with different search techniques
- To acquaint students with the field of Machine learning and the applications of AI

Course Contents:

1. Introduction to AI

- 1.1. Definition of Artificial Intelligence
- 1.2. Brief history of Artificial Intelligence
- 1.3. Importance and Applications of Artificial Intelligence
- 1.4. AI and related fields
- 1.5. Definition of Knowledge, and learning
- 1.6. Intelligent Agents & its type and performance measures

(6 hrs)

1 → 8 marks

2. Problem solving

- 2.1. Defining problems as a state space search
- 2.2. Problem formulation and Problem types
- 2.3. Well defined problems
- 2.4. Constraint satisfaction problem
- 2.5. Game playing
- 2.6. Production systems

(4 hrs)

1, 2, 3, 5 question

30
23

3. Search techniques

- 3.1. Uninformed search techniques- depth first search, breadth first search, depth limit search, and search strategy comparison.
- 3.2. Informed search techniques- hill climbing, best first search, greedy search, A* search, simulated annealing, Genetic algorithms
- 3.3. Adversarial search techniques- minimax procedure, alpha beta procedure

(6 hrs)

15 marks

4. Knowledge representation, inference and reasoning

(8 hrs)

- 4.1. Approaches to Knowledge Representation.
- 4.2. Issues in Knowledge Representation.
- 4.3. Propositional logic, predicate logic, FOPL
- 4.4. Rules of inference, resolution refutation system (RRS), answer extraction from RRS
- 4.5. Statistical Reasoning- Probability and Bayes' theorem and causal networks, reasoning in belief networks

question

~~4.5 Semantic nets and frames~~

3 question
fixed

~~5 Machine learning~~

~~5.1 Concepts of learning~~

(12 hrs)

~~5.2 Learning by analogy, Inductive learning, Explanation based learning~~

~~5.3 Supervised Learning (Classification/Regression)- Nearest Neighbor, Naive Bayes, Logistic Regression, Support Vector Machine, Neural Networks~~

~~5.4 Unsupervised Learning~~

~~5.4.1 Clustering, K-means~~

~~5.4.2 Dimensionality Reduction (Principal Component Analysis, Linear Discriminant Analysis)~~

~~5.5 Reinforcement learning~~

~~5.6 Fuzzy learning~~

~~5.7 Boltzmann Machines~~

~~5.8 Deep Learning~~

~~6 Applications of AI~~

~~6.1 Neural networks~~

(9 hrs)

~~6.1.1 Network structure~~

~~6.1.2 Perceptron~~

~~6.1.3 Adaline network~~

~~6.1.4 Multilayer Perceptron, Back Propagation~~

~~6.1.5 Hopfield network~~

~~6.1.6 Kohonen network~~

~~6.2 Expert System~~

~~6.2.1 Architecture of an expert system~~

~~6.2.2 Development of expert systems~~

~~6.3 Natural Language Processing~~

~~6.3.1 Levels of analysis: Phonetic, Syntactic, Semantic, Pragmatic~~

~~6.4 Introduction to Machine Vision~~

~~6.5 Current trends and the future.~~

Laboratory Work:

Laboratory exercises should be conducted in either LISP or PROLOG.

Laboratory exercises must cover the fundamental search techniques, inference and reasoning and machine learning (Regression, Back propagation, SVM, clustering and Dimensionality reduction).

References:

1. E. Rich and Knight, *Artificial Intelligence*, McGraw Hill, 1991.
2. Stuart Russell and Peter Norvig, *Artificial Intelligence A Modern Approach*, Pearson, 2009
3. D. W. Patterson, *Artificial Intelligence and Expert Systems*, Prentice Hall, 2001.
4. P. H Winston, *Artificial Intelligence*, Addison Wesley, 1984.

AI is the study of how to make computers do the things which, at the moment, people do better.

Poozath
Stha

Chapter 1

सुगम स्टेसनरी सप्लायर्स एण्ड फोटोकॉपी सर्विस
बालकुमारी, लैलितपुर, ९८४९५९५९२
NCIT College & Cosmos College

6 hrs ; 2 LQ
discussable

Date _____
Page _____
Cosmos college

Introduction to AI

- ✓ According to the father of Artificial Intelligence John Mc Carthy, "The science and engineering of making intelligent machines specially intelligent computer program is called AI."
- AI is the intelligence displayed by machine in contrast to the natural intelligence displayed by human or other animal.
- AI is a way of making a computer, a computer control robot or a software think intelligently in a similar manner the intelligent human think.
- AI process may include learning, reasoning and self correction.

• Roles of AI

- (1) To create expert system.
- (2) To implement human intelligence in machine.

