NEC **NARASARAOPETA ENGINEERING COLLEGE**
(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE FILE

Academic year	**: 2022-23**
Department	**: ME**
Course Name	**: B.Tech**
Student's Batch	**: 2020-24**
Regulation	**: R20**
Year and Semester	**: III B.Tech I Semester**
Name of the Subject	**: AI & ML**
Subject Code	**: R20ME3101**
Faculty In charge	**: Dr. D. Jagadish.**

Signature of Faculty

Head of the Department

NARASARAOPETA
NEC ENGINEERING COLLEGE
(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

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NARASARAOPETA
NEC ENGINEERING COLLEGE
(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

DEPARTMENT VISION AND MISSION

NARASARAOPETA
NEC ENGINEERING COLLEGE
(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

DEPARTMENT VISION AND MISSION

VISION:

To strive for making competent **Mechanical Engineering Professionals** to cater the real time needs of Industry and **Research** Organizations of high repute with **Entrepreneurial Skills and Ethical Values.**

MISSION:

M1. To train the students with State of Art Infrastructure to make them industry ready professionals and to promote them for higher studies and research.

M2. To employ committed faculty for developing competent mechanical engineering graduates to deal with complex problems.

M3. To support the students in developing professionalism and make them socially committed mechanical engineers with morals and ethical values.

HOD-ME

NARASARAOPETA
NEC ENGINEERING COLLEGE
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DEPARTMENT OF MECHANICAL ENGINEERING

INSTITUTE VISION AND MISSION

NARASARAOPETA
NEC ENGINEERING COLLEGE
(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

INSTITUTE VISION AND MISSION

VISION:

To emerge as a **Centre of excellence** in technical education with a blend of effective **student centric teaching learning** practices as well as **research** for the transformation of **lives and community**.

MISSION:

1. Provide the best class infrastructure to explore the field of engineering and research.
2. Build a passionate and a determined team of faculty with student centric teaching, imbibing experiential and innovative skills.
3. Imbibe lifelong learning skills, entrepreneurial skills and ethical values in students for addressing societal problems.

PRINCIPAL

NEC NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

PROGRAM OUTCOMES (POs)

PROGRAM OUTCOMES (POs):

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs):

I. The students will be able to apply knowledge of modern tools in manufacturing enabling to conquer the challenges of Modern Industry.

II. The students will be able to design various thermal engineering systems by applying the principles of thermal sciences.

III. The students will be able to design different mechanisms and machine components of transmission of power and automation in modern industry.

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NEC ENGINEERING COLLEGE
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DEPARTMENT OF MECHANICAL ENGINEERING

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

AND

PROGRAM SPECIFIC OUTCOMES (PSOs)

NARASARAOPETA
NEC ENGINEERING COLLEGE
(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1: Excel in profession with sound knowledge in mathematics and applied sciences

PEO 2: Demonstrate leadership qualities and team spirit in achieving goals

PEO 3: Pursue higher studies to ace in research and develop as entrepreneurs.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1. The students will be able to apply knowledge of modern tools in manufacturing enabling to conquer the challenges of Modern Industry.

PSO2. The students will be able to design various thermal engineering systems by applying the principles of thermal sciences.

PSO3. The students will be able to design different mechanisms and machine components of transmission of power and automation in modern industry.

HOD-ME

NARASARAOPETA
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(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

BLOOM'S TAXONOMY LEVELS

REVISED Bloom's Taxonomy Action Verbs

Definitions	I. Remembering	II. Understanding	III. Applying	IV. Analyzing	V. Evaluating	VI. Creating
Bloom's Definition	Exhibit memory of previously learned material by recalling facts, terms, basic concepts, and answers.	Demonstrate understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions, and stating main ideas.	Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way.	Examine and break information into parts by identifying motives or causes. Make inferences and find evidence to support generalizations.	Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria.	Compile information together in a different way by combining elements in a new pattern or proposing alternative solutions.
Verbs	• Choose • Define • Find • How • Label • List • Match • Name • Omit • Recall • Relate • Select • Show • Spell • Tell • What • When • Where • Which • Who • Why	• Classify • Compare • Contrast • Demonstrate • Explain • Extend • Illustrate • Infer • Interpret • Outline • Relate • Rephrase • Show • Summarize • Translate	• Apply • Build • Choose • Construct • Develop • Experiment with • Identify • Interview • Make use of • Model • Organize • Plan • Select • Solve • Utilize	• Analyze • Assume • Categorize • Classify • Compare • Conclusion • Contrast • Discover • Dissect • Distinguish • Divide • Examine • Function • Inference • Inspect • List • Motive • Relationships • Simplify • Survey • Take part in • Test for • Theme	• Agree • Appraise • Assess • Award • Choose • Compare • Conclude • Criteria • Criticize • Decide • Deduct • Defend • Determine • Disprove • Estimate • Evaluate • Explain • Importance • Influence • Interpret • Judge • Justify • Mark • Measure • Opinion • Perceive • Prioritize • Prove • Rate • Recommend • Rule on • Select • Support • Value	• Adapt • Build • Change • Choose • Combine • Compile • Compose • Construct • Create • Delete • Design • Develop • Discuss • Elaborate • Estimate • Formulate • Happen • Imagine • Improve • Invent • Make up • Maximize • Minimize • Modify • Original • Originate • Plan • Predict • Propose • Solution • Solve • Suppose • Test • Theory

Anderson, L. W., & Krathwohl, D. R. (2001). A taxonomy for learning, teaching, and assessing, Abridged Edition. Boston, MA: Allyn and Bacon.

NARASARAOPETA
NEC ENGINEERING COLLEGE
(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

CO-POs & CO-PSOs MAPPING
(COURSE ARTICULATION MATRIX)

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING
COURSE OUTCOMES & COURSE ARTICULATION MATRIX

R20-REGULATION

III B.Tech I SEMESTER

Course Code: C311	Course Name: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

COs	After successful completion of this course, the students will be able to:	POs & PSOs														
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C311.1	**Summarize** the characteristics of AI that make it useful to real-world problems.	3	2	-	-	-	2	-	-	-	-	-	2	-	-	-
C311.2	**Analyze** different search techniques and predicate logic in artificial Intelligence.	3	3	2	2	3	-	-	-	-	-	-	2	-	-	-
C311.3	**Interpret** knowledge representation and symbolic reasoning using different rules.	3	2	2	2	2	-	-	-	-	-	-	2	-	-	-
C311.4	**Apply** the basic knowledge on learning and reinforcement learning.	3	3	2	2	3	-	-	-	-	-	-	2	-	-	-
C311.5	**Explore** different machine learning algorithms.	3	2	2	2	2	-	-	-	-	-	-	2	-	-	-
C311		3.00	2.40	2.00	2.00	2.50	2.00	-	-	-	-	-	2.00	-	-	-

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NARASARAOPETA ENGINEERING COLLEGE

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE OUTCOMES (COs)

NARASARAOPETA
NEC ENGINEERING COLLEGE
(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING
R20 REGULATION - COURSE OUTCOMES
III B. TECH I SEMESTER

Course Name: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	Course Code: C311
CO	**After successful completion of this course, the students will be able to:**
C311.1	**Summarize** the characteristics of AI that make it useful to real-world problems.
C311.2	**Analyze** different search techniques and predicate logic in artificial Intelligence.
C311.3	**Interpret** knowledge representation and symbolic reasoning using different rules.
C311.4	**Apply** the basic knowledge on learning and reinforcement learning.
C311.5	**Explore** different machine learning algorithms.

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NARASARAOPETA ENGINEERING COLLEGE

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE INFORMATION SHEET

NEC	Narasaraopeta Engineering College (Autonomous) Yallmanda (Post), Narasaraopet- 522601 Department of Mechanical Engineering

COURSE INFORMATION SHEET

PROGRAMME: B. TECH MECHANICAL ENGINEERING	
COURSE: **ARTIFICIAL INTELLIGENCE & MACHINE LEARNING**	Semester: V CREDITS: **3**
COURSE CODE: **R20ME3101** REGULATION: **R20**	COURSE TYPE (CORE /ELECTIVE / BREADTH/ S&H): **CORE**
COURSE AREA/DOMAIN: Problem Solving	PERIODS: **5** Per Week.

COURSE PRE-REQUISITES:

COURSE NAME	DESCRIPTION	SEM
Problem solving using Python	Basics of Python Programming	**I**
Numerical Methods and Transformations	Knowledge of mathematics with emphasis on probability, statistics and reasoning	**III**

COURSE OUTCOMES:

SNO	Course Outcome Statements
CO1	Summarize the characteristics of AI that make it useful to real-world problems. [K2]
CO2	Analyze different search techniques and predicate logic in artificial Intelligence. [K4]
CO3	Interpret knowledge representation and symbolic reasoning using different rules. [K2]
CO4	Apply the basic knowledge on learning and reinforcement learning. [K3]
CO5	Explore different machine learning algorithms [K3]

SYLLABUS:

UNIT	DETAILS
I	**Introduction to Artificial Intelligence:** AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.
II	**Search Algorithms:** Uninformed(Blind) type- Breadth-first search, Uniform cost search, Depth-first search, Informed Search; Informed type-Greedy Search, A* Search, Graph Search.
III	**Knowledge Representation in AI:** Procedural Vs declarative knowledge, logic programming, forward Vs backward programming. **Python for Machine Learning:** Python data Types, Control Structure, Data manipulation using Numpy, Pandas and Matplotlib. Pre-processing steps of Machine Learning-Data quality assessment, Data cleaning, Data transformation and Data reduction.
IV	**Machine Learning:** Definition, Evaluation, need, types, Applications, Supervised Learning:- Classification, Regression; Un-supervised Learning: - Clustering, Density Estimation, Dimensionality reduction.
V	**Machine Learning Algorithms:** Classification, Regression, KNN, K Means, Logistic, Regression, Support, Vector Machines (SVM), Decision Tree, Naïve Bayes, Ensemble Methods, Random Forest algorithms.

TEXT BOOKS	
T	**BOOK TITLE/AUTHORS/PUBLISHER**
T1	Elaine Rich & Kevin Knight, Artificial Intelligence, Tata McGraw Hill Publishers
T2	Machine Learning Tom M. Mitchell, Tata McGraw Hill Edition Publishers
T3	Machine Learning with Python, Abhiskek Vijayvargia, BPB Publications
REFERENCE BOOKS	
R	**BOOK TITLE/AUTHORS/PUBLISHER**
R1	Artificial Intelligence- Saroj Kaushik, CENGAGE Learning,
R2	Applications of Machine Learning, Chandra Bansal, Kusum Deep, Springer Publications

WEB SOURCE REFERENCES:

1	https://www.coursera.org/learn/machine-learning
2	https://www.simplilearn.com/big-data-and-analytics/machine-learning
3	https://www.appliedaicourse.com/course/applied-ai-course-online
4	https://www.ibm.com/cloud/learn/machine-learning
5	http://nptel.ac.in/courses/106105152

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

☐Chalk & Talk	☐ PPT	☑Active Learning
☑Web Resources	☐ Students Seminars	☑Case Study
☐Blended Learning	☑ Quiz	☑Tutorials
☐Project based learning	☐NPTEL/MOOCS	☐ Simulation
☑Flipped Learning	☐Industrial Visit	☐Model Demonstration
☐Brain storming	☐Role Play	☐Virtual Labs

MAPPING CO'S WITH PO'S

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C311.1	3	2	-	-	-	2	-	-	-	-	-	2	-	-	-
C311.2	3	3	2	2	3	-	-	-	-	-	-	2	-	-	-
C311.3	3	3	2	2	2	-	-	-	-	-	-	2	-	-	-
C311.4	3	3	2	2	3	-	-	-	-	-	-	2	-	-	-
C311.5	3	2	2	2	2	-	-	-	-	-	-	2	-	-	-
Average	3.00	3.00	2.00	2.00	2.5	2.00	-	-	-	-	-	2.00	-	-	-

MAPPING COURSE WITH POs & PSOs

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C311	3.00	3.00	2.00		2.00	-	-	-	-	-	-	-	1.0		

<table>
<tr><td colspan="4">Course Outcome Assessment Methods</td><td colspan="2">Weightage</td><td rowspan="5">Final Course Outcome (100%)</td></tr>
<tr><td rowspan="4">Direct Assessment</td><td rowspan="3">Cumulative Internal Examinations (CIE)</td><td>Descriptive Test</td><td rowspan="3">30%</td><td rowspan="3">90%</td></tr>
<tr><td>Objective Test</td></tr>
<tr><td>Assignment Test</td></tr>
<tr><td colspan="2">Semester End Examinations (SEE)</td><td>70%</td></tr>
<tr><td>Indirect Assessment</td><td colspan="3">Course End Survey</td><td>10%</td></tr>
<tr><td colspan="7">*Grade Definition: A+: >=90%, A: 80-89%; B: 70-79%; C:60-69%; D:50-59%; E:40-49%; F:<40%;</td></tr>
</table>

Rubrics for overall attainment of course outcomes:
If 50% of the students crossed 50% of the marks: Attainment Level 1
If 60% of the students crossed 50% of the marks: Attainment Level 2
If 70% of the students crossed 50% of the marks: Attainment Level 3

Course Instructor **Course Coordinator** **Module Coordinator** **Head of the Department**

ANNEXURE I:

(A) PROGRAM OUTCOMES (POs) Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

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7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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Cognitive levels as per Revised Blooms Taxonomy:

Cognitive Domain	LEVEL	Key words
Remember	K1	Defines, describes, identifies, knows, labels, lists, matches, names, outlines, recalls, recognizes, reproduces, selects, states.
Understand	K2	Comprehends, converts, defends, distinguishes, estimates, explains, extends, generalizes, gives an example, infers, interprets, paraphrases, predicts, rewrites, summarizes, translates.
Apply	K3	Applies, changes, computes, constructs, demonstrates, discovers, manipulates, modifies, operates, predicts, prepares, produces, relates, shows, solves, uses.
Analyse	K4	Analyzes, breaks down, compares, contrasts, diagrams, deconstructs, differentiates, discriminates, distinguishes, identifies, illustrates, infers, outlines, relates, selects, separates.
Evaluate	K5	Appraises, compares, concludes, contrasts, criticizes, critiques, defends, describes, discriminates, evaluates, explains, interprets, justifies, relates, summarizes, supports
Create	K6	Categorizes, combines, compiles, composes, creates, devises, designs, explains, generates, modifies, organizes, plans, rearranges, reconstructs, relates, reorganizes, revises, rewrites, summarizes, tells, write

Unit wise Sample assessment questions
ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

SNO	Course Outcome Statement
CO1	Summarize the characteristics of AI that make it useful to real-world problems. [K2]
CO2	Analyze different search techniques and predicate logic in artificial Intelligence. [K3]
CO3	Interpret knowledge representation and symbolic reasoning using different rules. [K2]
CO4	Apply the basic knowledge on learning and reinforcement learning. [K3]
CO5	Explore different machine learning algorithms [K3]

S NO	QUESTION	KNOWLEDGE LEVEL	CO
	UNIT I		
1	What are the problem characteristics of AI	K2	CO1
2	Write and explain the application fields of AI	K2	CO1
3	Explain the structure of agents and problem solving agents	K2	CO1
	UNIT 2		
1	Explain the concept of problem solving through Search	K3	CO2
2	Explain the BFS algorithm efficiency in problem solving. And Compare with DFS.	K3	CO2
3	Explain A* algorithm with an Example	K3	CO2
	UNIT 3		
1	Illustrate with examples different types of knowledge representation in AI	K2	CO3
2	Clearly differentiate between Procedural knowledge and Declarative knowledge	K3	CO3
3	Explain briefly different data types used in python	K2	CO3
	UNIT 4		
1	What are the different types of Machine Learning	K2	CO4
2	Explain the classification and regression	K2	CO4
3	Discuss the concept of Clustering used in ML	K3	CO4
	UNIT 5		
1	How is KNN different from K-means clustering? Explain	K3	CO5
2	Explain the usage of Logistic Regression, Random Forest, Support Vector Machine methods appropriately to solve predictive models	K3	CO5
3	Discuss how decision tree algorithm is known to work best to detect non-linear interactions	K3	CO5

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

II B.Tech II Semester Regular Examinations

Sub Code: R20ME3101

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING
MODEL PAPER-I

Time: 3 hours

Max. Marks: 70

Note: Answer All FIVE Questions.
All Questions Carry Equal Marks (5 X 14 = 70M)

Q.No.		Questions	Marks
1		Unit-I	
	a	Write and explain the application fields of AI	[14M]
		OR	
	b	Explain the structure of agents and problem solving agents	[14M]
2		Unit-II	
	a	Explain the concept of problem solving through Search	[7M]
		Explain the BFS algorithm efficiency in problem solving. And Compare with DFS.	[7M]
		OR	
	b	Explain A* algorithm with an Example and also explain about Graph search	[14M]
3		Unit-III	
	a	Illustrate with examples different types of knowledge representation in AI	[14M]
		OR	
	b	Clearly differentiate between Procedural knowledge and Declarative knowledge	[14M]
4		Unit-IV	
	a	What are the different types of Machine Learning	[7M]
		Explain the classification and regression models	[7M]
		OR	
	b	Discuss the concept of Clustering used in ML	[7M]
		Discuss any four examples of machine learning applications	[7M]
5		Unit-V	
	a	Explain the usage of Logistic Regression, Random Forest, Support Vector Machine methods appropriately to solve predictive models	[14M]
		OR	
	b	KNN different from K-means clustering? Explain	[14M]

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

II B.Tech II Semester Regular Examinations

Sub Code: R20ME3101

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING
MODEL PAPER-I

Time: 3 hours

Max. Marks: 70

Note: Answer All **FIVE** Questions.
All Questions Carry Equal Marks (5 X 14 = 70M)

Q.No.		Questions	Marks
1		Unit-I	
	a	Write different applications of AI. Differentiate between natural intelligence and artificial intelligence	[14M]
		OR	
	b	Explain the structure of agents and explain how to measure the performance of an agent	[14M]
2		Unit-II	
	a	Explain the concept of problem solving through Search	[7M]
		Differentiate between breadth first search and depth first search with examples	[7M]
		OR	
	b	Differentiate clearly between uniformed and informed search techniques	[14M]
3		Unit-III	
	a	Describe the issues of Knowledge Representation in AI	[7M]
		Write the python program for normal data distribution	[7M]
		OR	
	b	List out any four applications of machine learning	[7M]
		Explain the steps in designing a learning system	[7M]
4		Unit-IV	
	a	Distinguish between supervised learning and Reinforcement learning. Illustrate with an example	[7M]
		Discuss any four examples of machine learning applications	[7M]
		OR	
	b	Discuss the concept of Clustering used in ML	[7M]
		Explain feature selection and feature extraction method for dimensionality reduction	[7M]
5		Unit-V	
	a	Explain how Support Vector Machine can be used for classification of linearly separable data	[14M]
		OR	
	b	Demonstrate the derivation of K- Means Algorithm and compare with KNN Method	[14M]

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NARASARAOPETA ENGINEERING COLLEGE

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DEPARTMENT OF MECHANICAL ENGINEERING

ACADEMIC CALENDAR

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

ACADEMIC CALENDAR
(B.Tech. 2020 Admitted Batch, Academic Year 2022-23)

2020 Batch 3rd Year 1st Semester			
Description	**From Date**	**To Date**	**Duration**
Commencement of Class Work	25-07-2022		7 Weeks
1st Spell of Instructions	25-07-2022	10-09-2022	
Assignment Test-I	15-08-2022	20-08-2022	
I Mid examinations	12-09-2022	17-09-2022	1 Week
2nd Spell of Instructions	19-09-2022	05-11-2022	7 Weeks
Assignment Test-II	10-10-2022	15-10-2022	
II Mid examinations	07-11-2022	12-11-2022	1 Week
Preparation & Practicals	14-11-2022	19-11-2022	1Week
Semester End Examinations	21-11-2022	03-12-2022	2 Weeks

PRINCIPAL

NEC

NARASARAOPETA ENGINEERING COLLEGE

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

TIME TABLE

NARASARAOPETA ENGINEERING COLLEGE: NARASARAOPET (AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING
III B.TECH I SEM TIME TABLE
Section-A

ROOM NO: 1216

Wef: 12/06/2023

	1	2	BREAK	3	4		5	6	7
TIMINGS	9.10-10.00	10.00-10.50	10.50-11.00	11.00-11.50	11.50-12.40	12.40-1.30	1.30-2.20	2.20-3.10	3.10-4.00
MON	AI&ML			DME-I		LUNCH	AI&ML LAB		
TUE	HPE	HPE / ROB&3D PRINTING LAB					OR		AI&ML
WED	PEHV	AI&ML LAB					AI&ML	HPE	
THU	OR			MCMT			DME-I		PEHV
FRI	HPE			MCMT			HPE	OR	
SAT	DME-I			AI&ML			HPE / ROB&3D PRINTING LAB		

CODE	SUBJECT	FACULTY
AI&ML	Artificial Intelligence & Machine Learning	Dr.D.Jagadish
HPE	Heat Power Engineering	Mr.P.Srinivasa Rao
DME-I	Design of Machine Elements-I	Dr.B.Ravi Naik
OR	Operation Research	Mr.K.John Babu
MCMT	Metal Cutting & Machine Tools	Dr.D.Suneel
AI&ML LAB	Artificial Intelligence & Machine Learning Lab	Mr.T.Ashok Kumar/SK.N.Meeravali
HPE LAB	Heat Power Engineering	Mr.P.Srinivasa Rao/ P.Sravani
ROB&3D P LAB	Robotics & 3D-Printing Lab	Mr.CH.Sekhar/Dr.M.Venkanna Babu
PEHV	PE&HV	Dr.B.Anki Reddy

Signature of HOD

Signature of Principal

NEC NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

SYLLABUS COPY

III B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20ME3101	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING						

COURSE OBJECTIVES:

- Develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents: Search, Knowledge representation, inference, logic and learning.
- Develop and interpret different machine learning algorithms with Python based programming applications.