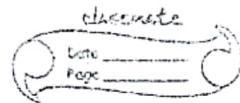
• History of AI

- During second world war, noted British computer scientist Alan Turing created Enigma machine, which could decipher German code.

- According to Turing, who came up with the idea in 1950, a machine that could converse with humans

without humans knowing that it is machine would win 'imitation game' and could be said to be intelligent.

- ⇒ In 1956, American computer scientist John McCarthy organized conference at which the term 'Artificial Intelligence' was adopted.
- ⇒ Also, in 50's John McCarthy, often known as the father of AI, developed the LISP programming language which became important in machine learning.
- ⇒ In 1960s researchers emphasized developing algorithms to solve mathematical problems and geometrical theorem.
- ⇒ In 1972, the first 'intelligent' humanoid robot was built in Japan.
- ⇒ However, despite this well-funded global effort over several decades, computer scientists found it incredibly difficult to create intelligence in machine.
- ⇒ Therefore, from mid 1970s to mid 1990s, scientist dealt with an acute shortage of funding for AI research.
- ⇒ Once again, in late 1990s American corporation once again became interested in AI.



→ In past 15 years, Amazon, Google, Baidu and other machine learning to their huge commercial advantage.

- Some definition of AI are categorized in four views of AI into 4 categories.

Thinking Humanly

Thinking Rationally

Acting Humanly

Acting Rationally

(1) Thinking Humanly (The cognitive modeling approach)

→ makes machines with just like that of human.

Cognition:

The action or process of acquiring knowledge and understanding through experience and senses is called cognition.

→ We need to understand the working of a human brain and then express it as a computer program.

Brain:

↳ Billions of nerve cell working together

↳ Synapses occur in brain.

↳ The areas in which the brain is still dominant over AI are:

1. Creativity

2. Emotion and empathy

3. Consciousness

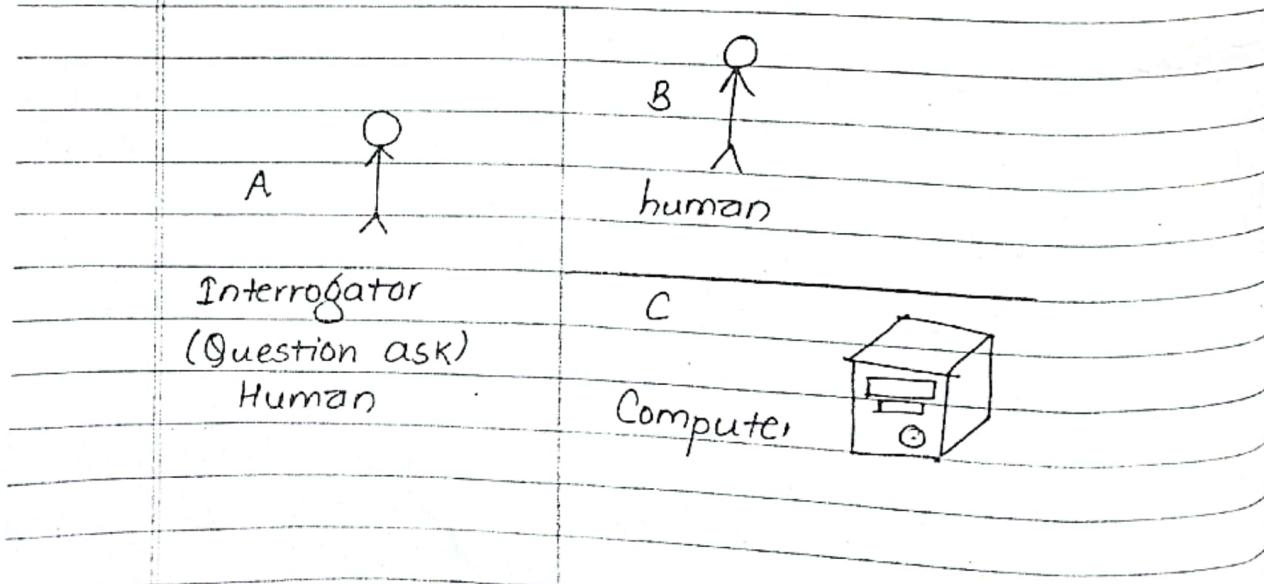
→ Two ways of thinking humanly

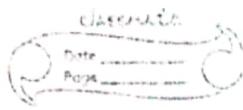
1.) Predicting and testing human behaviour
(Cognitive Science).

2.) Identification from neurological data
(Cognitive neuro Science).

(2) Acting Humanly (The turing test approach).

→ According to this text, a computer is said to have AI if it can mimic human responses under certain condition.