COURSE OUTCOMES:

After completion of this course, the students would be able to

CO 1: Summarize the characteristics of AI that make it useful to real-world problems. [K2]
CO 2: Analyze different search techniques and predicate logic in artificial Intelligence. [K3]
CO 3: Interpret knowledge representation and symbolic reasoning using different rules. [K2]
CO 4: Apply the basic knowledge on learning and reinforcement learning. [K3]
CO 5: Explore different machine learning algorithms [K3]

UNIT-I

INTRODUCTION TO ARTIFICIAL INTELLIGENCE: AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.

UNIT-II

SEARCH ALGORITHMS: Uninformed(Blind) type- Breadth-first search, Uniform cost search, Depth-first search, Informed Search; Informed type-Greedy Search, A* Search, Graph Search.

UNIT-III

KNOWLEDGE REPRESENTATION IN AI: Procedural versus declarative knowledge, logic programming, forward versus backward programming.

PYTHON FOR MACHINE LEARNING: Python data Types, Control Structure, Data manipulation using Numpy, Pandas and Matplotlib. Pre-processing steps of Machine Learning-Data quality assessment, Data cleaning, Data transformation and Data reduction.

UNIT-IV

MACHINE LEARNING: Definition, Evaluation, need, types, Applications, Supervised Learning:- Classification, Regression; Un-supervised Learning: - Clustering, Density Estimation, Dimensionality reduction.

UNIT-V

MACHINE LEARNING ALGORITHMS: Classification, Regression, KNN, K Means, Logistic, Regression, Support, Vector Machines (SVM), Decision Tree, Naïve Bayes, Ensemble Methods, Random Forest algorithms.

COURSE: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

SYLLABUS COPY

SNO	Course Outcome Statements
CO1	Summarize the characteristics of AI that make it useful to real-world problems. [K2]
CO2	Analyze different search techniques and predicate logic in artificial Intelligence. [K4]
CO3	Interpret knowledge representation and symbolic reasoning using different rules. [K2]
CO4	Apply the basic knowledge on learning and reinforcement learning. [K3]
CO5	Explore different machine learning algorithms [K3]

SYLLABUS:

UNIT	DETAILS
I	**Introduction to Artificial Intelligence:** AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.
II	**Search Algorithms:** Uninformed(Blind) type- Breadth-first search, Uniform cost search, Depth-first search, Informed Search; Informed type-Greedy Search, A* Search, Graph Search.
III	**Knowledge Representation in AI:** Procedural Vs declarative knowledge, logic programming, forward Vs backward programming. **Python for Machine Learning:** Python data Types, Control Structure, Data manipulation using Numpy, Pandas and Matplotlib. Pre-processing steps of Machine Learning-Data quality assessment, Data cleaning, Data transformation and Data reduction.
IV	**Machine Learning:** Definition, Evaluation, need, types**,** Applications, Supervised Learning:- Classification, Regression; Un-supervised Learning: - Clustering, Density Estimation, Dimensionality reduction.
V	**Machine Learning Algorithms:** Classification, Regression, KNN, K Means, Logistic, Regression, Support, Vector Machines (SVM), Decision Tree, Naïve Bayes, Ensemble Methods, Random Forest algorithms.

TEXT BOOKS	
T	**BOOK TITLE/AUTHORS/PUBLISHER**
T1	Elaine Rich & Kevin Knight, Artificial Intelligence, Tata McGraw Hill Publishers
T2	Machine Learning Tom M. Mitchell, Tata McGraw Hill Edition Publishers
T3	Machine Learning with Python, Abhiskek Vijayvargia, BPB Publications
REFERENCE BOOKS	
R	**BOOK TITLE/AUTHORS/PUBLISHER**
R1	Artificial Intelligence- Saroj Kaushik, CENGAGE Learning,
R2	Applications of Machine Learning, Chandra Bansal, Kusum Deep, Springer Publications

WEB SOURCE REFERENCES:

1	https://www.coursera.org/learn/machine-learning
2	https://www.simplilearn.com/big-data-and-analytics/machine-learning
3	https://www.appliedaicourse.com/course/applied-ai-course-online
4	https://www.ibm.com/cloud/learn/machine-learning
5	http://nptel.ac.in/courses/106105152

NARASARAOPETA
NEC ENGINEERING COLLEGE
(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

LESSON PLAN

NEC

Narasaraopeta Engineering College
(Autonomous)
Yallmanda(Post), Narasaraopet- 522601

DEPARTMENT OF MECHANICAL ENGINEERING
LESSON PLAN

Course Code	Course Title (Regulation)	Sem	Branch	Contact Periods/Week	Sections
R20ME3101	ARTIFICIAL INTELLIGENCE & MACHINE LEARNING	V	Mechanical Engineering	5	A & B

COURSE OUTCOMES: Students are able to

SNO	Course Outcome Statements
CO1	Summarize the characteristics of AI that make it useful to real-world problems. [K2]
CO2	Analyze different search techniques and predicate logic in artificial Intelligence. [K3]
CO3	Interpret knowledge representation and symbolic reasoning using different rules. [K2]
CO4	Apply the basic knowledge on learning and reinforcement learning. [K3]
CO5	Explore different machine learning algorithms [K3]

Unit No	Outcome		Topics/Activity	Ref Text book	Total Periods	Delivery Method
1	**CO1: Summarize the characteristics of AI that make it useful to real-world problems. [K2]**		**Unit-1: Introduction to Artificial Intelligence**			
		1.1	AI problems, foundation of AI and history	T1, T2, R1	12	Chalk & Talk, PPT, Active Learning & Tutorial
		1.2	AI intelligent agents	T1, T2, R1		
		1.3	Agents and Environments	T1, T2, R1		
		1.4	concept of rationality, the nature of environments, structure of agents	T1, T2, R1		
		1.5	Problem solving agents, problem formulation.	T1		
2	**CO2: Analyze different search techniques and predicate logic in artificial Intelligence. [K3]**		**Unit-2. Search Algorithms**			
		2.1	Uninformed(Blind) type- Breadth-first search	T1, T2, R2	12	Chalk & Talk, PPT Tutorial, Active Learning & Case Study
		2.2	Uniform cost search, Depth-first search	T1, T2, R2		
		2.3	Informed Search; Informed type-Greedy Search	T1, T2, R2		
		2.4	A* Search	T1, T2, R2		
		2.5	Graph Search.	T1		
	MID I EXAMINATION DURING SIXTH WEEK					
3	**CO3: Interpret knowledge representation and symbolic reasoning using**		**Unit-3. Knowledge Representation in AI:**			
		3.1	Procedural Vs declarative knowledge	T1, T2, R1	12	Chalk & Talk, PPT, Tutorial
		3.2	logic programming, forward Vs backward programming	T1, T2, R1		
		3.3	**Python for Machine Learning: :** Python data Types, Control	T1, T2, R1		

	different rules. [K2]		Structure			Active Learning &Case Study
		3.4	Data manipulation using Numpy, Pandas and Matplotlib.	T1, T2, R1		
		3.5	Pre-processing steps of Machine Learning-Data quality assessment, Data cleaning	T1, T2, R1		
		3.6	Data transformation and Data reduction.	T1		
4	CO4: Apply the basic knowledge on learning and reinforcement learning. [K3]		**Unit-4. Machine Learning**			
		4.1	Definition, Evaluation	T1, T2, R2	10	Chalk & Talk, PPT & Tutorial, , Industrial Visit, Demonstration with models.
		4.2	Need, types, Applications	T1, T2, R2		
		4.3	Supervised Learning, Classification, Regression	T1, T2, R2		
		4.4	Un-supervised Learning, Clustering	T1, T2, R2		
		4.5	Density Estimation, Dimensionality reduction.	T1		
5	CO5: Explore different machine learning algorithms [K3]		**Unit 5. Machine Learning Algorithms:**			
		5.1	Classification, Regression	T1, T2, R2	12	Chalk & Talk, PPT, Virtual labs, Tutorial, & Project based learning
		5.2	KNN, K Means	T1, T2, R1		
		5.3	Logistic, Regression	T1, T2, R2		
		5.4	Support, Vector Machines (SVM),	T1, T2, R1		
		5.5	Decision Tree, Naïve Bayes, Ensemble Methods	T1, T2, R1		
		5.4	Random Forest algorithms.	T1		
MID II EXAMINATION DURING EIGHTEENTH WEEK						
END EXAMINATIONS						

TEXT BOOKS	
T	**BOOK TITLE/AUTHORS/PUBLISHER**
T1	Elaine Rich & Kevin Knight, Artificial Intelligence, Tata McGraw Hill Publishers
T2	Machine Learning Tom M. Mitchell, Tata McGraw Hill Edition Publishers
T3	Machine Learning with Python, Abhiskek Vijayvargia, BPB Publications
REFERENCE BOOKS	
R	**BOOK TITLE/AUTHORS/PUBLISHER**
R1	Artificial Intelligence- Saroj Kaushik, CENGAGE Learning,
R2	Applications of Machine Learning, Chandra Bansal, Kusum Deep, Springer Publications

WEB SOURCE REFERENCES:

1	https://www.coursera.org/learn/machine-learning
2	https://www.simplilearn.com/big-data-and-analytics/machine-learning
3	https://www.appliedaicourse.com/course/applied-ai-course-online
4	https://www.ibm.com/cloud/learn/machine-learning
5	http://nptel.ac.in/courses/106105152

Principal **HOD** **Faculty**

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DEPARTMENT OF MECHANICAL ENGINEERING

WEB REFERENCES

WEB RESOURCES

1.	https://www.coursera.org/learn/machine-learning
2.	https://www.simplilearn.com/big-data-and-analytics/machine-learning
3.	https://www.appliedaicourse.com/course/applied-ai-course-online
4.	https://www.ibm.com/cloud/learn/machine-learning
5.	http://nptel.ac.in/courses/106105152

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NARASARAOPETA ENGINEERING COLLEGE

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

STUDENT'S ROLL LIST

NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS) :: NARASARAOPET

DEPARTMENT OF MECHANICAL ENGINEERING

III B.Tech I Sem Roll list

S.No	HTNo	Name of the Student
1	20471A0301	ALAVALA ADITHYA VARA PRASAD
2	20471A0302	BATTULA RAJESH
3	20471A0303	BHIMAVARAPU HEMANTH KUMAR
4	20471A0304	BONAM JAYA PRAKASH
5	20471A0305	BOYAPATI PAVAN KUMAR
6	20471A0306	DADDANALA VEERANJIREDDY
7	20471A0307	DERANGILA PARDHU GANESH
8	20471A0308	DOPPALAPUDI S S NAGA RAVITEJA
9	20471A0309	EEDARA MOHON SAI
10	20471A0310	GANESH SAI PAVAN
11	20471A0312	GERA KOTESWARA RAO
12	20471A0313	KARASALA PRASANTH
13	20471A0314	KARASANI PAVAN KUMAR REDDY
14	20471A0315	KATTA MAHESWAR
15	20471A0317	KESARI DHANUNJAYA REDDY
16	20471A0318	KOMARAGIRI SASIKUMAR
17	20471A0319	KOMERA SIVA NAGARAJU
18	20471A0320	KOTHA GOPI
19	20471A0321	KUNDURTHI NAVEEN
20	20471A0323	MADANU JOSEPH VINAY KUMAR
21	20471A0324	MADDUMALA RAMAKRISHNA
22	20471A0325	MAGANTI SASI PAVAN
23	20471A0326	MAKKENA SAMBASIVA RAO

24	20471A0327	MIRIYALA SASHANK
25	20471A0328	NALLA ABHIRAM CHOWDARY
26	20471A0329	NUTHAKKI RAKESH
27	20471A0330	ARAVAPALLI SAI SRINIVAS
28	20471A0331	PALETI JOHN HOSANNA
29	20471A0332	PERUMAALLA SRIKANTH
30	20471A0333	POLURI KRISHNA CHAITHANYA
31	20471A0334	PONNAGANTI CHANDU HARSHA VARDHAN
32	20471A0336	PATHAN MEERA VALI
33	20471A0337	POTTIMURTHI PURNA CHANDRA RAO
34	20471A0338	PRUDHVI DURGA BHARATH CHANDAN
35	20471A0339	RAMAVATHU BADDUNAIK
36	20471A0341	SHAIK APPAPURAM MAHABOOB SUBHANI
37	20471A0343	SHAIK GANGARAM ABDUL RAHAMAN
38	20471A0344	SHAIK GULLAPALLI NAGURVALI
39	20471A0345	SHAIK LAL AHAMAD BASHA
40	20471A0346	SHAIK MAHAMMAD FAREED
41	20471A0348	SHAIK MANISHA
42	20471A0349	SHAIK PARVEZ
43	20471A0350	SHAIK SADHIK
44	20471A0352	TIPPIREDDY AMARNATHREDDY
45	20471A0353	VADLAVALLI GANESH
46	20471A0354	VEERAGANDHAM VENKATA MANIKANTA
47	20471A0356	ADAKA GOPIRAJU
48	20471A0357	ATCHYUTHA PAVAN KUMAR
49	20471A0358	BALLE RAMANJANEYULU
50	20471A0359	BANDARU SAI GANESH
51	20471A0360	BERAM NARENDRA REDDY
52	20471A0361	CHEBROLU MANIKANTA SAI NITHIN
53	20471A0362	CHENNAMSETTY GOPI

54	20471A0363	GANGULA SUNNY
55	20471A0364	GANJI HANUMA KOTI GANESH
56	20471A0365	GANNNAVARAPU JAYA SRIKANTH
57	20471A0366	GUTTIKONDA AYYAPPA REDDY
58	20471A0367	MADDINENI AJAY
59	20471A0368	MANNEPALLI VEERA NARASIMHA
60	20471A0369	MARAGANI NAGA THIRUMALA RAO
61	20471A0370	PARELLA BALA GURAVAIAH
62	20471A0371	SETLAM RANENDRA VAMSHI
63	20471A0372	SHAIK GUTHIKONDA SALIM
64	20471A0373	SHAIK JAKIR
65	20471A0374	SHAIK MOHAMMAD TAHEER
66	20471A0375	THOTA SRIVAMSI NADH
67	20471A0376	YAKKANTI SAI KIRAN REDDY
68	21475A0301	PALLAPOTHU SAIKIRAN YADAV
69	21475A0302	SYED SARDAR VALI
70	21475A0303	DERANGULA GOPI KRISHNA
71	21475A0305	SHAIK ADIL
72	21475A0306	JANAPAREDDI PRASAD
73	21475A0307	REPALLE YASHWANTH
74	21475A0308	RAMAVATHU PAVAN KUMAR NAIK
75	21475A0309	NELAVALLI VIKAS
76	21475A0310	DUDDU JOSEPH
77	21475A0311	MUNIKOLA SANTHOSH KUMAR
78	21475A0312	MORAPAKULA CHARAN TEJA
79	21475A0313	GODA SANDEEP
80	21475A0314	MOGILI PRAKASH
81	21475A0315	SHAIK MABU SUBHANI
82	21475A0316	DAGGUPATI VENKATA PRADEEP
83	21475A0317	NAGASURENDRA CHARI UPPALAPATI

84	21475A0318	NALLURI NAVEEN
85	21475A0319	ORCHU VENKATA RAVINDRA
86	21475A0320	NELLURI YASWANTH
87	21475A0321	PENUMALA PAVAN KUMAR
88	21475A0322	BAANANA PRADEEP KUMAR
89	21475A0323	BOJANKI DEMUDU BABU
90	21475A0324	DATTI CHANDU
91	21475A0325	BORUGADDA NITHIN
92	21475A0326	VARIKUTI KARTHIK VENKATA RAM
93	21475A0327	GOLLA SUNDARA SAMRAJYA SUGNAN
94	21475A0328	CHATTA VENKATRAMAIAH
95	21475A0329	KSHATRIYA JITHENDRA SINGH
96	21475A0330	BOMMALI BALA SIVA YOGENDRA SAI NANDU
97	21475A0331	REVALLA SAI
98	21475A0332	BANDI SRINIVAS
99	21475A0333	GURRAM SIVA GANESH
100	21475A0334	EMANI LEELA SHANKAR
101	21475A0335	KUPPALA SRINU

PRINCIPAL

NARASARAOPETA
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DEPARTMENT OF MECHANICAL ENGINEERING

HAND WRITTEN/PRINTED LECTURE NOTES

Q. Write different applications of AI. Differentiate between natural intelligence and artificial intelligence

Ans:

Applications of AI

Artificial intelligence is bringing many changes in human life and is applicable in various fields. Artificial Intelligence strives to create machines and technologies that can imitate human behaviour and the mind's ability to learn and solve problems. It has brought about a revolution in the world of technologies and its impacts and its applications for solving complex problems.

The applications of AI are vast and can be used across various industries. The popular applications of AI are in the field of Healthcare, Agriculture, Robotics, Web Applications, Finance, Oil and Gas Industry, Chatbots, etc. the sections below will discuss various applications of artificial intelligence in various sectors.

Applications of AI in Healthcare

The health care sector is bringing about the changes in the treatment, development of medicines, and more with the applications of AI. AI used machine learning algorithms, and other related technologies for medical diagnosis purposes. Here are some applications of AI in Healthcare.

Analysis & acting on medical datas for predicting a particular outcome	In medical diagnosis purposes
Help doctors & medical providers deliver a more appropriate diagnosis and treatment plans	Uses Big Data and analyses them for improving preventive care recommendations
Track, record & forecast the spread of various diseases	Helps in drug discovery
Developing more effective medicines	Cost management of various healthcare services

AI Applications in Agriculture

AI can help farmers in providing real time insights from the field for different requirements such as irrigation, fertilisation, pesticide treatment, growth of crops, etc and more. Artificial Intelligence technologies can help in producing healthier crops, control pests, monitor soil, and increase the yield of crops. Tabulated below are some of the applications of AI in agriculture.

Crop and soil monitoring	Insect and plant disease detection
Livestock health monitoring	Intelligent spraying

Automatic weeding	Aerial survey and imaging
Produce grading and sorting	Improve overall harvest quality and accuracy

AI Applications to Robotics

Artificial intelligence can improve a robot's visuals and accuracy of image recognition. It can help a robot do a wide range of tasks, such as navigate their surroundings, identify objects around the robot, assist humans with bricklaying, installing drywall and robotic-assisted surgeries. Here are some of the applications of AI in Robotics.

Computer vision & Imaging	AI-enabled manipulation & grasping
AI-enhanced navigation & motion control	Real-world perception & natural language processing
Machine Learning Applications	Customer Service

AI Web Applications

AI can be used for various web design purposes including web design and development. It can help provide faster searches, relevant customer interaction and experiences, effective digital marketing, better interactions with the website visitors even better and more. Check out the applications of AI in Web Applications.

Artificial Intelligence (AI) in Website Development	Stimulating Customer Engagement
Faster Coding	Conduct Customer Behaviour Analysis
Quality Assurance	AI Research
Personalised User Experience (UX)	Effective marketing to the targeted customers

AI Applications in Finance

AI is helpful in finance for better predicting and assessing loan risks, detecting fraudulent activities, and more. AI technologies are used in banks to track investment behaviour of customers, push notifications, keep a record of its customers, perform KYC checks, and more. The tables are some of the applications of AI in Finance.

Assess risks	Detect and prevent payments fraud
Improve processes for anti-money laundering	Customer services
Credit scoring	Investment & lending
Operations	Audit & compliance

AI Applications in Oil and Gas Industry

AI can help gas companies in assessing the value of specific reservoirs, customising drilling and completing plans as per the geological area, along with risks assessment for each

individual well. It can also help predict market price of crude oil as well as the finished products. Check out the important applications of AI in the oil and gas industry.