- W
- ⇒ In the above scenario, there are two ROMs 'B' and 'C' which contain a human and a computer system
 - ⇒ A person from another room 'A' ask a question through text and receive answers from 'B' & 'C'.
 - ⇒ To pass the test the machine has to make the interrogator into believing that it is a human.

- The machine must contain certain abilities or condition.

(1) NLP (National Language Processing) → V

- ⇒ must be able to communicate in english successfully.
- ⇒ knowledge representation to store what it knows or hear.
- ⇒ Automated reasoning to use the stored information to answer question & to draw new conclusions.
- ⇒ Machine learning to adapt to new circumstance to detect and extrapolate patterns.

(3) Thinking Rationally: The laws of thought approach

→ Aristotle was one of the first to attempt to codify right thinking that is reasoning process.

syllogism

→ He gave syllogism that always result a correct conclusion when correct premises are given.

Eg:-

Socrates is a man.
Man is mortal.

} premises

i.e. Socrates is mortal → conclusion

→ This initiated the field the logic.

(4) Acting Rationally: The rational agent approach

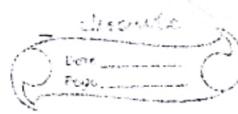
→ An agent is something that acts

→ Rational behaviour means doing the right thing.

→ Rational agent is the one that acts so as to achieve the best outcome when there is

uncertainty, the best expected outcome. In

→ In this approach the emphasis is given to correct inferences.



AI and related field:

- 1) Philosophy
- 2) Mathematics
- 3) Psychology
- 4) Economics
- 5) Linguistics
- 6) Neuroscience
- 7) Control theory

Intelligence

- ⇒ Ability for reason
- ⇒ Ability to understand
- ⇒ Ability to create plan and execute complex task
- ⇒ Ability to learn from experiences
- ⇒ Intelligent behaviour includes everyday task, formal task or expert task.

Applications of AI

1. Gaming

- ⇒ It plays crucial role in strategic games such as chess, poker, board game (Alpha GO; developed by Google Deepmind).

2. Natural Language processing (NLP)

- ⇒ It is possible to interact with the computer that understand natural language spoken by humans
Eg:- Okgoogle, Cortana, Alexa, Siri.



3. Intelligent Roberts

- ⇒ Aviation sector in teaching people to fix problems in aircraft.
- ⇒ Education sector in which intelligent robert tutors the student.
- ⇒ Different roberts used in heavy industry.

4. Speech/Handwritten Recognition

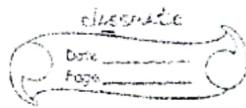
- ⇒ Different types of application are built to identify speech or handwriting.

5. Vision System

- ⇒ Doctor use clinical expert system to diagonsis the patient.
- ⇒ Face detection app in CCTV or smart phone.
- ⇒ Making maps through photograph taken.

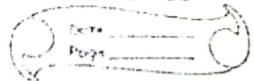
6. Music

- ⇒ Auto tuning ⇒ used
- ⇒ More advanced forms.



Difference between Intelligence & Artificial Intelligence

Intelligence	Artificial Intelligence
1. It can be defined as a general mental ability for reasoning, problem solving & learning.	It is the study of design of intelligent agent just like human which have the ability to analyze environment & produce action which maximize success.
2. Brain memory and thinking are used to perform action.	Built in instruction design by scientists or developer are used.
3. Higher creativity	Less creativity.
4. More biased	Less biased
5. Less operational ability	More operational ability.



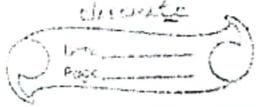
AI advantages /disadvantages

AI advantages:

1. Error reduction
2. Helps in difficult exploration like oceans beds, for fuels or travel in extreme condition & to carry out more task.
3. Daily application to help in our life as our assistant.
4. Helps to carry out repetitive job.
5. It donot require breaks or refreshment.
6. Has helped us to achieve greater heights in medical education and industry sector.

AI disadvantages:

1. High cast
2. No original creativity.
3. Rise in unemployment in human.
4. Can be used to create weapons for mass destruction.
5. No emotion attached so the decision may not



be that similar to human in some cases.

6. A technical glute can caused the whole system to go down and year of training is foiled.

Questions:

1. What is AI? Is AI a boon or a curse in present scenario?
2. Is your mobile phone an AI? Provide reasons for your answer.
3. As a student of engineering you are asked to prepare a government report on 'AI pros & cons' & whether it should be implemented in Nepal or not. Write a short report on it.
4. Differences between Intelligence & artificial intelligence. Trace the evolution of AI in brief.

Objectives of AI

⇒ The objective of AI is to enable computers to perform intellectual task such as decision making, problem solving, perception and understanding human communication.