Surface Analysis/Geological Assessment	Reducing Well/Equipment Downtime
Optimising Production and Scheduling	Asset tracking and maintenance with the use of digital twins
Defect Detection	AI-led Cybersecurity
Workplace Safety	Analytics-Driven Decision Making
Emission Tracking	Logistics Network Optimizations and Logistics
AI Led Inventory Management	Back Office Process and Procurement Optimization

AI Chatbot Applications

Chatbots is a form of AI used in messaging apps, chat windows, and voice calling apps. It provides convenience for customers, as they are automated programs to interact with customers just as humans would. Here are some of the applications of AI Chatbots.

Perform specialised task	They offer better services on Mobiles
Scale up operations	Divert human resources to core tasks
Adds value to customers	Assists customer in making right choices
Upselling and recouping carts	Increase personalisation
Millennial segments	Interactive marketing

AI Edge Applications

AI edge computing makes it possible for AI applications to run directly on field devices, processing field data as well as run machine learning and deep learning algorithms in fragments of seconds. It includes smart smart phones, laptops, robots, self-driven cars, etc which use video analytics. Tabulated below are some of the applications of AI Edge.

Retail and Artificial Intelligence: Shopping Experience	Retail and Artificial Intelligence: Shopping Experience
Creating safe, smart roads	Powering smart hospitals
Drones	Fire Fighting Robots
Industrial Internet of Things	-

Q. Differentiate between natural intelligence and artificial intelligence

Ans:

Artificial Intelligence: Artificial Intelligence is based on human insights that can be decided in a way that can machine can effortlessly actualize the tasks, from the basic to those that are

indeed more complex. The reason for manufactured insights is learning, problem-solving, reasoning, and perception.

This term may be connected to any machines which show related to a human intellect such as examination and decision-making and increments the efficiency.

AI covers assignments like robotics, control systems, face recognition, scheduling, data mining, and numerous others.

Human Intelligence: Human intelligence or the behaviour of the human being has come from past experiences and the doings based upon situation, and environment. And it is completely based upon the ability to change his/her surroundings through knowledge which we gained.

It gives diverse sorts of information. It can provide data on things related to a particular aptitude and knowledge, which can be another human subject, or, within the case of locators and spies, diplomatic data which they had to get to. So, after concluding all it can give data on interpersonal connections and arrange of interest.

Below is a table of differences between Artificial intelligence and Human intelligence:

S. No.	Feature	Artificial Intelligence	Human Intelligence
1.	Emergence	AI is an advancement made by human insights; its early improvement is credited to Norbert Weiner who theorized on criticism mechanisms.	On the other hand, human creatures are made with the intrinsic capacity to think, reason, review, etc.
2.	Nature	Artificial intelligence (AI) strives to build machines that can mimic human behaviour and carry out human-like tasks.	Human intelligence seeks to adapt to new situations by combining a variety of cognitive processes.
3.	State	Machines are digital.	The human brain is analogous.
4.	Function	AI-powered machines rely on input of data and instructions.	Humans use their brains' memory, processing power, and cognitive abilities.
5.	Pace/Rate of AI and human	As compared to people, computers can handle more data at a speedier rate. For occurrence, in the event that the human intellect can solve a math problem in 5 minutes, AI can solve 10 problems in a minute.	In terms of speed, humans cannot beat the speed of AI or machines.
6.	Learning ability	As machines are unable to reason abstractly or draw conclusions from the past. They can only acquire knowledge through information and frequent training, but they will never develop a human-specific thinking process.	Learning from various events and prior experiences is the foundation of human intelligence.

S. No.	Feature	Artificial Intelligence	Human Intelligence
7.	Decision Making	AI is profoundly objective in choice making because it analyzes based on absolutely accumulated data.	Human choices may be affected by subjective components which are not based on figures alone.
8.	Perfection	AI frequently produces precise comes about because its capacities are based on a set of modified rules.	For human insights, there's more often than not room for "human error" as certain subtle elements may be missed at one point or the other.
9.	Energy Consumption	The modern computer generally uses 2 watts of energy.	On the other hand, human brains uses about 25 watts
10.	Modification of AI and Human	AI takes much more time to adjust to unused changes.	Human insights can be adaptable in reaction to the changes in their environment. This makes individuals able to memorize and ace different skills.
11.	Versatility	AI can as it were perform fewer assignments at the same time as a framework can as it were learn duties one at a time.	The human judgment skills underpin multitasking as proven by differing and concurrent roles.
12.	Social Networking	AI has not aced the capacity to choose up on related social and enthusiastic cues.	On the other hand, as social creatures, people are much way better at social interaction since they can prepare theoretical data, have self-awareness, and are delicate to others' feelings.
13.	Task	It does optimization of the system. It cannot be creative or innovative as humans can only think and machines cannot.	It is innovative or creative.

Q. Write and explain the application fields of AI also write about concept of rationality

Ans:

Artificial intelligence is a new technical discipline that researches and develops theories, methods, technologies, and application systems for simulating the extension and expansion of human intelligence. The goal of artificial intelligence research is to let machines perform some complex tasks that require intelligent humans to complete. That is the machine can replace to solve some complicated tasks, not just repetitive mechanical activity but some that require human wisdom to participate in it.

There are three major directions of artificial intelligence technology that are speech recognition, computer vision, and natural language processing.

Speech Recognition

Speech recognition makes the computer listens which turns into the text and can automatically generate navigation in maps. There are some applications of speech recognition. Speech recognition can be divided into three aspects:

- **Speech synthesis**, including online and offline speech synthesis;
- **Speech recognition**, including speech dictation and other aspects;
- **Semantic understanding** is to use neural networks to extract the meaning of speech, including voice evaluation and some features of some of our commonly used machine translation.

Computer vision

Computer vision makes the computer sees. We hope that computers can replace some of the functions of the human eye. For example, there is a very useful document analysis technology, called OCR. The computer scans the document and read it. There are some researches on computer vision in the field of intelligent medical diagnosis. Although it is not yet commercially available; there will be broad application scenarios in the future. At the same time, in the military field, drones are replacing human observation and measuring the trajectory for missiles.

Popular directions for computer vision are:

- **Object recognition and detection.** The computer can quickly detect the information from the photos. Identification of plants, people, animals, or vehicles from the pictures
- **Object Movement Tracking.** Once the image of an object captured on a certain frame. In the subsequent videos, the machines can continuously track the changes and conditions of this object.

Natural language processing

Computer can listen to what humans say and see. The humans can interact with the computer, using natural language for communication; this is the aim of natural language processing. Natural language processing is now used in machine translation, information retrieval, and dialogue systems.

- **Computer translation:** It mainly includes machine simultaneous translation.
- **Information Retrieval:** Computers can recognize what humans are looking for, and then it can search related things.
- **Intelligent customer service:** Humans can interact with the computer through voice and let it answer the questions.

Concept of Rationality:

Rationality is the capacity to generate maximally successful behavior given available information. Rationality also indicates the capacity to compute perfectly rational decision given the initially available information. The capacity to select the optimal combination of

computation – sequence plus the action, under the constraint that the action must be selected by the computation is also rationality.

Perfect rationality constraints an agent's actions to provide the maximum expectations of success given the information available.

Q. What is an agent and explain basic kinds of agent program

Ans:

AGENT

Introduction

An AI system is composed of an agent and its environment. The agents act in their environment. The environment may contain other agents.

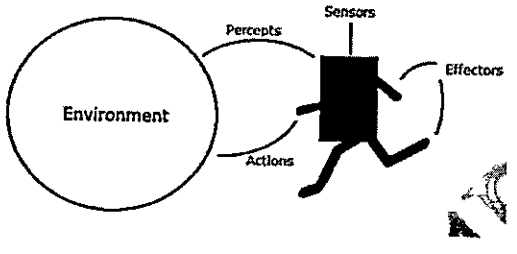
An **agent** is anything that can perceive its **environment** through **sensors** and acts upon that environment through **actuators.**

Sensor: Sensor is a device which detects the change in the environment and sends the information to other electronic devices. An agent observes its environment through sensors.

Actuators: Actuators are the component of machines that converts energy into motion. The actuators are only responsible for moving and controlling a system. An actuator can be an electric motor, gears, rails, etc.

Effectors: Effectors are the devices which affect the environment. Effectors can be legs, wheels, arms, fingers, wings, fins, and display screen.

- A **human agent** has sensory organs such as eyes, ears, nose, tongue and skin parallel to the sensors, and other organs such as hands, legs, mouth, for effectors.
- A **robotic agent** replaces cameras and infrared range finders for the sensors, and various motors and actuators for effectors.
- A **software** agent has encoded bit strings as its programs and actions.

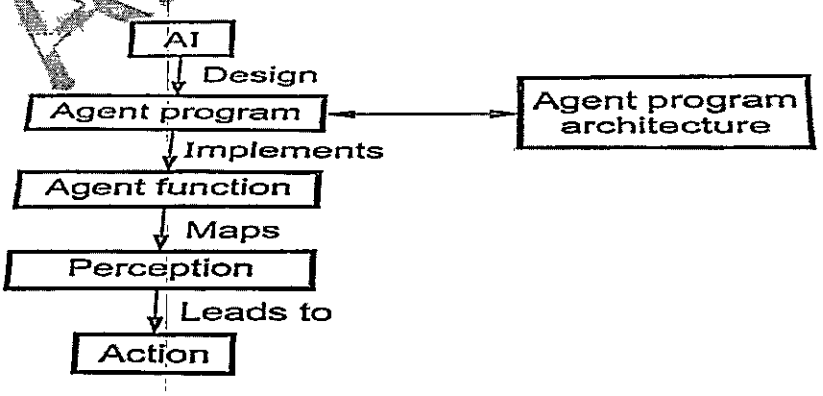


Agent Terminology

- **Performance Measure of Agent** – It is the criteria, which determines how successful an agent is.
- **Behavior of Agent** – It is the action that agent performs after any given sequence of percepts.
- **Percept** – It is agent's perceptual inputs at a given instance.
- **Percept Sequence** – It is the history of all that an agent has perceived till date.
- **Agent Function** – It is a map from the precept sequence to an action.

AI Agent Action Process:

Following diagram illustrated the agent action process, a specified by architecture.



Q:Explain the properties of AI Environment

Ans:

Properties of Environment

The environment has multifold properties –

1. Fully observable vs Partially Observable
2. Static vs Dynamic
3. Discrete vs Continuous
4. Deterministic vs Stochastic
5. Single-agent vs Multi-agent
6. Episodic vs sequential
7. Known vs Unknown
8. Accessible vs Inaccessible

1. Fully observable vs Partially Observable:

- A fully observable environment is easy as there is no need to maintain the internal state to keep track history of the world.
- An agent with no sensors in all environments then such an environment is called as **unobservable.**

2. Deterministic vs Stochastic:

- If an agent's current state and selected action can completely determine the next state of the environment, then such environment is called a deterministic environment.
- A stochastic environment is random in nature and cannot be determined completely by an agent.
- In a deterministic, fully observable environment, agent does not need to worry about uncertainty.

3. Episodic vs Sequential:

- In an episodic environment, there is a series of one-shot actions, and only the current percept is required for the action.
- However, in Sequential environment, an agent requires memory of past actions to determine the next best actions.

4. Single-agent vs Multi-agent

- If only one agent is involved in an environment, and operating by itself then such an environment is called single agent environment.
- However, if multiple agents are operating in an environment, then such an environment is called a multi-agent environment.
- The agent design problems in the multi-agent environment are different from single agent environment.

5. Static vs Dynamic:

- If the environment can change itself while an agent is deliberating then such environment is called a dynamic environment else it is called a static environment.
- Static environments are easy to deal because an agent does not need to continue looking at the world while deciding for an action.
- However for dynamic environment, agents need to keep looking at the world at each action.
- Taxi driving is an example of a dynamic environment whereas Crossword puzzles are an example of a static environment.

6. Discrete vs Continuous:

- If in an environment there are a finite number of percepts and actions that can be performed within it, then such an environment is called a discrete environment else it is called continuous environment.
- A chess gamecomes under discrete environment as there is a finite number of moves that can be performed.
- A self-driving car is an example of a continuous environment.

7. Known vs Unknown

- Known and unknown are not actually a feature of an environment, but it is an agent's state of knowledge to perform an action.
- In a known environment, the results for all actions are known to the agent. While in unknown environment, agent needs to learn how it works in order to perform an action.
- It is quite possible that a known environment to be partially observable and an

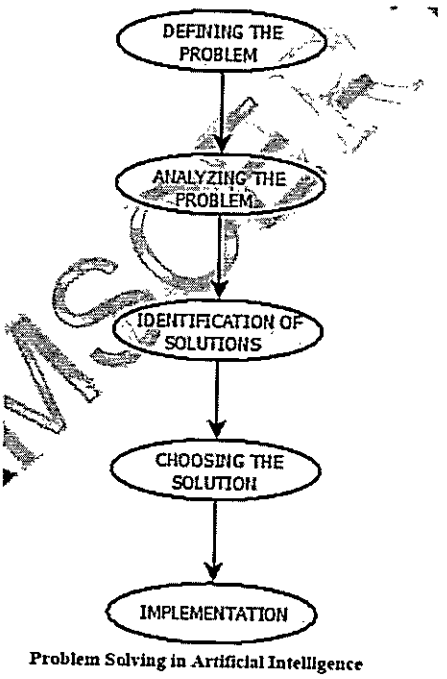
8. Accessible vs Inaccessible

- If an agent can obtain complete and accurate information about the state's environment, then such an environment is called an Accessible environment else it is called inaccessible.
- An empty room whose state can be defined by its temperature is an example of an accessible environment.
- Information about an event on earth is an example of Inaccessible environment.

Q.What is problem formulation and list out its components

Ans:

Problems are the issues which comes across any system. A solution is needed to solve that particular problem.
The process of solving a problem consists of five steps. These are:



Problem Solving in Artificial Intelligence

1. Defining The Problem: The definition of the problem must be included precisely. It should contain the possible initial as well as final situations which should result in acceptable solution.
2. Analyzing The Problem: Analyzing the problem and its requirement must be done as few features can have immense impact on the resulting solution.
3. Identification Of Solutions: This phase generates reasonable amount of solutions to the given problem in a particular range.
4. Choosing a Solution: From all the identified solutions, the best solution is chosen basis on the results produced by respective solutions.

Q. Differentiate clearly between uniformed and informed search techniques

Ans: Solutions Informed Search vs. Uninformed Search is depicted pictorially as follows:

Parameters	Informed Search	Uninformed Search
Known as	It is also known as Heuristic Search.	It is also known as Blind Search.
Using Knowledge	It uses knowledge for the searching process.	It doesn't use knowledge for the searching process.
Performance	It finds a solution more quickly.	It finds solution slow as compared to an informed search.
Completion	It may or may not be complete.	It is always complete.
Cost Factor	Cost is low.	Cost is high.
Time	It consumes less time because of quick searching.	It consumes moderate time because of slow searching.
Direction	There is a direction given about the solution.	No suggestion is given regarding the solution in it.
Implementation	It is less lengthy while implemented.	It is lengthier while implemented.
Efficiency	It is more efficient as efficiency takes into account cost and performance. The incurred cost is less and speed of finding solutions is quick.	It is comparatively less efficient as incurred cost is more and the speed of finding the Breadth-First solution is slow.
Computational requirements	Computational requirements are lessened.	Comparatively higher computational requirements.
Size of search problems	Having a wide scope in terms of handling large search problems.	Solving a massive search task is challenging.
Examples of Algorithms	• Greedy Search • A* Search • AO* Search • Hill Climbing Algorithm	• Depth First Search (DFS) • Breadth First Search (BFS) • Branch and Bound

Q. Explain the BFS algorithm efficiency in problem solving. And Compare with DFS.

Ans:

Defining the problem as State Space Search:
The state space representation forms the basis of most of the AI methods.
• Formulate a problem as a state space search by showing the legal problem states, the legal operators, and
the initial and goal states.
• A state is defined by the specification of the values of all attributes of interest in the world
• An operator changes one state into the other; it has a precondition which is the value of certain attributes
prior to the application of the operator, and a set of effects, which are the attributes altered by the operator
• The initial state is where you start
• The goal state is the partial description of the solution

Breadth- First -Search:

Consider the state space of a problem that takes the form of a tree. Now, if we search the goal along each breadth
of the tree, starting from the root and continuing up to the largest depth, we call it breadth first search.
• Algorithm:
1. Create a variable called NODE-LIST and set it to initial state
2. Until a goal state is found or NODE-LIST is empty do
a. Remove the first element from NODE-LIST and call it E. If NODE-LIST was empty, quit
b. For each way that each rule can match the state described in E do:
i. Apply the rule to generate a new state
ii. If the new state is a goal state, quit and return this state
iii. Otherwise, add the new state to the end of NODE-LIST
BFS illustrated:
Step 1: Initially fringe contains only one node corresponding to the source state A.

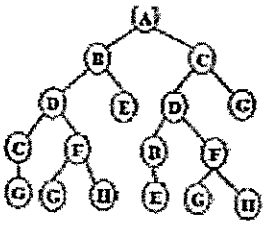


Figure 1

FRINGE: A

Step 2: A is removed from fringe. The node is expanded, and its children B and C are generated. They are p
at the back of fringe.

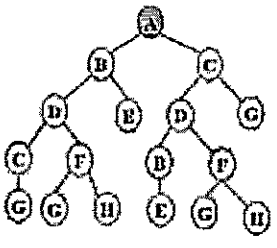


Figure 2

FRINGE: B C

Step 3: Node B is removed from fringe and is expanded. Its children D, E are generated and put at the ba
fringe.

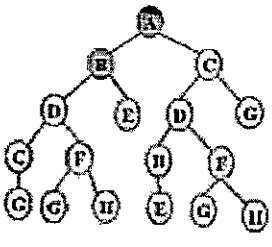


Figure 3

FRINGE: C D E

Step 4: Node C is removed from fringe and is expanded. Its children D and G are added to the back of fringe.

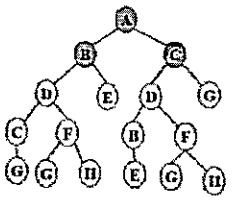


Figure 4

FRINGE: D E D G

Step 5: Node D is removed from fringe. Its children C and F are generated and added to the back of fringe.

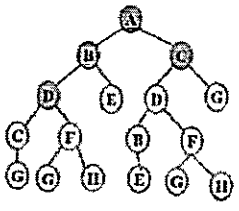


Figure 5

FRINGE: E D G C F

Step 6: Node E is removed from fringe. It has no children.

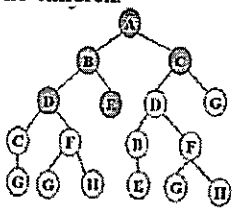


Figure 6

FRINGE: D G C F

Step 7: D is expanded; B and F are put in OPEN.

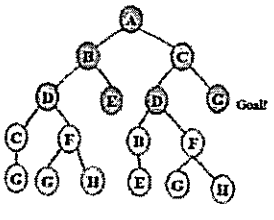


Figure 7

FRINGE: G C F B F

Step 8: G is selected for expansion. It is found to be a goal node. So the algorithm returns the path A C G by following the parent pointers of the node corresponding to G. The algorithm terminates.

Breadth first search is:

- One of the simplest search strategies
- Complete. If there is a solution, BFS is guaranteed to find it.
- if there are multiple solutions, then a minimal solution will be found
- the algorithm is optimal (i.e., admissible) if all operators have the same cost. Otherwise, breadth first search finds a solution with the shortest path length.
- **Time complexity** : $O(b^d)$
- **Space complexity** : $O(b^d)$
- **Optimality** :Yes

b - branching factor(maximum no of successors of any node),
d – Depth of the shallowest goal node
Maximum length of any path (m) in search space

Depth- First- Search:

We may sometimes search the goal along the largest depth of the tree, and move up only when further traversal along the depth is not possible. We then attempt to find alternative offspring of the parent of the node (state) last visited. If we visit the nodes of a tree using the above principles to search the goal, the traversal made is called depth first traversal and consequently the search strategy is called *depth first search.*

• Algorithm:

1. Create a variable called NODE-LIST and set it to initial state

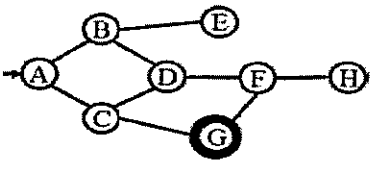
2. Until a goal state is found or NODE-LIST is empty do

a. Remove the first element from NODE-LIST and call it E. If NODE-LIST was empty, quit

b. For each way that each rule can match the state described in E do:

i. Apply the rule to generate a new state
ii. If the new state is a goal state, quit and return this state
iii. Otherwise, add the new state in front of NODE-LIST

DFS illustrated:



A State Space Graph

Step 1: Initially fringe contains only the node for A.

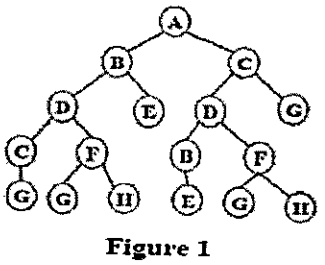


Figure 1

FRINGE: A

Step 2: A is removed from fringe. A is expanded and its children B and C are put in front of fringe.