Q With the help of an example explain the objective of AI.

knowledge & learning

⇒ The fact or condition of knowing something with familiarity gain through experience or association is knowledge.

⇒ To solve many problems knowledge should be represented in the computer system.

⇒ A good representation should be:

1) Rich enough to express the knowledge need to solve the problem.

2) Will to efficient computation.

3) Able to be gained from people, data and past experiences.

⇒ knowledge can be language, concept, procedure, rules, ideas, abstraction, etc.

Types of knowledge

(1) Meta knowledge

⇒ It is a knowledge about a knowledge and how to gain them.

(2) Procedural knowledge.

⇒ It is compiled or process form of information and is related to the performance of some task.

⇒ For example:

Sequence of step to solve a problem is procedural knowledge.

(3) Declarative knowledge:

⇒ It is passive knowledge in the form of statement of facts about the world.

⇒ For example:

Marks statement of a student is declarative knowledge.

(4) Heuristic knowledge: (best)

⇒ It is used to make judgement and also to simplify solution of problems and is acquired through experience.

(5) Structural knowledge:

⇒ It describes what relationship exist between concepts

Q. What is knowledge & learning? Explain different types of knowledge.

⇒ Learning is construction or modifying representation of what is being experienced.

⇒ Learning is acquiring new or modifying existing knowledge, behaviour, skills, values and may involve synthesizing different types of information.

⇒ Learning involves three factors:

- (1) Changes
- (2) Generalization
- (3) Improvement

⇒ Machine learning is branch of AI, is a scientific discipline concerned with a design and development of algorithm that allow computers to evolve behaviour based on empirical data such as from sensor data or database.

Intelligent agent and its type and performance measure:



Intelligent agents:

⇒ An agent is anything that can be viewed as perceiving each environment through sensor and acting upon that environment through actuators.

Sensor - ill
actuator: hands
legs off
mouth

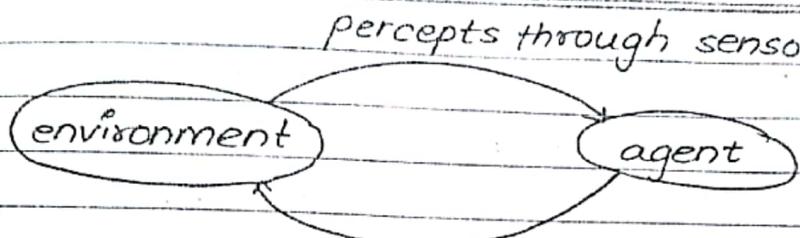
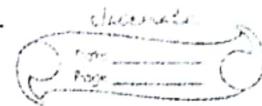


Fig: Agents & environments.

For example:

Human agent

Sensor: Eyes, Ears, skin act as sensor.

Actuator: Hand, legs, mouth act as actuator.

Robotic agent

Sensor: Camera, Infrared

Actuator: Motors

Properties of Agent.

- (1) Autonomous
- (2) Interact with environment and other agent
- (3) Reactive with the environment
- (4) It is goal directive.

PEAS:

To design an intelligent agent, we must specify its task environment.

PEAS stands Performance measure

Environment

Actuator &

Sensor.

- Performance measure:

⇒ An objective criteria for success of an agent behaviour is called performance measure.

⇒ Example:

Performance measure of a vacuum cleaner agent would be amount of dirt end up, amount of time taken, amount of electricity consume, amount of noise generated.

- Q. Point out the task designing of a bus driver agent about system according PEAS description.

Performance measure

bus driv

- 1) Safe
- 2) Fast
- 3) Legal
- 4) Comfortable trip
- 5) Maximize profit

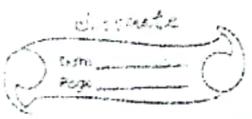
Environment

- 1) Road
- 2) traffic
- 3) Pedestrian
- 4) Passangers

ste

Actuator

- 1) Steering
- 2) Wheel



3) gear

Output

4) brake

5) accelerator

6) signal

Sensor

Input

1) Eyes

2) Ears

3) Camera

4) Speedometer

5) GPS

6) Odometer

Q. Agent: part picking Robot PEAS?

Performance measure

1) Accuracy & efficiency

2) Speed

3) Percentage of pickup part

4) Percentage of part correct bin.

Environment

1) Parts

2) Boxes

3) Conveyer

Actuator

1) Arm & hand

Sensor

1) Camera

2) Joint ^{angle} sensor

Agent Medical Diagnosis System PEAS?

Performance measure

- 1) Recommendation accuracy
- 2) Healthy patient
- 3) Minimize cost

Environment

- 1) Hospital
- 2) Patient
- 3) Doctor
- 4) Staff (maintain)

Actuator

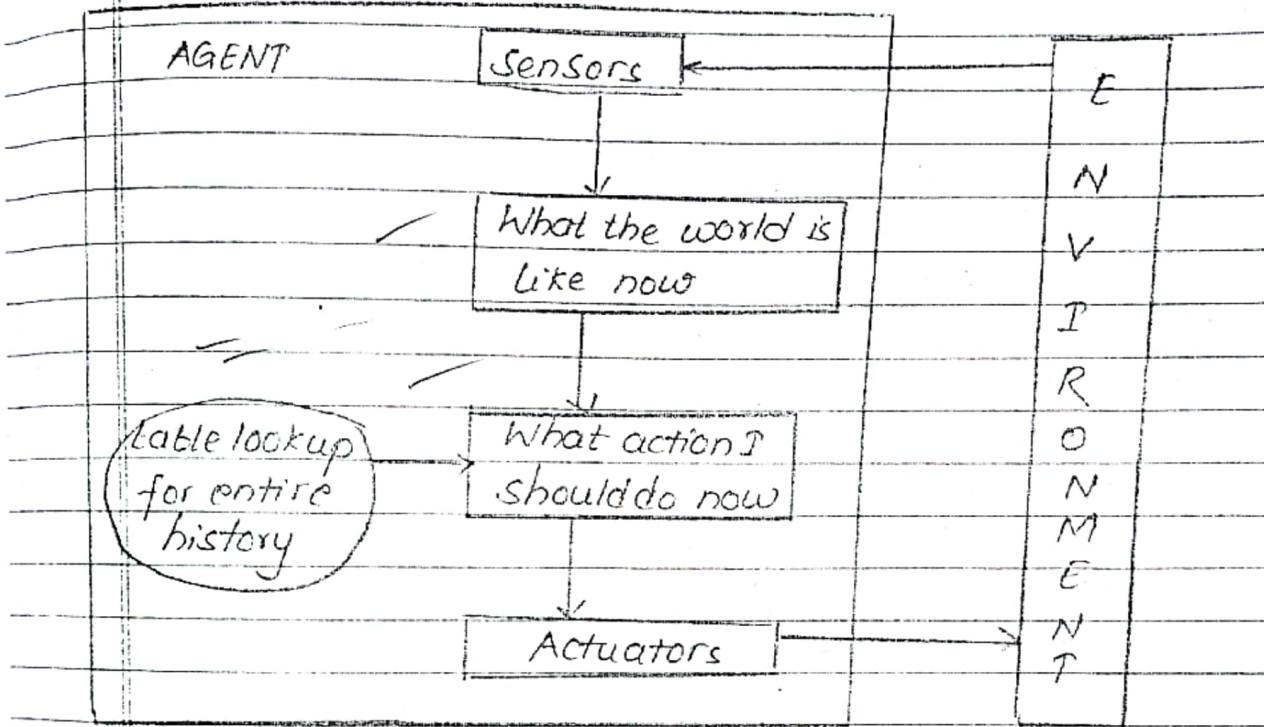
- 1) Screen display
- 2) Question
- 3) Recommendation
- 4) Voice "sensor"
- 1) Touch screen
- 2) Keyboard
- 3) Patient feedback



Agent Types:

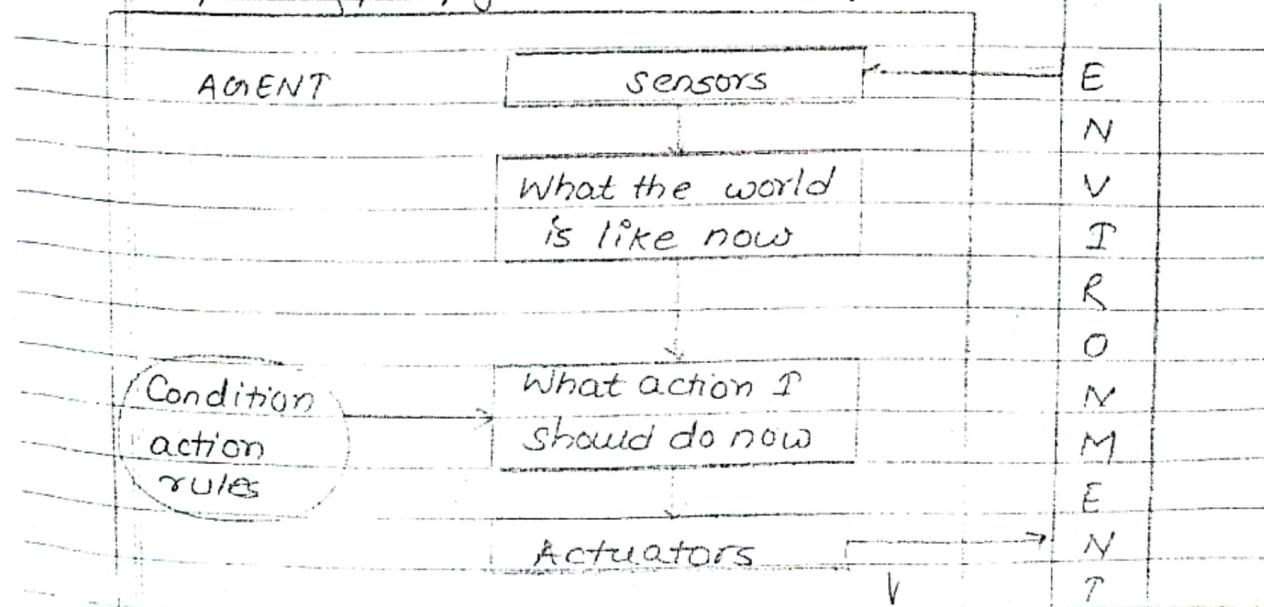
- (1) Table driven agent *
- (2) Simple reflex agent
- (3) Model based reflex agent
- (4) Goal based agent
- (5) Utility based agent