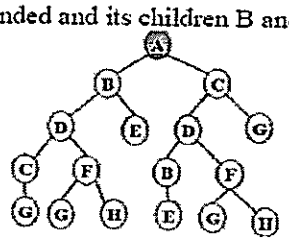
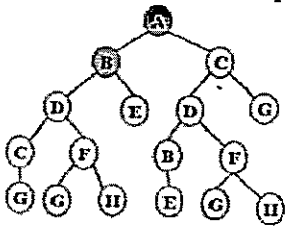


Figure 2

FRINGE: B C

Step 3: Node B is removed from fringe, and its children D and E are pushed in front of fringe.



FRINGE: D E C

Step 4: Node D is removed from fringe. C and F are pushed in front of fringe.

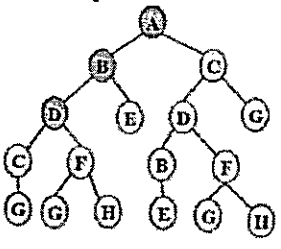


Figure 4

FRINGE: C F E C

Step 5: Node C is removed from fringe. Its child G is pushed in front of fringe.

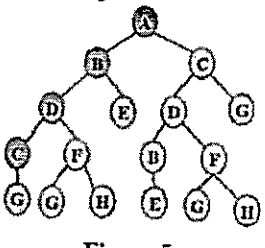


Figure 5

FRINGE: G F E C

Step 6: Node G is expanded and found to be a goal node.

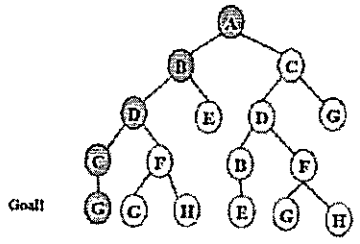


Figure 6

FRINGE: G F E C

The solution path A-B-D-C-G is returned and the algorithm terminates.

Depth first search is:

1. The algorithm takes exponential time.

2. If N is the maximum depth of a node in the search space, in the worst case the algorithm will take time $O(b^d)$.

3. The space taken is linear in the depth of the search tree, O (bN).

Note that the time taken by the algorithm is related to the maximum depth of the search tree. If the search tree has infinite depth, the algorithm may not terminate. This can happen if the search space is infinite. It can also happen if the search space contains cycles. The latter case can be handled by checking for cycles in the algorithm. Thus **Depth First Search is not complete.**

Q. Explain A* algorithm with an Example and also explain about Graph search

Ans:

A* Algorithm

The Best First algorithm is a simplified form of the *A** algorithm.

The **A* search algorithm** (pronounced "Ay-star") is a tree search algorithm that finds a path from a given initial node to a given goal node (or one passing a given goal test). It employs a "heuristic estimate" which ranks each node by an estimate of the best route that goes through that node. It visits the nodes in order of this heuristic estimate.

Similar to greedy best-first search but is more accurate because A* takes into account the nodes that have already been traversed.

From *A** we note that $f = g + h$ where

g is a measure of the distance/cost to go from the initial node to the current node

h is an estimate of the distance/cost to solution from the current node.

Thus f is an estimate of how long it takes to go from the initial node to the solution

A* begins at a selected node. Applied to this node is the "cost" of entering this node (usually zero for the initial node). A* then estimates the distance to the goal node from the current

node. This estimate and the cost added together are the heuristic which is assigned to the path leading to this node. The node is then added to a priority queue, often called "open".

□ The algorithm then removes the next node from the priority queue (because of the way a priority queue works, the node removed will have the lowest heuristic). If the queue is empty, there is no path from the initial node to the goal node and the algorithm stops. If the node is the goal node, A* constructs and outputs the successful path and stops.

□ If the node is not the goal node, new nodes are created for all admissible adjoining nodes; the exact way of doing this depends on the problem at hand. For each successive node, A* calculates the "cost" of entering the node and saves it with the node. This cost is calculated from the cumulative sum of costs stored with its ancestors, plus the cost of the operation which reached this new node.

□ The algorithm also maintains a 'closed' list of nodes whose adjoining nodes have been checked. If a newly generated node is already in this list with an equal or lower cost, no further processing is done on that node or with the path associated with it. If a node in the closed list matches the new one, but has been stored with a *higher* cost, it is removed from the closed list, and processing continues on the new node.

□ Next, an estimate of the new node's distance to the goal is added to the cost to form the heuristic for that node. This is then added to the 'open' priority queue, unless an identical node is found there.

□ Once the above three steps have been repeated for each new adjoining node, the original node taken from the priority queue is added to the 'closed' list. The next node is then popped from the priority queue and the process is repeated

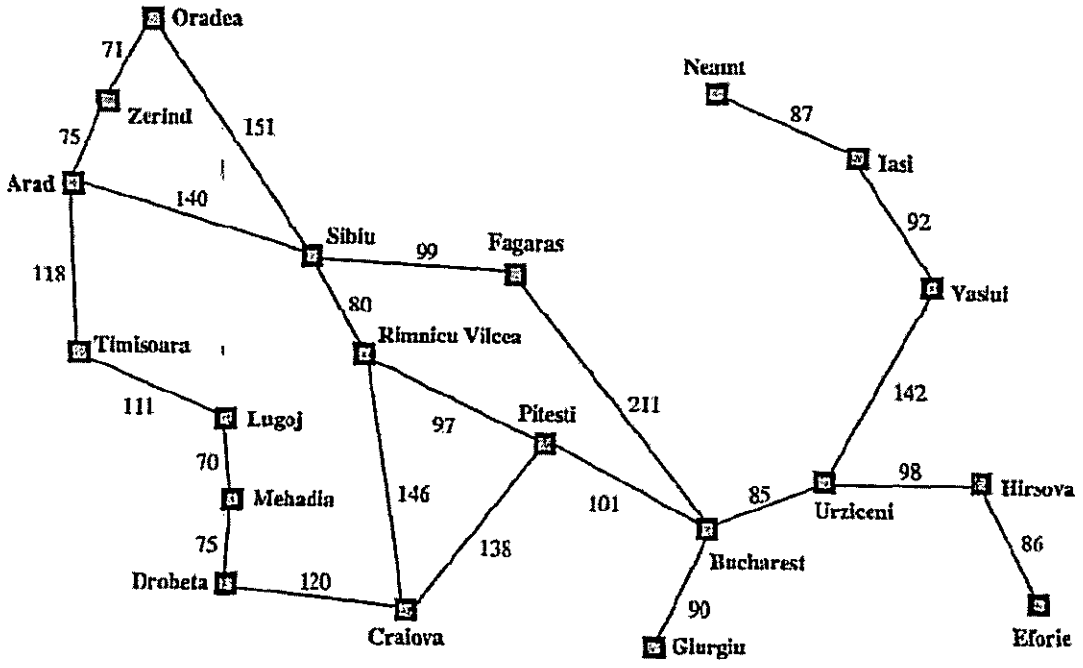
A* search properties:

- The algorithm A* is admissible. This means that provided a solution exists, the first s found by A* is an optimal solution. A* is admissible under the following conditions:
- Heuristic function: for every node n , $h(n) \leq h^*(n)$.
    - A* is also complete.
- A* is optimally efficient for a given heuristic.
- A* is much more efficient that uninformed search.

Example of A* Problem Solution:

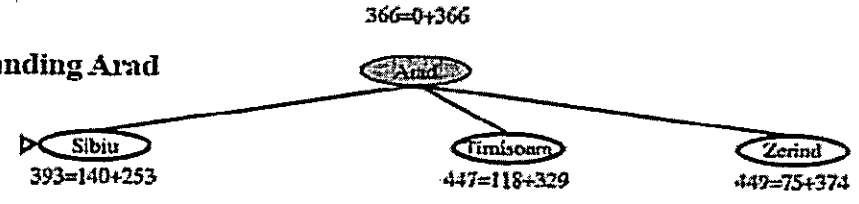
The heuristic costs from each city to Bucharest:

Arad	366	**Mehadia**	241
Bucharest	0	**Neamt**	234
Craiova	160	**Oradea**	380
Drobeta	242	**Pitesti**	100
Eforie	161	**Rimnicu Vilcea**	193
Fagaras	176	**Sibiu**	253
Giurgiu	77	**Timisoara**	329
Hirsova	151	**Urziceni**	80
Iasi	226	**Vaslui**	199
Lugoj	244	**Zerind**	374

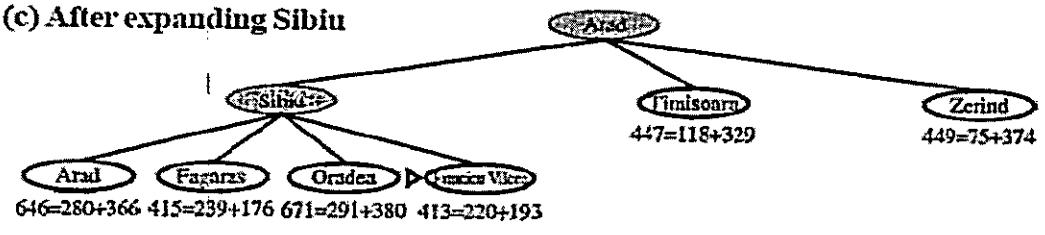


(a) The initial state

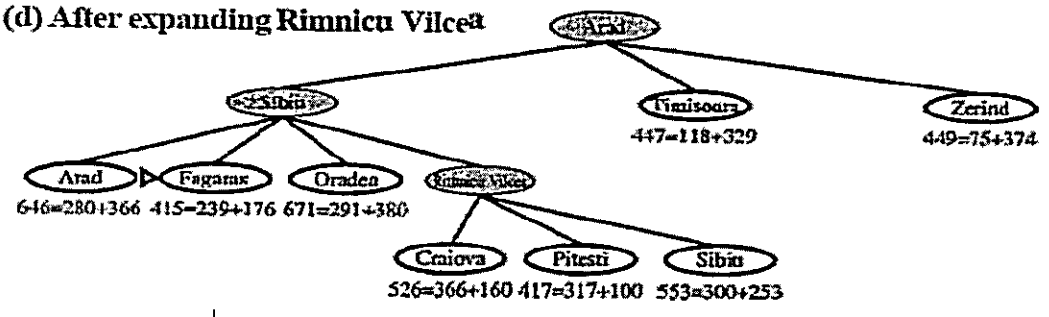
(b) After expanding Arad



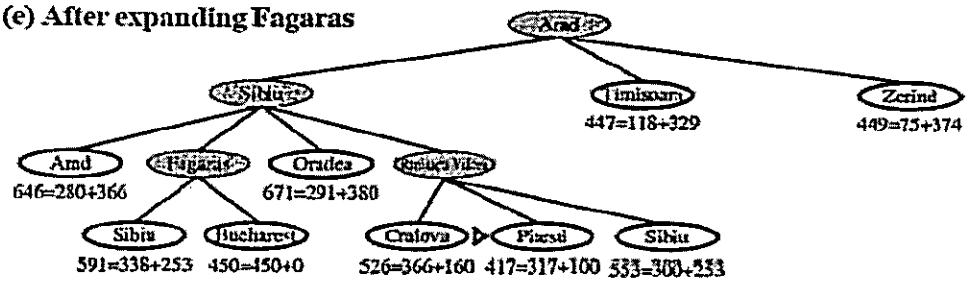
(c) After expanding Sibiu



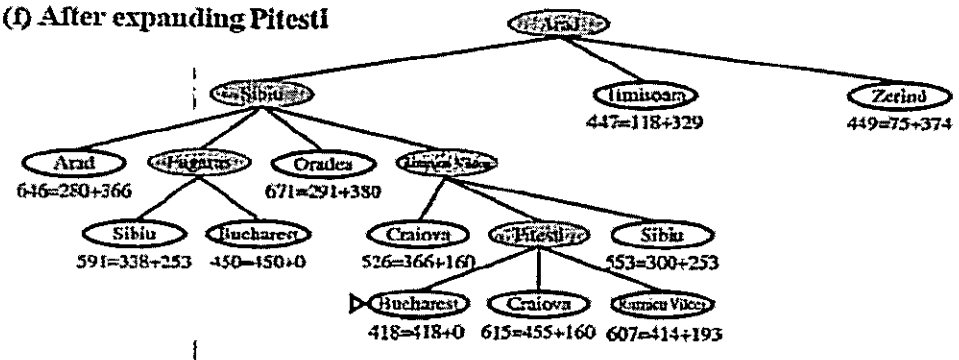
(d) After expanding Rimnicu Vilcea



(e) After expanding Fagaras



(f) After expanding Pitesti



Q. Illustrate with examples different types of knowledge representation in AI

Ans:

Knowledge Representation in AI describes the representation of knowledge. Basically, it is a study of how the **beliefs, intentions,** and **judgments** of an **intelligent agent** can be expressed suitably for automated reasoning. One of the primary purposes of Knowledge Representation includes modeling intelligent behavior for an agent.

Knowledge Representation and Reasoning (**KR, KRR**) represents information from the real world for a computer to understand and then utilize this knowledge to solve **complex real-life problems** like communicating with human beings in natural language. Knowledge representation in AI is not just about storing data in a database, it allows a machine to learn from that knowledge and behave intelligently like a human being.

The different kinds of knowledge that need to be represented in AI include:

- **Objects**
- **Events**
- **Performance**
- **Facts**
- **Meta-Knowledge**
- **Knowledge-base**

Different Types of Knowledge

There are 5 types of Knowledge such as:

- **Declarative Knowledge** – It includes concepts, facts, and objects and expressed in a declarative sentence.
- **Structural Knowledge** – It is a basic problem-solving knowledge that describes the relationship between concepts and objects.
- **Procedural Knowledge** – This is responsible for knowing how to do something and includes rules, strategies, procedures, etc.
- **Meta Knowledge** – Meta Knowledge defines knowledge about other types of Knowledge.
- **Heuristic Knowledge** – This represents some expert knowledge in the field or subject.

These are the important types of Knowledge Representation in AI. Now, let's have a look at the cycle of knowledge representation and how it works.

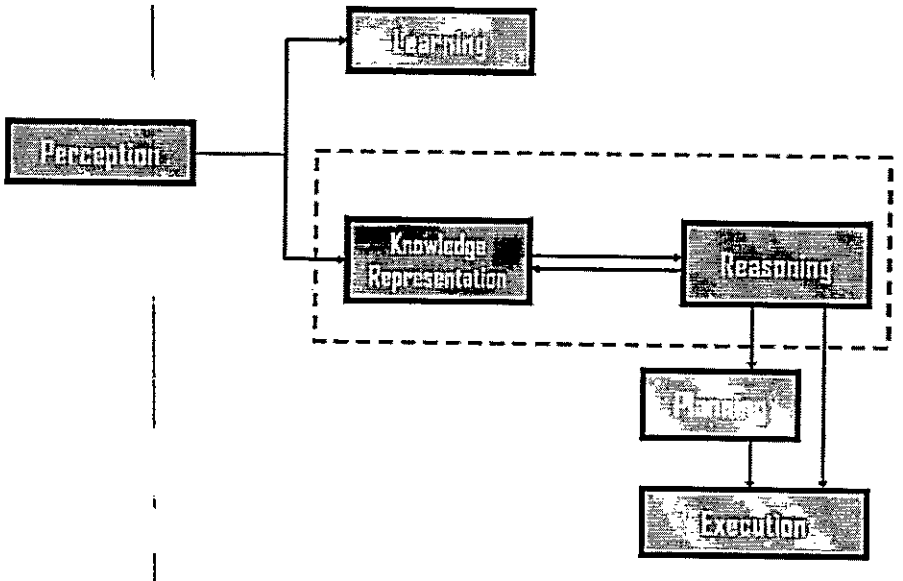
Cycle of Knowledge Representation in AI

Artificial Intelligent Systems usually consist of various components to display their intelligent behaviour. Some of these components include:

- **Perception**
- **Learning**
- **Knowledge Representation & Reasoning**
- **Planning**
- **Execution**

Here is an example to show the different components of the system and how it works:

Example



Q. Clearly differentiate between Procedural knowledge and Declarative knowledge

Ans:

The following are some of the important differences between Procedural Knowledge and Declarative Knowledge.

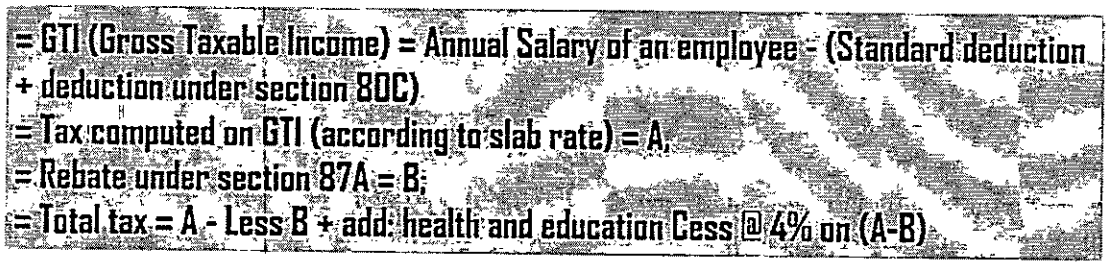
Sr. No.	Key	Procedural Knowledge	Declarative Knowledge
1	**Name**	Procedural knowledge is also termed as imperative knowledge.	Declarative knowledge is also termed as functional knowledge
2	**Basis**	Procedural knowledge revolves around **How to** the concept.	Declarative knowledge revolves around **What to** the concept.
3	**Communication**	Procedural knowledge is difficult to communicate.	Declarative knowledge is easily communicable.
4	**Orientation**	Procedural knowledge is process-oriented.	Declarative knowledge is data-oriented.
5	**Validation**	Validation is not very easy in procedural knowledge.	Validation is quite easy in declarative knowledge.

Definition of Procedural Knowledge

The **Procedural knowledge** is a type of knowledge where the essential control information that is required to use the information is integrated in the knowledge itself. It also used with an interpreter to employ the knowledge which follows the instructions given in the knowledge.

Example

Let's understand this by an example; it can include a group of logical assertions merged with a resolution theorem prover to provide an absolute program for solving problems. Here, the implied income tax of an employee salary can be thought of as a procedural knowledge as it would require a process to calculate it as given below.



So, this is how the tax of an employee is calculated by following a lengthy process instead of just collecting facts.

Definition of Declarative Knowledge

A **Declarative knowledge** is where only knowledge is described but not the use to which the knowledge is employed is not provided. So, in order to use this declarative knowledge, we need to add it with a program that indicates what is to be done to the knowledge and how it is to be done.

Example

Let us understand this by the example of an employee whose ID, name, address, salary have to stored in a database where this information is fact-based does not require much effort to acquire it.

Key Differences between Procedural and Declarative Knowledge

1. When the conscious perception and conscious planning is involved in the knowledge it is known as procedural knowledge. On the contrary, in declarative knowledge is not conscious.
2. Declarative knowledge is verbalized, shared, copied, processed and stored in an easy way while procedural knowledge is hard to express.
3. Among procedural and declarative knowledge the declarative knowledge is more commonly used.
4. Procedural knowledge is obtained from experience, action and subjective insight. As against, declarative knowledge is obtained from artifact, procedure, process and concepts.
5. Procedural knowledge is process-oriented in nature whereas declarative knowledge is data-oriented.

Conclusion

The procedural and declarative knowledge can easily be distinguished by identifying where control information is residing and whether it is used consciously and unconsciously.