1. Table Driven Agent



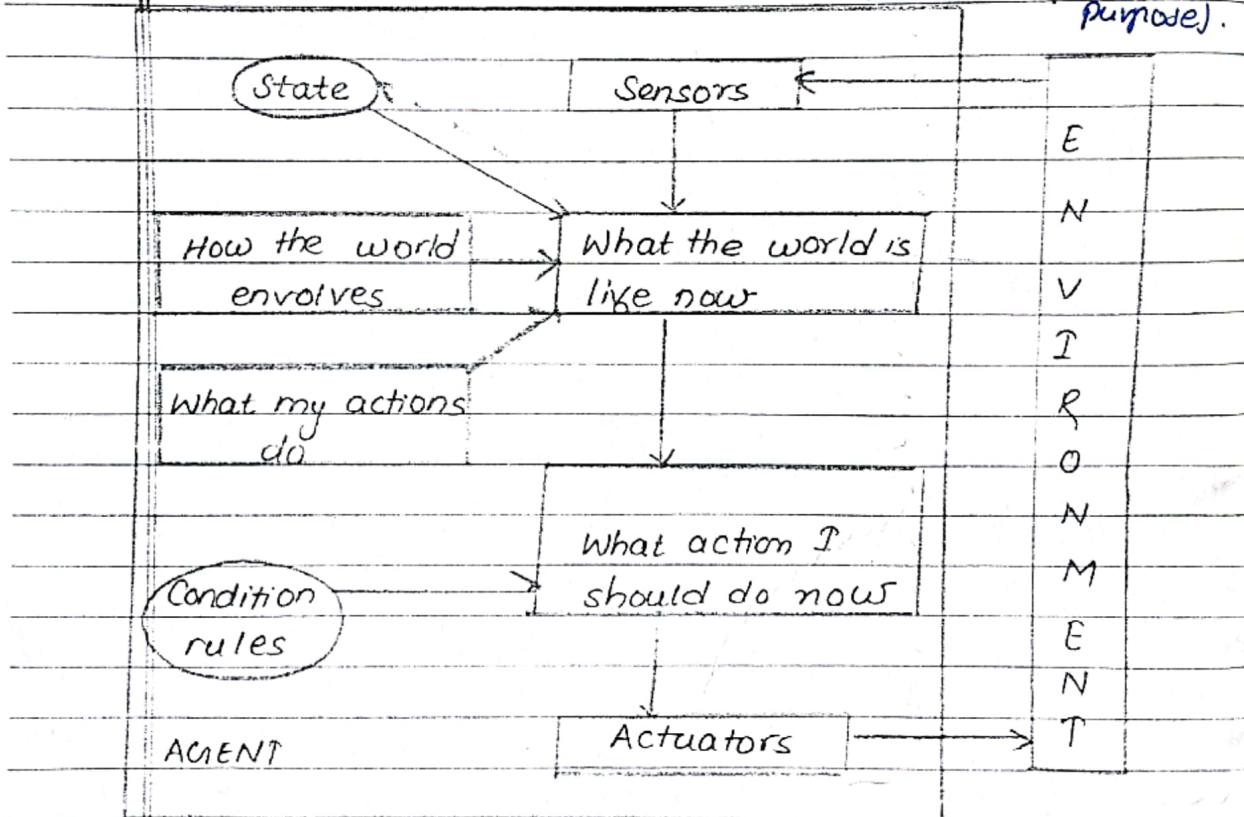
⇒ It is impractical and is primitive type of agent

2. Simplex Reflex Agent: (Many see girl, purpose)

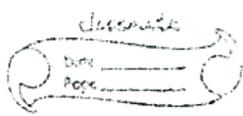


- ⇒ It's fast but to Simple.
- ⇒ They choose actions only based on the current percept.
- ⇒ No memory is used.
- ⇒ Fails if environment is partially observable.
- ⇒ Eg:- Vacuum cleaner world.

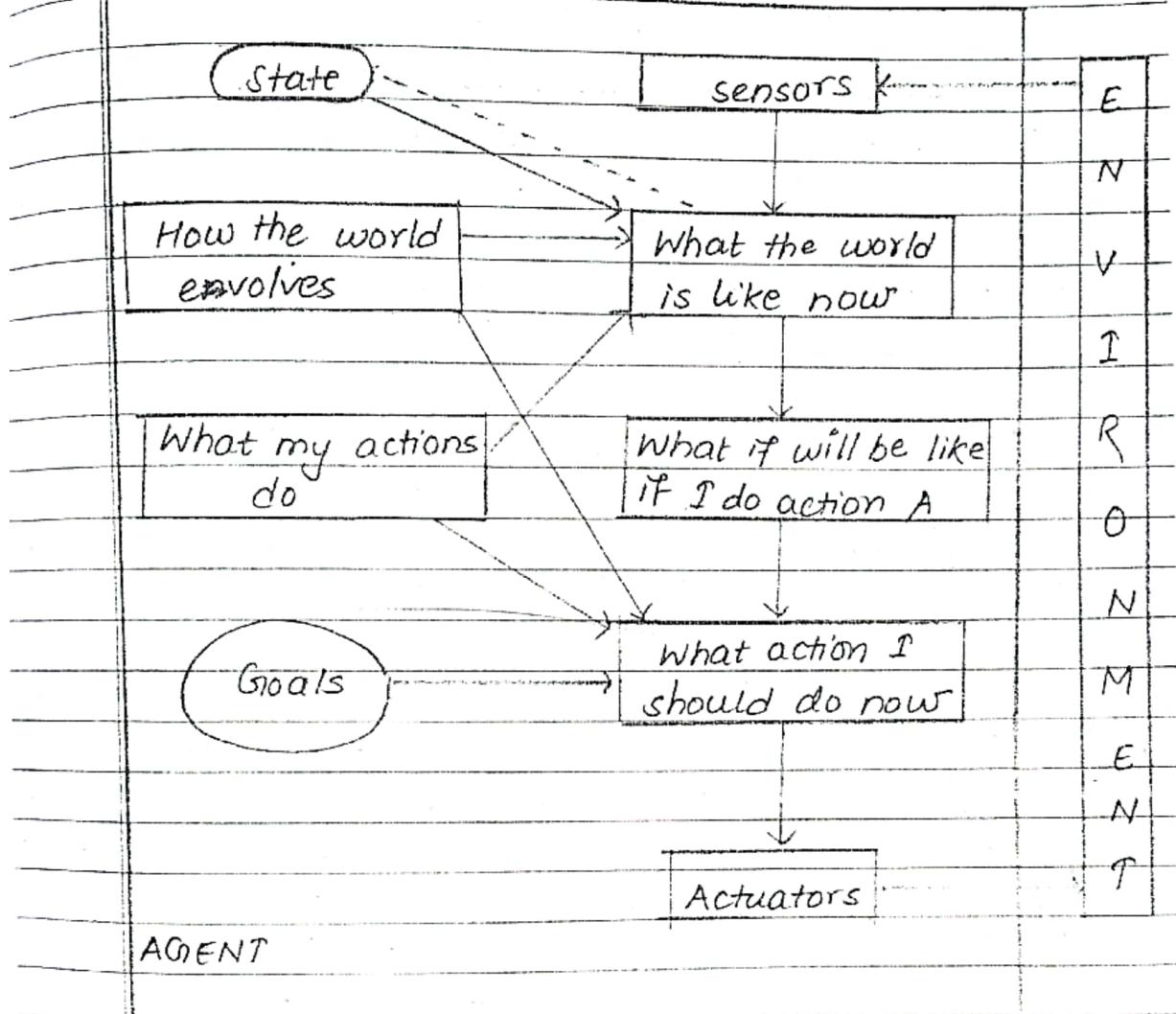
3. Model Based Reflex action (many see girls, does background check and then purpose).



- ⇒ They use a model of the world to choose their action.
- ⇒ They can work with partial information.
- ⇒ Model: knowledge about how the things happen in the world.