NEC NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

MID & ASSIGNMENT EXAMINATION QUESTION PAPERS WITH SCHEME AND SOLUTIONS

Narasaraopeta Engineering College::Narasaraopet (Autonomous)

Department of Mechanical Engineering

III B.Tech- I Semester

Assignment Test-I

Subject: AI&ML	Date: 29/08/2022
Duration: 30 min	Max Marks: 10

S.No.	Questions	Course Outcome	Knowledge Level	Marks
1	Write different applications of AI. Differentiate between natural intelligence and artificial intelligence	01	K2	5
2	Explain the application fields of AI also write about concept of rationality	01	K2	5
3	What is an agent and explain basic kinds of agent program	01	K2	5
4	Explain the properties of AI Environment	01	K2	5
5	What is problem formulation and list out its components	01	K2	5

NARASARAOPET ENGINEERING COLLEGE: NARASARAOPET
DEPARTMENT OF MECHANICAL ENGINEERING
III B. TECH I -SEMESTER I-MID EXAMINATION

SUBJECT: AI&ML **CODE:** R20ME3101	**DATE:**19/09/2022
DURATION:90 min	**MAX MARKS:** 25

Answer all questions

Q.no	Questions	CO	Knowledge Level	Marks
1.	a) Write and explain the application fields of AI	1	K2	5
	b) Explain the structure of agents and problem solving agents in AI			5
2.	a) Explain breadth first search algorithm with help of an example	2	K3	5
	b) What is an informed search? Explain the methodology of A* search in problem solving			5
3.	Illustrate with examples different types of knowledge representation in AI	3	K2	5

Scheme of valuation

Mid-I

1. a. Explain any five applications – 5M

b. Agents Description – 2M
types – 2M
Problem Solving – 1M

2. a. Breadth first search
Introduction – 1M
flow diagram – 2M
Soln. method – 2M

b. Informed Search Intro – 1M
A* Algorithm features – 2M
Soln. steps – 2M

3. Knowledge representation df – 1M
types of KR – 2M
Outcomes of KR – 2M

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Narasaraopeta Engineering College::Narasaraopet (Autonomous)

Department of Mechanical Engineering

III B.Tech- I Semester

Assignment Test-II

Subject: AI&ML	Date: 10/10/2022
Duration: 30 min	Max Marks: 10

S.No.	Questions	Course Outcome	Knowledge Level	Marks
1	Explain different types of machine learning	03	K2	5
2	Explain the classification algorithms used in machine learning	03	K2	5
3	Explain the 'Logistic regression' problem in machine learning	03	K2	5
4	Write a python program for normal data distribution	03	K2	5
5	Explain in detail the 'support vector machine' classification of the given data.	03	K2	5

NARASARAOPET ENGINEERING COLLEGE: NARASARAOPET
DEPARTMENT OF MECHANICAL ENGINEERING
III B. TECH I -SEMESTER II-MID EXAMINATION

SUBJECT: AI&ML **CODE:** R20ME3101		**DATE:**17/11/2022
DURATION:90 min		**MAX MARKS:** 25

Answer all questions

Q.no	Questions	CO	Knowledge Level	Marks
1.	a) Write few applications of Machine Learning	3	K2	5
	b) Clearly differentiate between supervised and un-supervised learning			5
2.	a) Explain the classification used in machine leaning. Explain the 'SVM Algorithm'.	4	K3	5
	b) Explain in detail the 'Decision Tree Algorithm' used and compare with Random Forest Method.			5
3.	Explain what is unsupervised learning. Briefly explain the 'Clustering algorithm'.	5	K2	5

Mid-2

Scheme of valuation

1. a. Any five applications of ML - 1×5 - 5M

b. Supervised learning Def - 1M

unsupervised learning def - 1M

Any 3 differences of supervised Vs Unsupervised } - 3M

2. a. Classification meaning - 1M

Algorithm - 1M

SVM algorithm - 3M

3 points

2. b. Decision tree algorithm

meaning - 1M

Evolution - 1M

Random forest algorithm

meaning - 1M

Evolution - 1M

Combining both - 1M

3. Unsupervised learning - 2M

Clustering meaning - 1M

algorithm steps - 2M

NARASARAOPETA ENGINEERING COLLEGE::NARASARAOPET

(AUTONOMOUS)

(R20) 2020 BATCH III B.TECH I SEMESTER FINAL INTERNAL MARKS - DEC- 2022

BRANCH - ME-A			ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (R20ME3101)								
SL.NO.	H.T.NO.	STUDENT NAME	A1	D1	Q1	CYCLE-1	A2	D2	Q2	CYCLE-2	TOT
1	20471A0301	ALAVALA ADITHYA VARA PRASAD	4	6	5	15	5	5	10	20	19
2	20471A0302	BATTULA RAJESH	5	9	8	22	A	9	7	16	21
3	20471A0303	BHIMAVARAPU HEMANTH KUMAR	A	A	A	0	A	5	9	14	12
4	20471A0304	BONAM JAYA PRAKASH	5	5	7	17	A	A	A	0	14
5	20471A0305	BOYAPATI PAVAN KUMAR	A	6	5	11	A	5	9	14	14
6	20471A0306	DADDANALA VEERANJIREDDY	5	14	9	28	5	5	8	18	26
7	20471A0307	DERANGILA PARDHU GANESH	5	9	7	21	A	8	6	14	20
8	20471A0308	DOPPALAPUDI S S NAGA RAVITEJA	5	10	5	20	5	6	9	20	20
9	20471A0309	EEDARA MOHON SAI	5	6	6	17	5	8	10	23	22
10	20471A0310	GANESH SAI PAVAN	5	7	5	17	A	6	9	15	17
11	20471A0311	GANGARAPU VENKATA REDDY	A	A	A	0	A	A	A	0	0
12	20471A0312	GERA KOTESWARA RAO	5	12	8	25	5	9	6	20	24
13	20471A0313	KARASALA PRASANTH	5	13	4	22	5	9	7	21	22
14	20471A0314	KARASANI PAVAN KUMAR REDDY	5	6	6	17	5	5	6	16	17
15	20471A0315	KATTA MAHESWAR	5	12	8	25	5	13	10	28	28
16	20471A0317	KESARI DHANUNJAYA REDDY	5	8	5	18	5	11	6	22	22
17	20471A0318	KOMARAGIRI SASIKUMAR	A	10	5	15	5	10	7	22	21
18	20471A0319	KOMERA SIVA NAGARAJU	A	A	A	0	A	A	3	3	3
19	20471A0320	KOTHA GOPI	5	11	5	21	5	9	8	22	22
20	20471A0321	KUNDURTHI NAVEEN	5	11	4	20	A	A	A	0	16
21	20471A0323	MADANU JOSEPH VINAY KUMAR	5	6	6	17	5	6	8	19	19
22	20471A0324	MADDUMALA RAMAKRISHNA	A	6	5	11	A	6	5	11	11
23	20471A0325	MAGANTI SASI PAVAN	5	A	A	5	A	6	6	12	11
24	20471A0326	MAKKENA SAMBASIVA RAO	5	6	5	16	5	6	8	19	19
25	20471A0327	MIRIYALA SASHANK	5	14	7	26	A	12	9	21	25
26	20471A0328	NALLA ABHIRAM CHOWDARY	5	6	3	14	A	6	9	15	15
27	20471A0329	NUTHAKKI RAKESH	A	7	6	13	5	6	8	19	18
28	20471A0330	ARAVAPALLI SAI SRINIVAS	5	6	5	16	5	A	A	5	14
29	20471A0331	PALETI JOHN HOSANNA	5	A	A	5	5	11	6	22	19
30	20471A0332	PERUMAALLA SRIKANTH	5	13	9	27	5	9	10	24	27
31	20471A0333	POLURI KRISHNA CHAITHANYA	5	14	4	23	5	6	10	21	23
32	20471A0334	PONNAGANTI CHANDU HARSHA VARDHAN	5	8	8	21	A	6	10	16	20
33	20471A0336	PATHAN MEERA VALI	5	0	3	8	A	A	A	0	7
34	20471A0337	POTTIMURTHI PURNA CHANDRA RAO	5	12	8	25	A	11	10	21	25
35	20471A0338	PRUDHVI DURGA BHARATH CHANDAN	A	3	6	9	A	11	10	21	19
36	20471A0339	RAMAVATHU BADDUNAIK	5	A	A	5	A	7	5	12	11
37	20471A0341	SHAIK APPAPURAM MAHABOOB SUBHANI	5	5	5	15	5	4	7	16	16
38	20471A0342	SHAIK ASIF	5	A	A	5	A	A	A	0	4
39	20471A0343	SHAIK GANGARAM ABDUL RAHAMAN	5	A	A	5	A	5	9	14	13
40	20471A0344	SHAIK GULLAPALLI NAGURVALI	A	6	4	10	5	5	10	20	18
41	20471A0345	SHAIK LAL AHAMAD BASHA	5	0	6	11	A	5	9	14	14
42	20471A0346	SHAIK MAHAMMAD FAREED	4	8	6	18	5	6	5	16	

BRANCH - ME-A			ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (R20ME3101)								
SL.NO.	H.T.NO.	STUDENT NAME	A1	D1	Q1	CYCLE-1	A2	D2	Q2	CYCLE-2	TOTAL
43	20471A0347	SHAIK MAHAMMAD YUNUS	5	A	A	5	A	A	A	0	4
44	20471A0348	SHAIK MANISHA	5	15	9	29	5	15	9	29	29
45	20471A0349	SHAIK PARVEZ	5	12	7	24	5	8	6	19	23
46	20471A0350	SHAIK SADHIK	5	11	7	23	5	7	5	17	22
47	20471A0351	SHAIK SALMAN	5	A	A	5	A	A	A	0	4
48	20471A0352	TIPPIREDDY AMARNATHREDDY	5	3	7	15	5	5	9	19	19
49	20471A0353	VADLAVALLI GANESH	A	3	2	5	5	3	10	18	16
50	20471A0354	VEERAGANDHAM VENKATA MANIKANTA	5	6	7	18	3	8	10	21	21
51	20471A0356	ADAKA GOPIRAJU	5	5	7	17	5	0	10	15	17

NAME OF THE STAFF MEMBER Dr. D. Jagadish

SIGNATURE OF THE STAFF MEMBER

SIGNATURE OF THE HOD

NARASARAOPETA ENGINEERING COLLEGE::NARASARAOPET

(AUTONOMOUS)

(R20) 2020 BATCH III B.TECH I SEMESTER FINAL INTERNAL MARKS - DEC- 2022

ANCH - ME-B

..NO.	H.T.NO.	STUDENT NAME	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (R20ME3101)								
			A1	D1	Q1	CYCLE-1	A2	D2	Q2	CYCLE-2	TOTAL
1	20471A0357	ATCHYUTHA PAVAN KUMAR	5	7	7	19	5	10	7	22	22
2	20471A0358	BALLE RAMANJANEYULU	5	10	9	24	5	9	9	23	24
3	20471A0359	BANDARU SAI GANESH	5	2	8	15	5	6	9	20	19
4	20471A0360	BERAM NARENDRA REDDY	5	3	9	17	5	6	7	18	18
5	20471A0361	CHEBROLU MANIKANTA SAI NITHIN	5	6	8	19	5	10	6	21	21
6	20471A0362	CHENNAMSETTY GOPI	5	10	6	21	5	11	9	25	25
7	20471A0363	GANGULA SUNNY	5	9	7	21	5	12	9	26	25
8	20471A0364	GANJI HANUMA KOTI GANESH	5	8	8	21	5	6	7	18	21
9	20471A0365	GANNNAVARAPU JAYA SRIKANTH	5	A	A	5	A	3	0	3	5
10	20471A0366	GUTTIKONDA AYYAPPA REDDY	5	14	9	28	5	13	10	28	28
[redacted]	20471A0367	MADDINENI AJAY	A	14	8	22	5	14	8	27	26
12	20471A0368	MANNEPALLI VEERA NARASIMHA	5	9	3	17	A	5	10	15	17
13	20471A0369	MARAGANI NAGA THIRUMALA RAO	5	11	9	25	5	8	8	21	25
14	20471A0370	PARELLA BALA GURAVAIAH	A	6	7	13	A	5	8	13	13
15	20471A0371	SETLAM RANENDRA VAMSHI	5	9	5	19	5	13	9	27	26
16	20471A0372	SHAIK GUTHIKONDA SALIM	5	15	7	27	5	14	10	29	29
17	20471A0373	SHAIK JAKIR	5	8	6	19	5	13	9	27	26
18	20471A0374	SHAIK MOHAMMAD TAHEER	5	8	8	21	5	A	9	14	20
19	20471A0375	THOTA SRIVAMSI NADH	5	3	7	15	A	5	8	13	15
20	20471A0376	YAKKANTI SAI KIRAN REDDY	5	12	6	23	A	4	7	11	21
21	21475A0301	PALLAPOTHU SAIKIRAN YADAV	5	14	8	27	5	12	10	27	27
22	21475A0302	SYED SARDAR VALI	5	15	10	30	5	15	10	30	30
23	21475A0303	DERANGULA GOPI KRISHNA	5	14	7	26	5	10	8	23	26
24	21475A0304	VADDANI RAKESH	5	A	A	5	A	6	7	13	12
[redacted]	21475A0305	SHAIK ADIL	5	9	9	23	5	10	7	22	23
[redacted]	21475A0306	JANAPAREDDI PRASAD	5	15	9	29	5	13	10	28	29
27	21475A0307	REPALLE YASHWANTH	A	11	9	20	A	9	8	17	20
28	21475A0308	RAMAVATHU PAVAN KUMAR NAIK	5	7	9	21	A	9	8	17	21
29	21475A0309	NELAVALLI VIKAS	5	15	5	25	5	12	5	22	25
30	21475A0310	DUDDU JOSEPH	5	6	5	16	5	9	9	23	22
31	21475A0311	MUNIKOLA SANTHOSH KUMAR	5	7	9	21	5	7	9	21	21
32	21475A0312	MORAPAKULA CHARAN TEJA	5	13	6	24	5	10	9	24	24
33	21475A0313	GODA SANDEEP	5	12	9	26	5	8	9	22	26
34	21475A0314	MOGILI PRAKASH	5	9	-	14	5	9	7	21	20
35	21475A0315	SHAIK MABU SUBHANI	5	14	8	27	5	A	10	15	25
36	21475A0316	DAGGUPATI VENKATA PRADEEP	5	15	9	29	5	15	8	28	29
37	21475A0317	NAGASURENDRA CHARI UPPALAPATI	A	15	9	24	5	12	9	26	26
38	21475A0318	NALLURI NAVEEN	5	15	8	28	5	12	10	27	28
39	21475A0319	ORCHU VENKATA RAVINDRA	5	12	4	21	3	10	9	22	22
40	21475A0320	NELLURI YASWANTH	5	15	8	28	5	13	10	28	28
41	21475A0321	PENUMALA PAVAN KUMAR	4	13	7	24	A	9	9	18	23
42	21475A0322	BAANANA PRADEEP KUMAR	5	15	8	28	5	13	10	28	28
43	21475A0323	BOJANKI DEMUDU BABU	5	15	8	28	5	12	9	26	28
44	21475A0324	DATTI CHANDU	5	15	8	28	5	12	9	26	28
45	21475A0325	BORUGADDA NITHIN	5	12	8	25	A	10	6	16	24
46	21475A0326	VARIKUTI KARTHIK VENKATA RAM	5	12	7	24	A	A	7	7	21

BRANCH - ME-B			ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (R20ME3101)								
L.NO.	H.T.NO.	STUDENT NAME	A1	D1	Q1	CYCLE-1	A2	D2	Q2	CYCLE-2	TOTAL
47	21475A0327	GOLLA SUNDARA SAMRAJYA SUGNAN	5	15	9	29	5	12	7	24	28
48	21475A0328	CHATTA VENKATRAMAIAH	5	14	9	28	5	6	8	19	27
49	21475A0329	KSHATRIYA JITHENDRA SINGH	5	11	4	20	A	9	9	18	20
50	21475A0330	BOMMALI BALA SIVA YOGENDRA SAI NANDU	5	14	9	28	5	12	9	26	28
51	21475A0331	REVALLA SAI	5	14	8	27	5	10	10	25	27
52	21475A0332	BANDI SRINIVAS	5	11	5	21	4	7	10	21	21
53	21475A0333	GURRAM SIVA GANESH	5	10	8	23	A	9	8	17	22
54	21475A0334	EMANI LEELA SHANKAR	5	12	8	25	A	9	9	18	24
55	21475A0335	KUPPALA SRINU	5	14	7	26	5	11	7	23	26

AME OF THE STAFF MEMBER Dr. D. Jagadish

SIGNATURE OF THE STAFF MEMBER

IGNATURE OF THE HOD

NEC NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

UNIT WISE IMPORTANT QUESTIONS

Unit wise Sample assessment questions

SNO	Course Outcome Statement
CO1	Summarize the characteristics of AI that make it useful to real-world problems. [K2]
CO2	Analyze different search techniques and predicate logic in artificial Intelligence. [K4]
CO3	Interpret knowledge representation and symbolic reasoning using different rules. [K2]
CO4	Apply the basic knowledge on learning and reinforcement learning. [K3]
CO5	Explore different machine learning algorithms [K3]

S NO	QUESTION	KNOWLEDGE LEVEL	CO
	UNIT I		
1	What are the problem characteristics of AI	K2	CO1
2	Write and explain the application fields of AI	K2	CO1
3	Explain the structure of agents and problem solving agents	K2	CO1
	UNIT 2		
1	Explain the concept of problem solving through Search	K3	CO2
2	Explain the BFS algorithm efficiency in problem solving. And Compare with DFS.	K3	CO2
3	Explain A* algorithm with an Example	K3	CO2
	UNIT 3		
1	Illustrate with examples different types of knowledge representation in AI	K2	CO3
2	Clearly differentiate between Procedural knowledge and Declarative knowledge	K3	CO3
3	Explain briefly different data types used in python	K2	CO3
	UNIT 4		
1	What are the different types of Machine Learning	K2	CO4
2	Explain the classification and regression	K2	CO4
3	Discuss the concept of Clustering used in ML	K3	CO4
	UNIT 5		
1	How is KNN different from K-means clustering? Explain	K3	CO5
2	Explain the usage of Logistic Regression, Random Forest, Support Vector Machine methods appropriately to solve predictive models	K3	CO5
3	Discuss how decision tree algorithm is known to work best to detect non-linear interactions	K3	CO5

NEC NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

PREVIOUS QUESTION PAPERS

NEC ENGINEERING COLLEGE
(AUTONOMOUS)

Subject Code: R20ME3101

III B.Tech. - I Semester Regular Examinations, November-2022
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
(ME)

Time: 3 hours **Max. Marks: 70**

Note: Answer All FIVE Questions.
All Questions Carry Equal Marks (5 X 14 =70M)

QNo		Questions	KL	CO	Marks
		Unit-I			
1	a	What is AI? Why AI and what are the advantages of AI?	K2	CO1	7M
		Write the applications of AI and explain with the help of diagram?	K2	CO1	7M
		OR			
	b	Describe the purpose of AI agents and explain the types of AI agents in detail.	K2	CO1	7M
		Explain state space search for defining problem with a suitable example.	K2	CO1	7M
		Unit-II			
2	a	Explain Breadth First Search in brief.	K3	CO1	7M
		Explain the A* search Algorithm with a suitable example.	K3	CO1	7M
		OR			
	b	Describe the Hill climbing algorithm in Artificial Intelligence	K3	CO2	14M
		Unit-III			
3	a	What is knowledge representation? Explain the AI knowledge cycle.	K2	CO3	7M
		What are the requirements for a knowledge representation system?	K2	CO3	7M
		OR			
	b	Explain different functions in Numpy, Pandas and Matplotlib.	K2	CO3	7M
		Describe different Data cleaning and Data reduction techniques.	K2	CO3	7M
		Unit-IV			
4	a	Explain the differences between Supervised Learning and Unsupervised Learning.	K3	CO5	7M
		Describe the following terms with example (a) Classification (b) Regression	K3	CO4	7M
		OR			
	b	What is Density Estimation?	K3	CO4	7M
		Describe the Dimensionality reduction with a suitable example.	K3	CO4	7M
		Unit-V			
5	a	Explain decision tree algorithm with the help of a suitable example?	K3	CO5	7M
		Write the differences between KNN and K Means techniques.	K3	CO5	7M
		OR			
	b	Describe the Random Forest algorithm.	K3	CO5	7M
		Explain Support vector machines (SVM) with suitable examples	K3	CO5	7M

KL: Blooms Taxonomy Knowledge Level CO: Course Outcome M:Marks

AI&ML Key

R20ME3101

Nov.2022

1.a What is AI? Why AI and What are the advantages of AI?

Or

Write the applications of AI with examples

Artificial intelligence is bringing many changes in human life and is applicable in various fields. Artificial Intelligence strives to create machines and technologies that can imitate human behaviour and the mind's ability to learn and solve problems. It has brought about a revolution in the world of technologies and its impacts and its applications for solving complex problems.

The applications of AI are vast and can be used across various industries. The popular applications of AI are in the field of Healthcare, Agriculture, Robotics, Web Applications, Finance, Oil and Gas Industry, Chatbots, etc. the sections below will discuss various applications of artificial intelligence in various sectors.

Applications of AI in Healthcare

The health care sector is bringing about the changes in the treatment, development of medicines, and more with the applications of AI. AI used machine learning algorithms, and other related technologies for medical diagnosis purposes. Here are some applications of AI in Healthcare.

Analysis & acting on medical datas for predicting a particular outcome	In medical diagnosis purposes
Help doctors & medical providers deliver a more appropriate diagnosis and treatment plans	Uses Big Data and analyses them for improving preventive care recommendations
Track, record & forecast the spread of various diseases	Helps in drug discovery
Developing more effective medicines	Cost management of various healthcare services

AI Applications in Agriculture

AI can help farmers in providing real time insights from the field for different requirements such as irrigation, fertilisation, pesticide treatment, growth of crops, etc and more. Artificial Intelligence technologies can help in producing healthier crops, control pests, monitor soil,

and increase the yield of crops. Tabulated below are some of the applications of AI in agriculture.

Crop and soil monitoring	Insect and plant disease detection
Livestock health monitoring	Intelligent spraying
Automatic weeding	Aerial survey and imaging
Produce grading and sorting	Improve overall harvest quality and accuracy

AI Applications to Robotics

Artificial intelligence can improve a robot's visuals and accuracy of image recognition. It can help a robot do a wide range of tasks, such as navigate their surroundings, identify objects around the robot, assist humans with bricklaying, installing drywall and robotic-assisted surgeries. Here are some of the applications of AI in Robotics.

Computer vision & Imaging	AI-enabled manipulation & grasping
AI-enhanced navigation & motion control	Real-world perception & natural language processing
Machine Learning Applications	Customer Service

AI Web Applications

AI can be used for various web design purposes including web design and development. It can help provide faster searches, relevant customer interaction and experiences, effective digital marketing, better interactions with the website visitors even better and more. Check out the applications of AI in Web Applications.

1.b.

Describe the purpose of AI agents and explain the types of AI agents in detail

Ans:

AGENT

Introduction

An AI system is composed of an agent and its environment. The agents act in their environment. The environment may contain other agents.

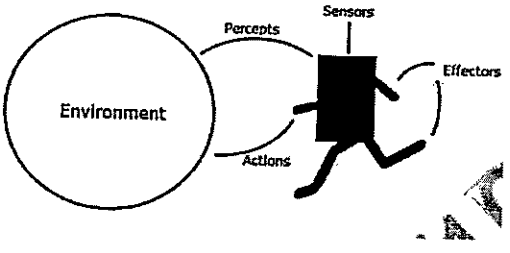
An **agent** is anything that can perceive its **environment** through **sensors** and acts upon that environment through **actuators.**

Sensor: Sensor is a device which detects the change in the environment and sends the information to other electronic devices. An agent observes its environment through sensors.

Actuators: Actuators are the component of machines that converts energy into motion. The actuators are only responsible for moving and controlling a system. An actuator can be an electric motor, gears, rails, etc.

Effectors: Effectors are the devices which affect the environment. Effectors can be legs, wheels, arms, fingers, wings, fins, and display screen.

- A **human agent** has sensory organs such as eyes, ears, nose, tongue and skin parallel to the sensors, and other organs such as hands, legs, mouth, for effectors.
- A **robotic agent** replaces cameras and infrared range finders for the sensors, and various motors and actuators for effectors.
- A **software** agent has encoded bit strings as its programs and actions.

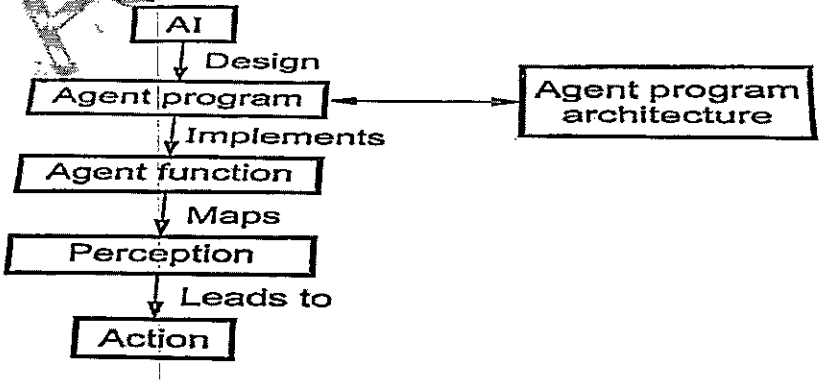


Agent Terminology

- **Performance Measure of Agent** – It is the criteria, which determines how successful an agent is.
- **Behavior of Agent** – It is the action that agent performs after any given sequence of percepts.
- **Percept** – It is agent's perceptual inputs at a given instance.
- **Percept Sequence** – It is the history of all that an agent has perceived till date.
- **Agent Function** – It is a map from the precept sequence to an action.

AI Agent Action Process:

Following diagram illustrated the agent action process, a specified by architecture.



Agents can be grouped into five classes based on their degree of perceived intelligence and capability :

- Simple Reflex Agents.
- Model-Based Reflex Agents.
- Goal-Based Agents.
- Utility-Based Agents.
- Learning Agent.

1.b. Define state space search for defining problem with suitable example

State space search is a process used in the field of computer science, including artificial intelligence (AI), in which successive configurations or *states* of an instance are considered, with the intention of finding a *goal state* with the desired property.

Problems are often modelled as a state space, a set of *states* that a problem can be in. The set of states forms a graph where two states are connected if there is an *operation* that can be performed to transform the first state into the second.

State space search often differs from traditional computer science search methods because the state space is *implicit*: the typical state space graph is much too large to generate and store in memory. Instead, nodes are generated as they are explored, and typically discarded thereafter. A solution to a combinatorial search instance may consist of the goal state itself, or of a path from some *initial state* to the goal state.

Representation

In state space search, a state space is formally represented as a tuple , in which:

- is the set of all possible states;
- is the set of possible actions, not related to a particular state but regarding all the state space;
- is the function that establish which action is possible to perform in a certain state;
- is the function that returns the state reached performing action in state
- is the cost of performing an action in state . In many state spaces is a constant, but this is not true in general.

2.a. Explain breadth first search in brief

Ans:

Defining the problem as State Space Search:
The state space representation forms the basis of most of the AI methods.
• Formulate a problem as a state space search by showing the legal problem states, the legal operators, and
the initial and goal states.
• A state is defined by the specification of the values of all attributes of interest in the world
• An operator changes one state into the other; it has a precondition which is the value of certain attributes
prior to the application of the operator, and a set of effects, which are the attributes altered by the operator
• The initial state is where you start
• The goal state is the partial description of the solution

Breadth- First -Search:

Consider the state space of a problem that takes the form of a tree. Now, if we search the goal along each breadth
of the tree, starting from the root and continuing up to the largest depth, we call it breadth first search.
• Algorithm:

1. Create a variable called NODE-LIST and set it to initial state
2. Until a goal state is found or NODE-LIST is empty do
a. Remove the first element from NODE-LIST and call it E. If NODE-LIST was empty, quit
b. For each way that each rule can match the state described in E do:
i. Apply the rule to generate a new state
ii. If the new state is a goal state, quit and return this state
iii. Otherwise, add the new state to the end of NODE-LIST

BFS illustrated:

Step 1: Initially fringe contains only one node corresponding to the source state A.

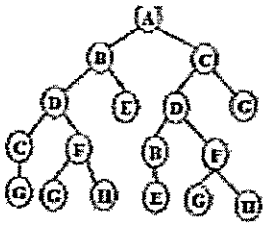


Figure 1

FRINGE: A

Step 2: A is removed from fringe. The node is expanded, and its children B and C are generated. They are p at the back of fringe.

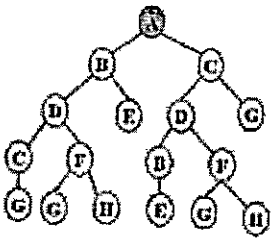


Figure 2

FRINGE: B C

Step 3: Node B is removed from fringe and is expanded. Its children D, E are generated and put at the ba fringe.

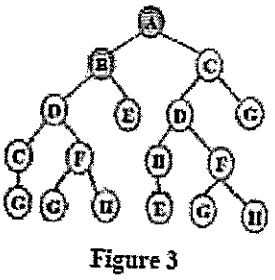


Figure 3

FRINGE: C D E

Step 4: Node C is removed from fringe and is expanded. Its children D and G are added to the back of fringe.

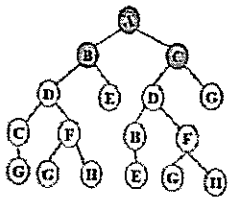


Figure 4

FRINGE: D E D G

Step 5: Node D is removed from fringe. Its children C and F are generated and added to the back of fringe.

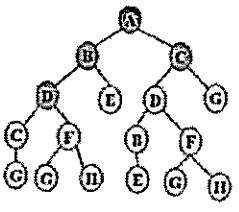


Figure 5

FRINGE: E D G C F

Step 6: Node E is removed from fringe. It has no children.

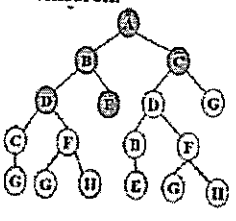


Figure 6

FRINGE: D G C F

Step 7: D is expanded; B and F are put in OPEN.

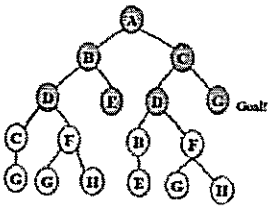


Figure 7

FRINGE: G C F B F

Step 8: G is selected for expansion. It is found to be a goal node. So the algorithm returns the path A C G by following the parent pointers of the node corresponding to G. The algorithm terminates.

Breadth first search is:

- One of the simplest search strategies
- Complete. If there is a solution, BFS is guaranteed to find it.
- if there are multiple solutions, then a minimal solution will be found
- the algorithm is optimal (i.e., admissible) if all operators have the same cost. Otherwise, breadth first search finds a solution with the shortest path length.
- **Time complexity** : $O(b^d)$
- **Space complexity** : $O(b^d)$
- **Optimality** :Yes

b - branching factor(maximum no of successors of any node),
d – Depth of the shallowest goal node
Maximum length of any path (m) in search space

2.a. Explain A* Search algorithm with suitable example

A* Algorithm

The Best First algorithm is a simplified form of the *A** algorithm.
The **A* search algorithm** (pronounced "Ay-star") is a tree search algorithm that finds a path from a given initial node to a given goal node (or one passing a given goal test). It employs a "heuristic estimate" which ranks each node by an estimate of the best route that goes through that node. It visits the nodes in order of this heuristic estimate.
Similar to greedy best-first search but is more accurate because A* takes into account the nodes that have already been traversed.
From *A** we note that $f = g + h$ where
g is a measure of the distance/cost to go from the initial node to the current node
h is an estimate of the distance/cost to solution from the current node.
Thus f is an estimate of how long it takes to go from the initial node to the solution

A* begins at a selected node. Applied to this node is the "cost" of entering this node (usually zero for the initial node). A* then estimates the distance to the goal node from the current node. This estimate and the cost added together are the heuristic which is assigned to the path leading to this node. The node is then added to a priority queue, often called "open".

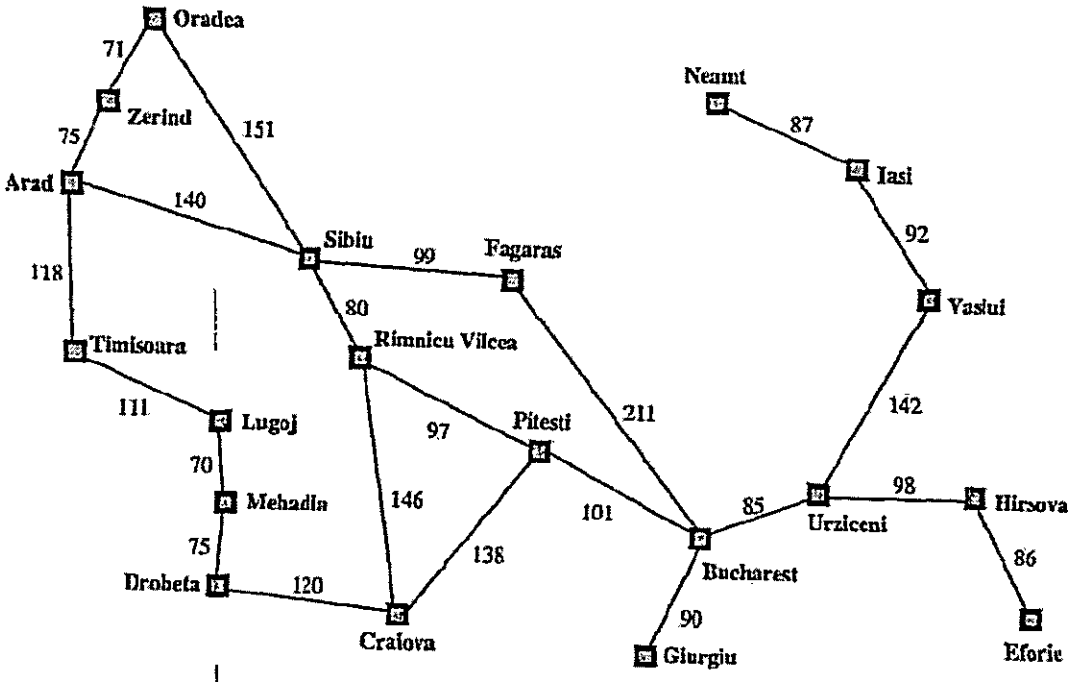
A* search properties:

- The algorithm A* is admissible. This means that provided a solution exists, the first solution found by A* is an optimal solution. A* is admissible under the following conditions:
- Heuristic function: for every node n , $h(n) \leq h^*(n)$.
- A* is also complete.
- A* is optimally efficient for a given heuristic.
- A* is much more efficient that uninformed search.

Example of A* Problem Solution:

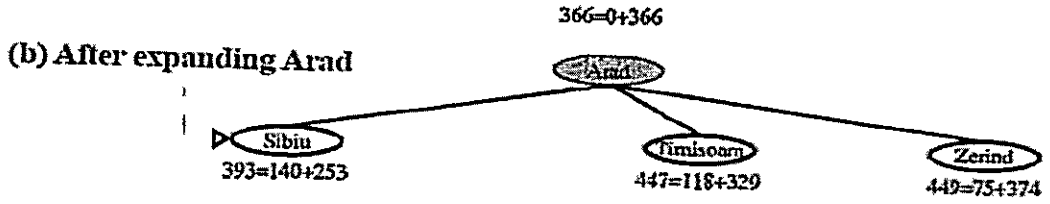
The heuristic costs from each city to Bucharest:

Arad	366	Mehadia	241
Bucharest	0	Neamt	234
Craiova	160	Oradea	380
Drobeta	242	Pitesti	100
Eforie	161	Rimnicu Vilcea	193
Fagaras	176	Sibiu	253
Giurgiu	77	Timisoara	329
Hirsova	151	Urziceni	80
Iasi	226	Vaslui	199
Lugoj	244	Zerind	374

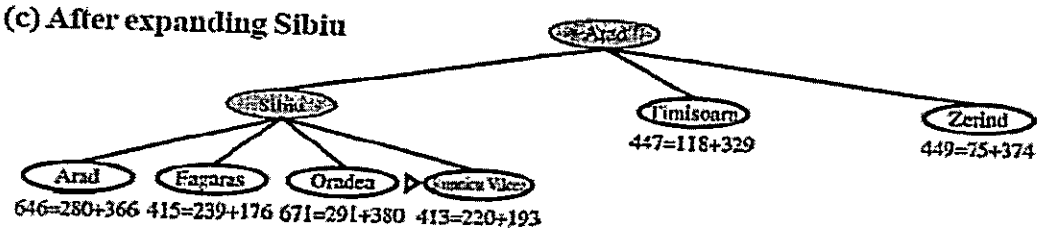


(a) The initial state

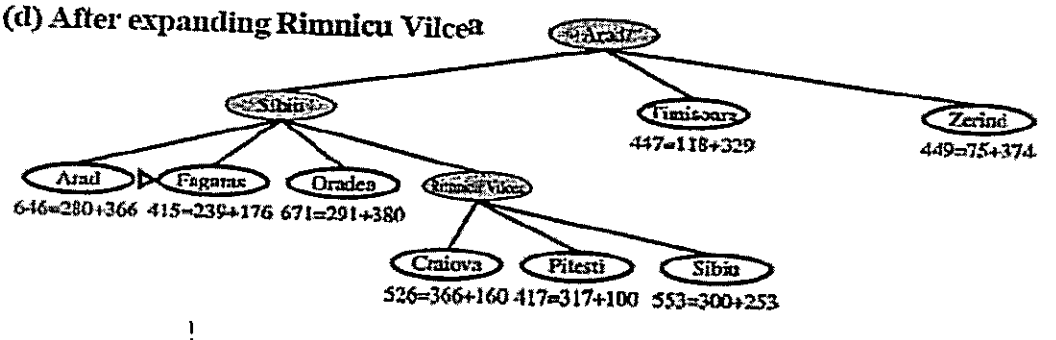
(b) After expanding Arad



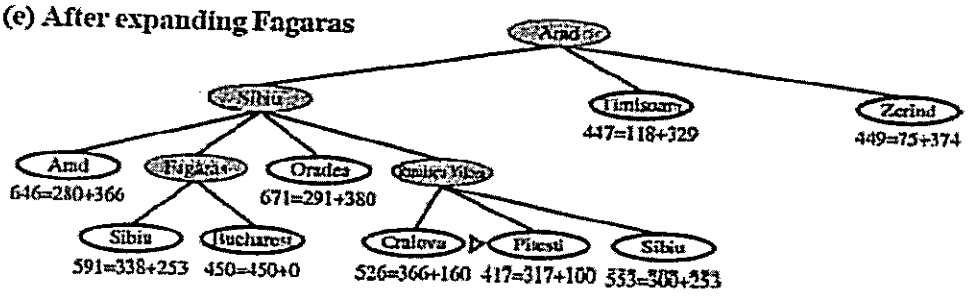
(c) After expanding Sibiu



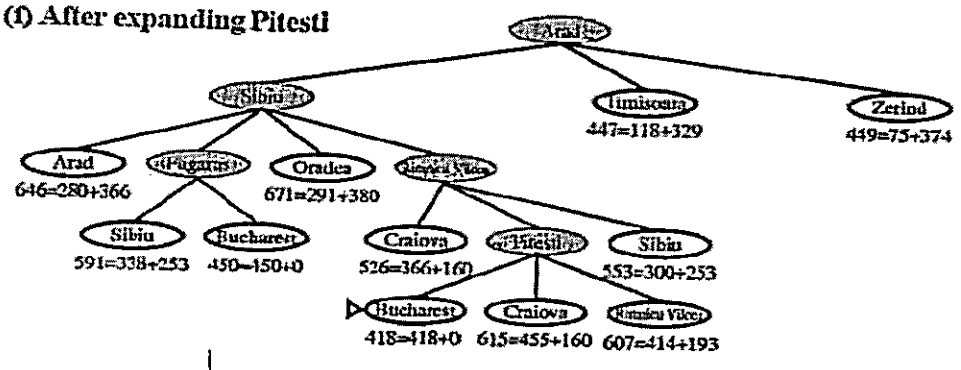
(d) After expanding Rimnicu Vilcea



(e) After expanding Fagaras



(f) After expanding Pitesti



2.b.

Types of Hill Climbing Algorithm:

- Simple hill Climbing:
- Steepest-Ascent hill-climbing:
- Stochastic hill Climbing:

1. Simple Hill Climbing:

Simple hill climbing is the simplest way to implement a hill climbing algorithm. **It only evaluates the neighbor node state at a time and selects the first one which optimizes current cost and set it as a current state.** It only checks it's one successor state, and if it finds better than the current state, then move else be in the same state. This algorithm has the following features:

- Less time consuming
- Less optimal solution and the solution is not guaranteed

Algorithm for Simple Hill Climbing:

- **Step 1:** Evaluate the initial state, if it is goal state then return success and Stop.
- **Step 2:** Loop Until a solution is found or there is no new operator left to apply.
- **Step 3:** Select and apply an operator to the current state.
- **Step 4:** Check new state:
    1. If it is goal state, then return success and quit.
    2. Else if it is better than the current state then assign new state as a current state.
    3. Else if not better than the current state, then return to step2.
- **Step 5:** Exit.

2. Steepest-Ascent hill climbing:

The steepest-Ascent algorithm is a variation of simple hill climbing algorithm. This algorithm examines all the neighboring nodes of the current state and selects one neighbor node which is closest to the goal state. This algorithm consumes more time as it searches for multiple neighbors

Algorithm for Steepest-Ascent hill climbing:

- **Step 1:** Evaluate the initial state, if it is goal state then return success and stop, else make current state as initial state.
- **Step 2:** Loop until a solution is found or the current state does not change.
    1. Let SUCC be a state such that any successor of the current state will be better than it.
    2. For each operator that applies to the current state:
        I. Apply the new operator and generate a new state.
        II. Evaluate the new state.
        III. If it is goal state, then return it and quit, else compare it to the SUCC.
        IV. If it is better than SUCC, then set new state as SUCC.
        V. If the SUCC is better than the current state, then set current state to SUCC.

- **Step 5:** Exit.