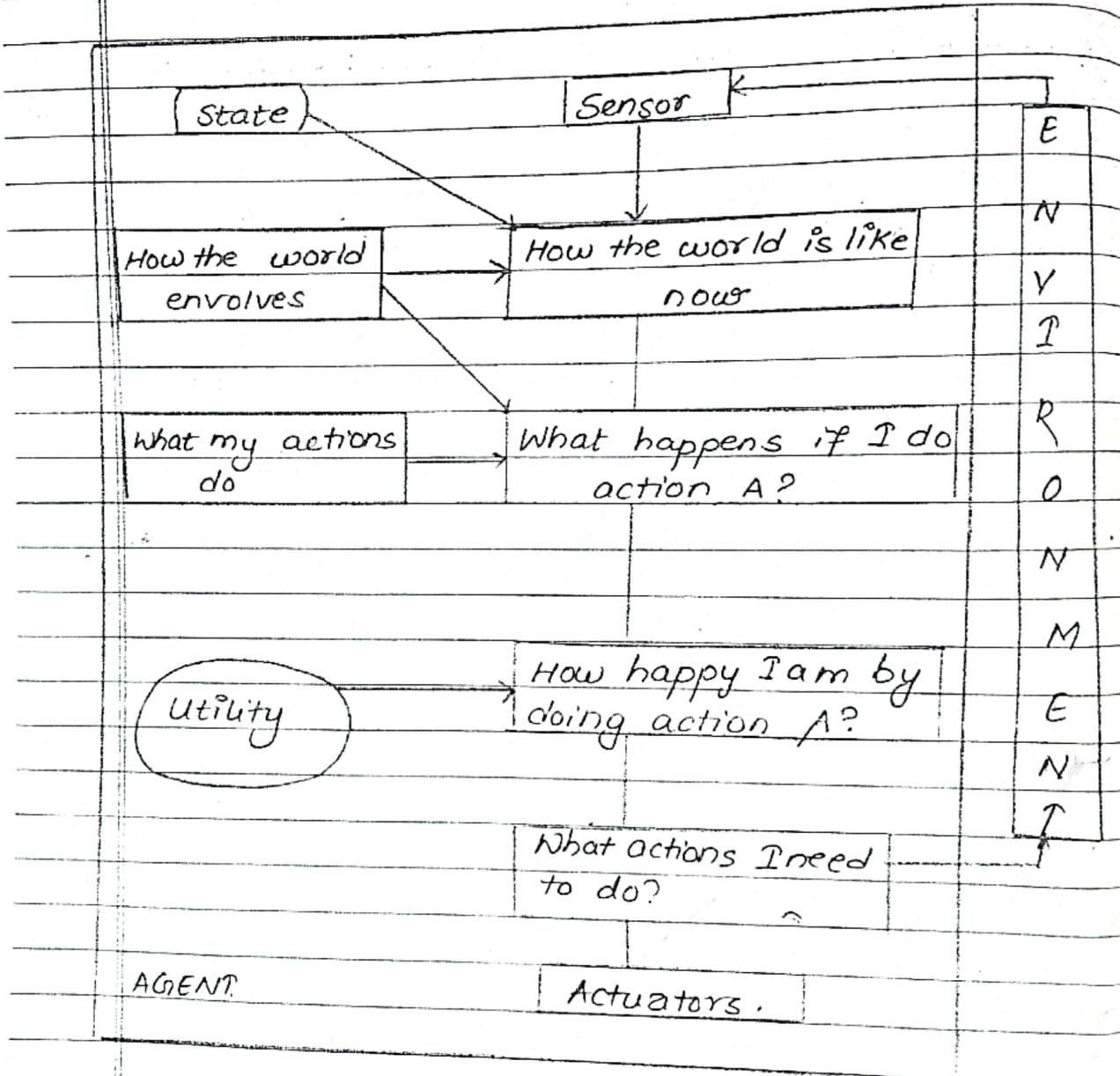


4. Goal Based Agent (Many purpose agent to many here).



- They choose their action in order to achieve goal.
- It's more flexible than reflex agent model.
- It provides reason to prefer one action over the other.

5. Utility Based Agent (Many purpose girl to be happy)



- They choose action based on a preference utility for each state.
- It is the most complex type of agent.
- Goals have some uncertainty & we need to choose the most important one goal from the other.



Q. Machines can be made intelligent. Artificially but ultimately persons make the machine. So, who is more intelligent? The artificial machine or the person? Discuss.

Q. What can AI system do and don't do?

⇒ AI → don't do

→ don't learn a Natural Language

→ don't answer interview question

→ don't have empathy, emotional, creativity, self consciousness.

→ make moral choices

→ invent or being more creative.

7/1