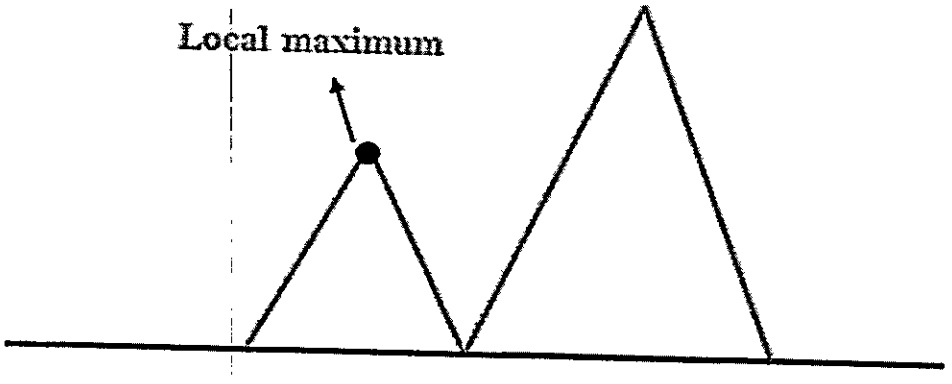
3. Stochastic hill climbing:

Stochastic hill climbing does not examine for all its neighbor before moving. Rather, this search algorithm selects one neighbor node at random and decides whether to choose it as a current state or examine another state.

Problems in Hill Climbing Algorithm:

1. Local Maximum: A local maximum is a peak state in the landscape which is better than each of its neighboring states, but there is another state also present which is higher than the local maximum.

Solution: Backtracking technique can be a solution of the local maximum in state space landscape. Create a list of the promising path so that the algorithm can backtrack the search space and explore other paths as well.



2. Plateau: A plateau is the flat area of the search space in which all the neighbor states of the current state contains the same value, because of this algorithm does not find any best direction to move. A hill-climbing search might be lost in the plateau area.

Solution: The solution for the plateau is to take big steps or very little steps while searching, to solve the problem. Randomly select a state which is far away from the current state so it is possible that the algorithm could find non-plateau region.

3.a.b

Knowledge representation in AI

Knowledge Representation in AI describes the representation of knowledge. Basically, it is a study of how the **beliefs, intentions,** and **judgments** of an **intelligent agent** can be expressed suitably for automated reasoning. One of the primary purposes of Knowledge Representation includes modeling intelligent behavior for an agent.

Knowledge Representation and Reasoning (**KR, KRR**) represents information from the real world for a computer to understand and then utilize this knowledge to solve **complex real-**

life problems like communicating with human beings in natural language. Knowledge representation in AI is not just about storing data in a database, it allows a machine to learn from that knowledge and behave intelligently like a human being.

The different kinds of knowledge that need to be represented in AI include:

- **Objects**
- **Events**
- **Performance**
- **Facts**
- **Meta-Knowledge**
- **Knowledge-base**

Different Types of Knowledge

There are 5 types of Knowledge such as:

- **Declarative Knowledge** – It includes concepts, facts, and objects and expressed in a declarative sentence.
- **Structural Knowledge** – It is a basic problem-solving knowledge that describes the relationship between concepts and objects.
- **Procedural Knowledge** – This is responsible for knowing how to do something and includes rules, strategies, procedures, etc.
- **Meta Knowledge** – Meta Knowledge defines knowledge about other types of Knowledge.
- **Heuristic Knowledge** – This represents some expert knowledge in the field or subject.

These are the important types of Knowledge Representation in AI. Now, let's have a look at the cycle of knowledge representation and how it works.

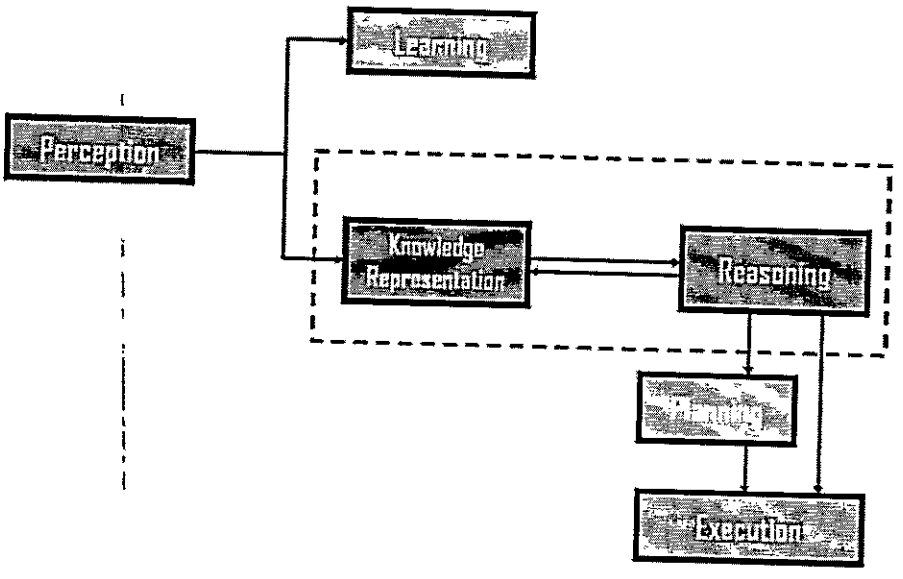
Cycle of Knowledge Representation in AI

Artificial Intelligent Systems usually consist of various components to display their intelligent behaviour. Some of these components include:

- **Perception**
- **Learning**
- **Knowledge Representation & Reasoning**
- **Planning**
- **Execution**

Here is an example to show the different components of the system and how it works:

Example



Knowledge Representation Requirement:

A good knowledge representation system must have properties such as: Representational Accuracy: It should represent all kinds of required knowledge. Inferential Adequacy: It should be able to manipulate the representational structures to produce new knowledge corresponding to the existing structure.

3.b.

Numpys and Pandas

A panda is defined as an open-source library that provides high-performance data manipulation in Python. It is built on top of the NumPy package, which means **Numpy** is required for operating the Pandas. The name of Pandas is derived from the word **Panel Data**, which means **an Econometrics from Multidimensional data.**

NumPy is mostly written in C language, and it is an extension module of Python. It is defined as a Python package used for performing the various numerical computations and processing of the multidimensional and single-dimensional array elements. The calculations using Numpy arrays are faster than the normal Python array.

3.b.

Steps of Data Cleaning

While the techniques used for data cleaning may vary according to the types of data your company stores, you can follow these basic steps to cleaning your data, such as:

1. Remove duplicate or irrelevant observations

Remove unwanted observations from your dataset, including duplicate observations or irrelevant observations. Duplicate observations will happen most often during data collection. When you combine data sets from multiple places, scrape data, or receive data from clients or multiple departments, there are opportunities to create duplicate data. De-duplication is one of the largest areas to be considered in this process. Irrelevant observations are when you notice observations that do not fit into the specific problem you are trying to analyze.

For example, if you want to analyze data regarding millennial customers, but your dataset includes older generations, you might remove those irrelevant observations. This can make analysis more efficient, minimize distraction from your primary target, and create a more manageable and performable dataset.

2. Fix structural errors

Structural errors are when you measure or transfer data and notice strange naming conventions, typos, or incorrect capitalization. These inconsistencies can cause mislabeled categories or classes. For example, you may find "N/A" and "Not Applicable" in any sheet, but they should be analyzed in the same category.

3. Filter unwanted outliers

Often, there will be one-off observations where, at a glance, they do not appear to fit within the data you are analyzing. If you have a legitimate reason to remove an outlier, like improper data entry, doing so will help the performance of the data you are working with.

However, sometimes, the appearance of an outlier will prove a theory you are working on. And just because an outlier exists doesn't mean it is incorrect. This step is needed to determine the validity of that number. If an outlier proves to be irrelevant for analysis or is a mistake, consider removing it.

4. Handle missing data

You can't ignore missing data because many algorithms will not accept missing values. There are a couple of ways to deal with missing data. Neither is optimal, but both can be considered, such as:

- You can drop observations with missing values, but this will drop or lose information, so be careful before removing it.
- You can input missing values based on other observations; again, there is an opportunity to lose the integrity of the data because you may be operating from assumptions and not actual observations.
- You might alter how the data is used to navigate null values effectively.

Data Reduction:

Data reduction is **the process of reducing the amount of capacity required to store data.** Data reduction can increase storage efficiency and reduce costs. Storage vendors will often describe storage capacity in terms of raw capacity and effective capacity, which refers to data after the reduction.

4.a.

Classical machine learning is often categorized by how an algorithm learns to become more accurate in its predictions. There are four basic approaches: supervised learning, unsupervised learning, semi-supervised learning and reinforcement learning. The type of algorithm data scientists choose to use depends on what type of data they want to predict.

- **Supervised learning:** In this type of machine learning, data scientists supply algorithms with labelled training data and define the variables they want the algorithm to assess for correlations. Both the input and the output of the algorithm is specified.
- **Unsupervised learning:** This type of machine learning involves algorithms that train on unlabeled data. The algorithm scans through data sets looking for any meaningful connection. The data that algorithms train on as well as the predictions or recommendations they output are predetermined.
- **Semi-supervised learning:** This approach to machine learning involves a mix of the two preceding types. Data scientists may feed an algorithm mostly labeled training data, but the model is free to explore the data on its own and develop its own understanding of the data set.
- **Reinforcement learning:** Data scientists typically use reinforcement learning to teach a machine to complete a multi-step process for which there are clearly defined rules. Data scientists program an algorithm to complete a task and give it positive or negative cues as it works out how to complete a task. But for the most part, the algorithm decides on its own what steps to take along the way.

Supervised machine learning:

Supervised machine learning requires training the algorithm with both labeled inputs and desired outputs. Supervised learning algorithms are good for the following tasks:

- **Binary classification:** Dividing data into two categories.
- **Multi-class classification:** Choosing between more than two types of answers.
- **Regression modeling:** Predicting continuous values.
- **Ensembling:** Combining the predictions of multiple machine learning models to produce an accurate prediction.

Unsupervised machine learning:

Unsupervised machine learning algorithms do not require data to be labelled. They sift through unlabeled data to look for patterns that can be used to group data points into subsets. Most types of deep learning, including neural networks, are unsupervised algorithms. Unsupervised learning algorithms are good for the following tasks:

- **Clustering:** Splitting the dataset into groups based on similarity.
- **Anomaly detection:** Identifying unusual data points in a data set.

- **Association mining:** Identifying sets of items in a data set that frequently occur together.
- **Dimensionality reduction:** Reducing the number of variables in a data set.

4.a.

The Classification algorithm is a Supervised Learning technique that is used to identify the category of new observations on the basis of training data. In Classification, a program learns from the given dataset or observations and then classifies new observation into a number of classes or groups. Such as, **Yes or No, 0 or 1, Spam or Not Spam, pig or dog,** etc. Classes can be called as targets/labels or categories.

Unlike regression, the output variable of Classification is a category, not a value, such as "Green or Blue", "fruit or animal", etc. Since the Classification algorithm is a supervised learning technique, hence it takes labelled input data, which means it contains input with the corresponding output.

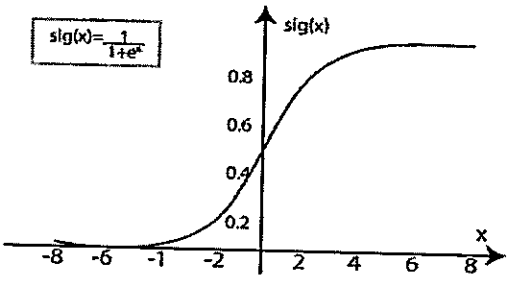
Logistic regression is another supervised learning algorithm which is used to solve the classification problems. In classification problems, we have dependent variables in a binary or discrete format such as 0 or 1.

- Logistic regression algorithm works with the categorical variable such as 0 or 1, Yes or No, True or False, Spam or not spam, etc.
- It is a predictive analysis algorithm which works on the concept of probability.
- Logistic regression is a type of regression, but it is different from the linear regression algorithm in the term how they are used.
- Logistic regression uses sigmoid function or logistic function which is a complex cost function. This sigmoid function is used to model the data in logistic regression. The function can be represented as:

$$f(x)=\frac{1}{1+e^{-x}}$$

f(x)= Output between the 0 and 1 value.
x= input to the function
e= base of natural logarithm

When we provide the input values (data) to the function, it gives the S-curve as follows:



It uses the concept of threshold levels, values above the threshold level are rounded up to 1, and values below the threshold level are rounded up to 0.

There are three types of logistic regression:
o Binary(0/1, pass/fail)
o Multi(bears, dogs, lions)
o Ordinal(low, medium, high)

4b.

Density Estimation: It is the process of finding out the density of the whole population by examining a random sample of data from that population. One of the best ways to achieve a density estimate is by using a histogram plot.

Parametric Density Estimation

A normal distribution has two given parameters, mean and standard deviation. We calculate the sample mean and standard deviation of the random sample taken from this population to estimate the density of the random sample. The reason it is termed as *'parametric'* is due to the fact that the relation between the observations and its probability can be different based on the values of the two parameters.

What is Dimensionality Reduction?

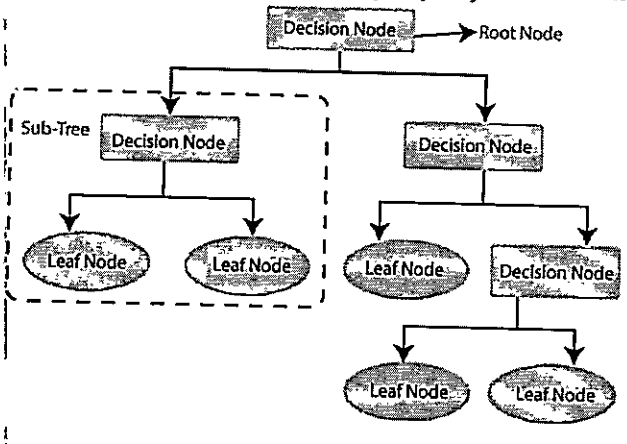
In machine learning classification problems, there are often too many factors on the basis of which the final classification is done. These factors are basically variables called features. The higher the number of features, the harder it gets to visualize the training set and then work on it. Sometimes, most of these features are correlated, and hence redundant. This is where dimensionality reduction algorithms come into play. Dimensionality reduction is the process of reducing the number of random variables under consideration, by obtaining a set of principal variables. It can be divided into feature selection and feature extraction.

5.a.

- Decision Tree is a **supervised learning technique** that can be used for both classification and Regression problems, but mostly it is preferred for solving Classification problems. It is a tree-structured classifier, where **internal nodes represent the features of a dataset, branches represent the decision rules** and **each leaf node represents the outcome.**
- In a Decision tree, there are two nodes, which are the **Decision Node** and **Leaf Node.** Decision nodes are used to make any decision and have multiple branches, whereas Leaf nodes are the output of those decisions and do not contain any further branches.

- The decisions or the test are performed on the basis of features of the given dataset.
- ***It is a graphical representation for getting all the possible solutions to a problem/decision based on given conditions.***
- It is called a decision tree because, similar to a tree, it starts with the root node, which expands on further branches and constructs a tree-like structure.
- In order to build a tree, we use the **CART algorithm,** which stands for **Classification and Regression Tree algorithm.**
- A decision tree simply asks a question, and based on the answer (Yes/No), it further split the tree into subtrees.
- Below diagram explains the general structure of a decision tree:

Note: A decision tree can contain categorical data (YES/NO) as well as numeric data.



Use of Decision Tree:

There are various algorithms in Machine learning, so choosing the best algorithm for the given dataset and problem is the main point to remember while creating a machine learning model. Below are the two reasons for using the Decision tree:

- Decision Trees usually mimic human thinking ability while making a decision, so it is easy to understand.
- The logic behind the decision tree can be easily understood because it shows a tree-like structure.

Decision Tree Terminologies

Root Node: Root node is from where the decision tree starts. It represents the entire dataset, which further gets divided into two or more homogeneous sets.

Leaf Node: Leaf nodes are the final output node, and the tree cannot be segregated further after getting a leaf node.

Splitting: Splitting is the process of dividing the decision node/root node into sub-nodes according to the given conditions.

Branch/Sub Tree: A tree formed by splitting the tree.

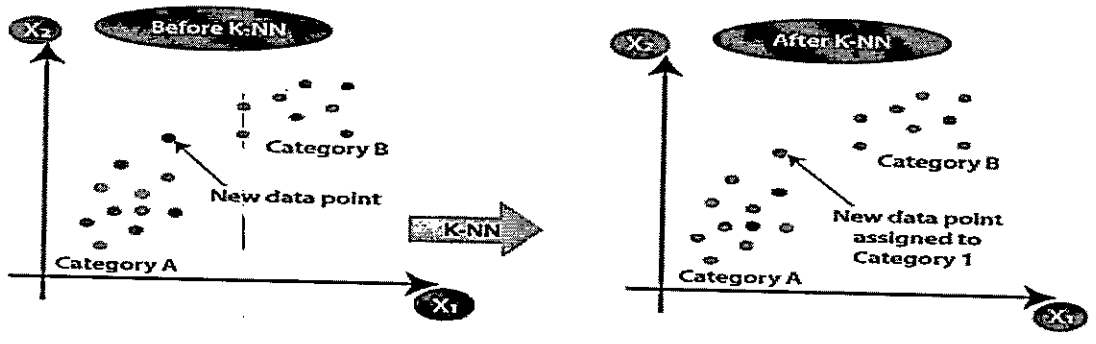
Pruning: Pruning is the process of removing the unwanted branches from the tree.

Parent/Child node: The root node of the tree is called the parent node, and other nodes are called the child nodes.

5.a.

- K-Nearest Neighbour is one of the simplest Machine Learning algorithms based on Supervised Learning technique.
- K-NN algorithm assumes the similarity between the new case/data and available cases and put the new case into the category that is most similar to the available categories.
- K-NN algorithm stores all the available data and classifies a new data point based on the similarity. This means when new data appears then it can be easily classified into a well suite category by using K- NN algorithm.
- K-NN algorithm can be used for Regression as well as for Classification but mostly it is used for the Classification problems.
- K-NN is a **non-parametric algorithm**, which means it does not make any assumption on underlying data.
- It is also called a **lazy learner algorithm** because it does not learn from the training set immediately instead it stores the dataset and at the time of classification, it performs an action on the dataset.
- KNN algorithm at the training phase just stores the dataset and when it gets new data, then it classifies that data into a category that is much similar to the new data.

Suppose there are two categories, i.e., Category A and Category B, and we have a new data point x1, so this data point will lie in which of these categories. To solve this type of problem, we need a K-NN algorithm. With the help of K-NN, we can easily identify the category or class of a particular dataset. Consider the below diagram:

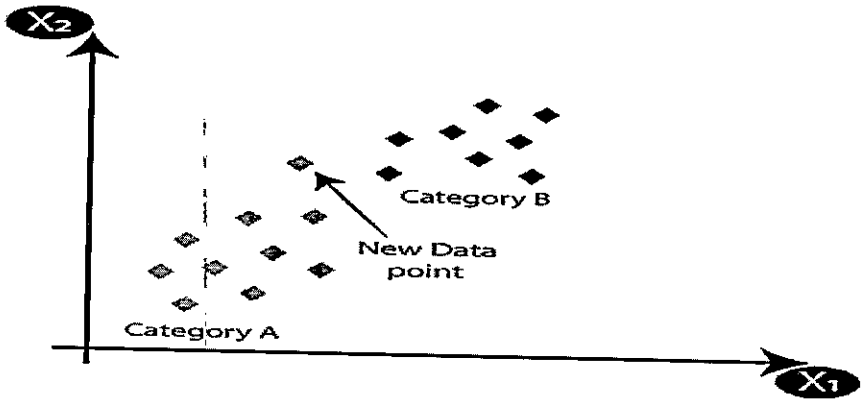


How does K-NN work?

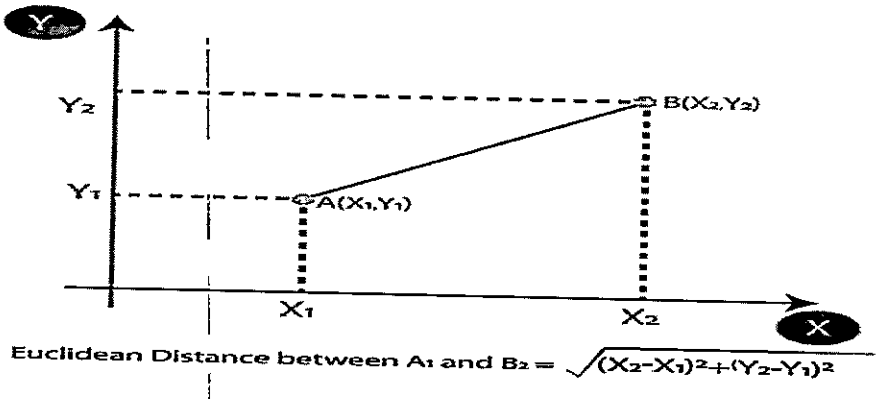
The K-NN working can be explained on the basis of the below algorithm:

- **Step-1:** Select the number K of the neighbours
- **Step-2:** Calculate the Euclidean distance of **K number of neighbors**
- **Step-3:** Take the K nearest neighbors as per the calculated Euclidean distance.
- **Step-4:** Among these k neighbors, count the number of the data points in each category.
- **Step-5:** Assign the new data points to that category for which the number of the neighbor is maximum.
- **Step-6:** Our model is ready.

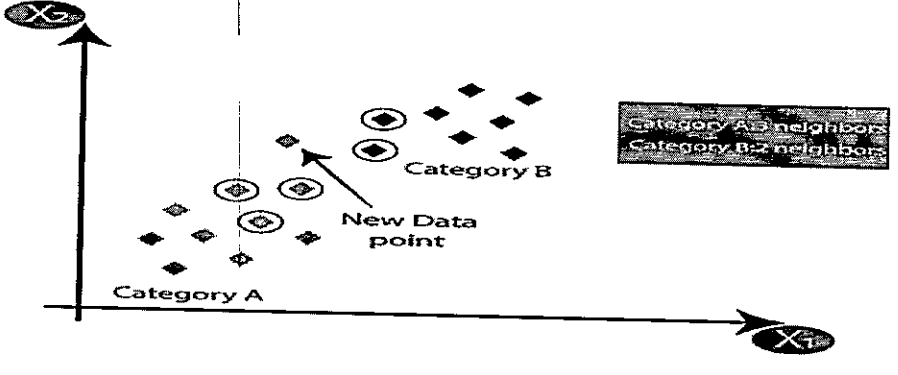
Suppose we have a new data point and we need to put it in the required category. Consider the below image:



- Firstly, we will choose the number of neighbors, so we will choose the k=5.
- Next, we will calculate the **Euclidean distance** between the data points. The Euclidean distance is the distance between two points, which we have already studied in geometry. It can be calculated as:



- By calculating the Euclidean distance we got the nearest neighbors, as three nearest neighbors in category A and two nearest neighbors in category B. Consider the below image:



- As we can see the 3 nearest neighbours are from category A, hence this new data point must belong to category A.

How to select the value of K in the K-NN Algorithm?

Below are some points to remember while selecting the value of K in the K-NN algorithm:

- There is no particular way to determine the best value for "K", so we need to try some values to find the best out of them. The most preferred value for K is 5.
- A very low value for K such as K=1 or K=2, can be noisy and lead to the effects of outliers in the model.
- Large values for K are good, but it may find some difficulties.

Advantages of KNN Algorithm:

- It is simple to implement.
- It is robust to the noisy training data
- It can be more effective if the training data is large.

Disadvantages of KNN Algorithm:

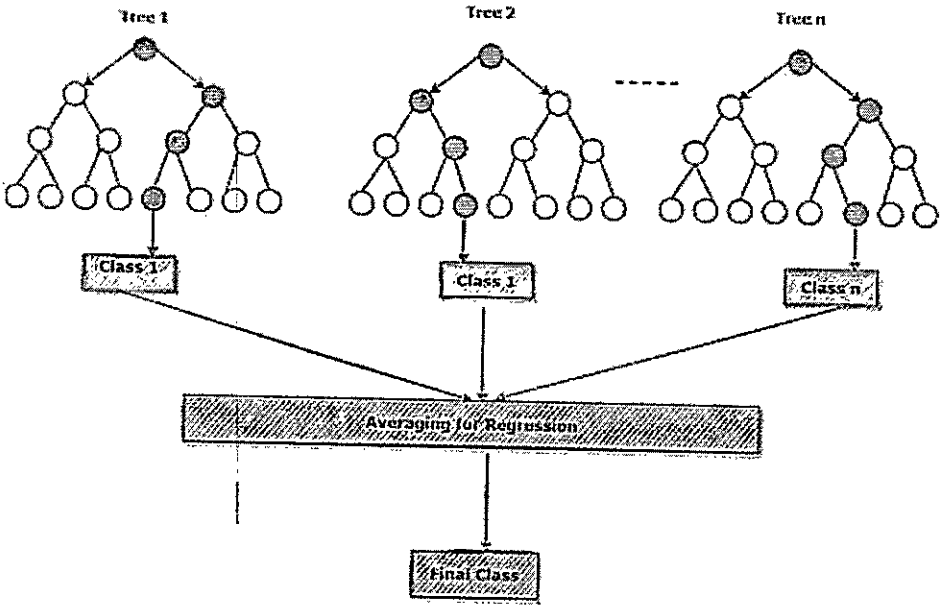
- Always needs to determine the value of K which may be complex some time.
- The computation cost is high because of calculating the distance between the data points for all the training samples.

5.b.

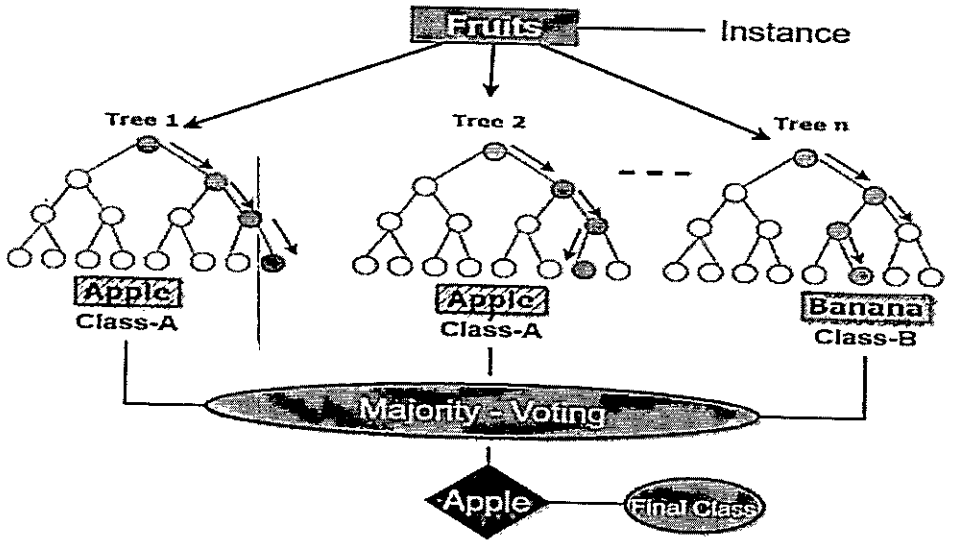
Working of the Random Forest Algorithm is quite intuitive. It is implemented in two phases: The first is to combine N decision trees with building the random forest, and the second is to make predictions for each tree created in the first phase.

The following steps can be used to demonstrate the working process:

Step 1: Pick M data points at random from the training set.
Step 2: Create decision trees for your chosen data points (Subsets).
Step 3: Each decision tree will produce a result. Analyze it.
Step 4: For classification and regression, accordingly, the final output is based on Majority Voting or Averaging, accordingly.
The flowchart below will help you understand better:



Example - Consider the following scenario: a dataset containing several fruits images. And the Random Forest Classifier is given this dataset. Each decision tree is given a subset of the dataset to work with. During the training phase, each decision tree generates a prediction result. The Random Forest classifier predicts the final decision based on most outcomes when a new data point appears.



Although a random forest is a collection of decision trees, its behavior differs significantly.

We will differentiate Random Forest from Decision Trees based on 3 Important parameters: Overfitting, Speed, and Process.

1. **Overfitting** - Overfitting is not there as in Decision trees since random forests are formed from subsets of data, and the final output is based on average or majority rating.
2. **Speed** - Random Forest Algorithm is relatively slower than Decision Trees.

3. **Process** - Random forest collects data at random, forms a decision tree, and averages the results. It does not rely on any formulas as in Decision trees.

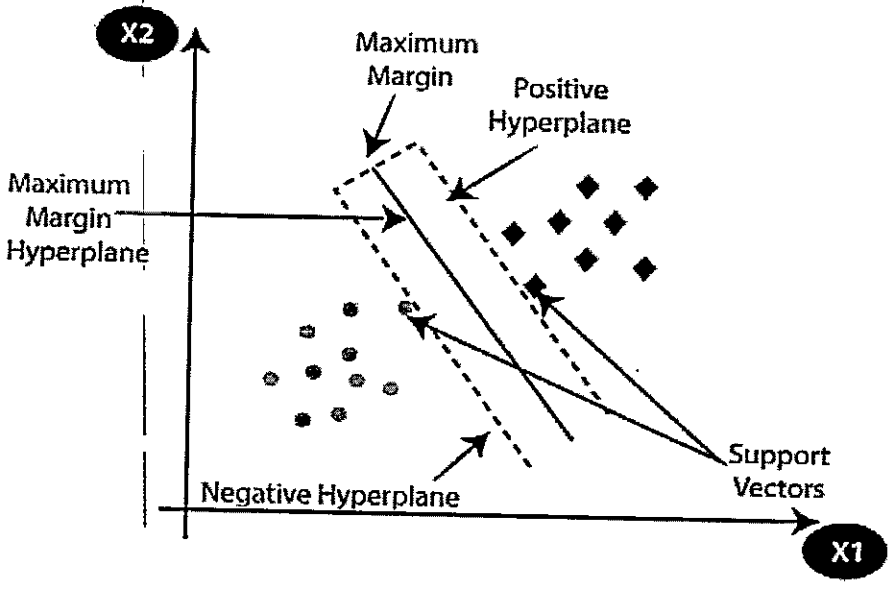
Applications cases of Random Forest Algorithm

The Random Forest Algorithm is most usually applied in the following four sectors:

- **Banking:** It is mainly used in the banking industry to identify loan risk.
- **Medicine:** To identify illness trends and risks.
- **Land Use:** Random Forest Classifier is also used to classify places with similar land-use patterns.
- **Market Trends:** You can determine market trends using this algorithm.

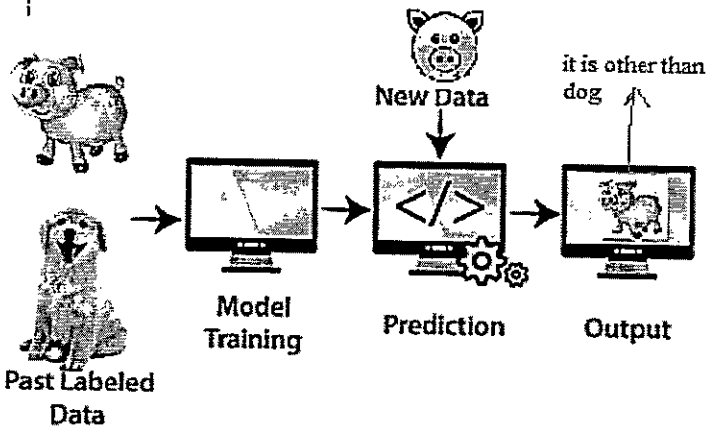
5.b. SVM

Support Vector Machine or SVM is one of the most popular Supervised Learning algorithms, which is used for Classification as well as Regression problems. However, primarily, it is used for Classification problems in Machine Learning. The goal of the SVM algorithm is to create the best line or decision boundary that can segregate n-dimensional space into classes so that we can easily put the new data point in the correct category in the future. This best decision boundary is called a hyperplane. SVM chooses the extreme points/vectors that help in creating the hyperplane. These extreme cases are called as support vectors, and hence algorithm is termed as Support Vector Machine. Consider the below diagram in which there are two different categories that are classified using a decision boundary or hyperplane:



Example: Suppose we see a strange animal that also has some features of dogs, so if we want a model that can accurately identify whether it is a dog, so such a model can be created by using the SVM algorithm. We will first train our model with lots of images of dogs and other animals and then we test it with this strange creature. So as support vector creates a decision boundary between these two data (bull and dog) and choose extreme cases (support vectors),

it will see the extreme case of an animal and dog. On the basis of the support vectors, it will classify it as identified. Consider the below diagram:

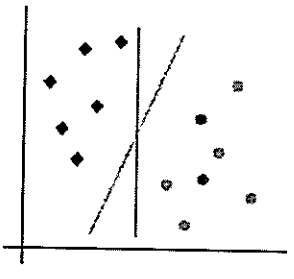


SVM algorithm can be used for Face detection, image classification, text categorization, etc.

Types of SVM

Linear SVM: Linear SVM is used for linearly separable data, which means if a dataset can be classified into two classes by using a single straight line, then such data is termed as linearly separable data, and classifier is used called as Linear SVM classifier.

The working of the SVM algorithm can be understood by using an example. Suppose we have a dataset that has two tags (green and blue), and the dataset has two features x1 and x2. We want a classifier that can classify the pair(x1, x2) of coordinates in either green or blue. **Consider the below image:**

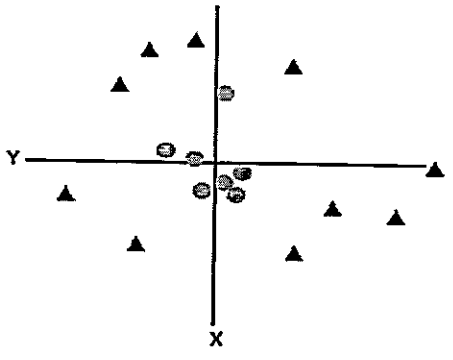


SVM algorithm helps to find the best line or decision boundary; this best boundary or region is called as a hyperplane. SVM algorithm finds the closest point of the lines from both the classes. These points are called support vectors. The distance between the vectors and the

hyperplane is called as margin. And the goal of SVM is to maximize this margin. The hyperplane with maximum margin is called the optimal hyperplane.

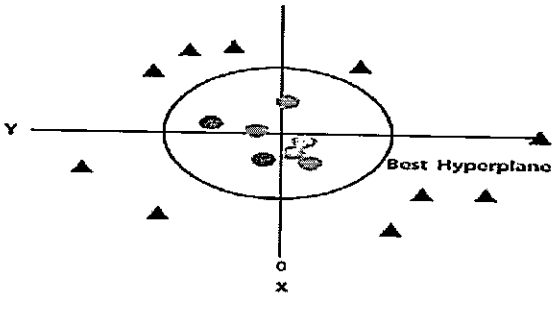
Non-linear SVM: Non-Linear SVM is used for non-linearly separated data, which means if a dataset cannot be classified by using a straight line, then such data is termed as non-linear data and classifier used is called as Non-linear SVM classifier

If data is linearly arranged, then we can separate it by using a straight line, but for non-linear data, we cannot draw a single straight line. Consider the below image:



So to separate these data points, we need to add one more dimension. For linear data, we have used two dimensions x and y, so for non-linear data, we will add a third dimension z. It can be calculated as: $z=x^2+y^2$

by adding the third dimension, the sample space will become as below image:



Hence we get a circumference of radius 1 in case of non-linear data.

NARASARAOPETA
NEC ENGINEERING COLLEGE
(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

CO-POs & CO-PSOs ATTAINMENT

Course Code: C311	Course Name: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	Year/Sem: III/I

External Examination Assessment

S. No	Q.No	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5
		a		b		a		b		a		b		a		b		a		b	
		i	ii	i	ii	i	ii	i	ii	i	ii	i	ii	i	ii	i	ii	i	ii	i	ii
	COs	I	I	I	I	II	II	II	II	III	III	III	III	IV	IV	IV	IV	V	V	V	V
	Max. Marks	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
1								4	4	5	4			3	5						5
2		5	4					5		4	5				5					3	5
3		2	2			3	3			1											
4		4	2			3	3							4	4			4			
5		2	1			1	2			3	3			2	2						
6		2	2			3	2			3											
7		4	5					5	4					4	5			4	4		
8		3	4					3	3					4	4			5			
9		4	3							4	4					5	4		4		
10		4	5							4	5			5	4			4			
11				4	4	4	5							5	4					5	6
12		5	4			3	4			5	4			4							
13		0																			
14		4	5			4	4					3	5	4	4			4	4		
15		4	3							5	5			4	4			4	3		
16		5	4					5	5			4	4			2				5	5
17						1	2							1	2			1			
18				4	4			5	5			5	5			4	5	5			
19		2	3							3	3			3							
20				3	3			4	4						4						
21				4	5			5	4			4	4					4	4		
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25			6			4					4						4				
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32		1																			
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35				5	4	5	5			4	4					2		5	5		
36												2	3	2	3			1			
37				4	4							5	4	5	4					5	6
38								1	2			3	3							3	3

39									4	4						4			3	3				
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85			4	4			5	5			3	4					4	4	4	3		
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98					4	4					4	5			5	4					5	6
99					4				5	5	4	5						5			5	3
100			3	4			4	4					5	5							4	4
101					5	4			3	4							4	5		4		
102					4	5			5	4			4	4					4	4		
No. of Students answered			57	55	29	29	40	36	38	37	41	38	35	33	46	48	24	24	54	46	23	23
50% of Max.Marks			4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
No. of Students crossed 50% of Max Marks			42	42	26	25	27	27	33	32	28	34	23	27	35	39	21	22	43	36	19	19
% of Students crossed 50% of Max Marks			74	76	90	86	68	75	87	86	68	89	66	82	76	81	88	92	80	78	83	83
Attainment Level			3	3	3	3	2	3	3	3	2	3	2	3	3	3	3	3	3	3	3	3
Course Outcome			I	II	III	IV	V															
No.of Times repeated			4	4	4	4	4															
Final CO Attainment Level			3	3	3	3	3															

Rubrics:

If 50% of the students crossed 50% of the marks: Attainment Level 1
If 60% of the students crossed 50% of the marks: Attainment Level 2
If 70% of the students crossed 50% of the marks: Attainment Level 3

1. Enter the question wise marks.
2. Identify the CO of each question.
3. Calculate the maximum marks of each CO.
4. Calculate the CO wise marks obtained by each student.
5. Calculate 50% of maximum marks of each CO.
6. Find number of students crossed 50% of maximum marks for each CO.
7. Find percentage of students crossed 50% of maximum marks for each CO.
8. Find the attainment level of each CO as per the above Rubrics.

Course Code: C311	Course Name: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	Year/Sem: III/I

Internal Examination Assessment

S.No	Roll. No	Test	Mid1					A1	Quiz1	Mid2					A2	Quiz 2	CO I	CO II	CO III	CO IV	CO V
		Q.No	1		2		3			1	2		3								
			1.a	1.b	2.a	2.b	3.a			1.a	2.a	2.b	3.a	3.b			Max. Marks	Max. Marks	Max. Marks	Max. Marks	Max. Marks
		COs	I	I	II	II	III	I		III	IV	IV	V	V							
		Max. Marks	5	5	5	5	5	5	10	5	5	5	5	5	5	10	25	20	35	25	20
1	204710301		2	3	1	3	1	4	5	2	3			3	5	10	14	9	23	18	13
2	204710302		2	5	5	2	1	5	8	3	2	3	4	3		7	20	15	19	12	14
3	204710303									2	3			3		9	0	0	11	12	12
4	204710304		2	1	2	1	2	5	7								15	10	9	0	0
5	204710305		3	2	1	2	2		5	2	3			3		9	10	8	18	12	12
6	204710306		5	4	5	5	4	5	9	2		3		3	5	8	23	19	28	16	11
7	204710307		3	3	2	4	3	5	7	2	3	3	3	2		6	18	13	18	12	11
8	204710308		4	2	5	3	3	5	5	4	3	3			5	9	16	13	26	20	9
9	204710309		2	3	3	1	1	5	6	3	3	3	2	2	5	10	16	10	25	21	14
10	204710310		4	2	2	3	1	5	5	3			4	3		9	16	10	18	9	16
11	204710312		5	5	3	2	5	5	8	3	2	3	4	3	5	6	23	13	27	16	13
12	204710313		5	5	4	4	4	5	4	3	2	3	4	3	5	7	19	12	23	17	14
13	204710314		2	3	1	1	3	5	6		3		2	3	5	6	16	8	20	14	11
14	204710315		5	2	3	5	5	5	8	4	5	4	5	4	5	10	20	16	32	24	19
15	204710317		1	3	5	2	2	5	5	3	4	4	3	4	5	6	14	12	21	19	13
16	204710318		5	4	2	4	2		5	3	4	3	4	3	5	7	14	11	22	19	14
17	204710319															3	0	0	3	3	3
18	204710320		5	4	1	5	3	5	5	3	2	3	4	3	5	8	19	11	24	18	15
19	204710321		4	5	2	4	3	5	4								18	10	7	0	0

20	204710323		2	1	3	2	2	5	6	4	3	3			5	8	14	11	25	19	8
21	204710324		1	3	2	1	3		5	4	3	3				5	9	8	17	11	5
22	204710325							5				4	3	3		6	5	0	6	10	12
23	204710326		2	2	1	3	2	5	5	4	3	3			5	8	14	9	24	19	8
24	204710327		5	5	3	5	5	5	7	4	4	4	4	4		9	22	15	25	17	17
25	204710328		2	1	3	3	1	5	3		3	3	4			9	11	9	13	15	13
26	204710329		3	2	1	4	2	-	6	4	3	3			5	8	11	11	25	19	8
27	204710330		3	1	1	2	3	5	5						5		14	8	13	5	0
28	204710331							5		3	4	4	3	4	5	6	5	0	14	19	13
29	204710332		5	5	4	4	4	5	9	4	2	3	3	3	5	10	24	17	32	20	16
30	204710333		5	5	4	5	4	5	4		3	3		4	5	10	19	13	23	21	14
31	204710334		3	2	3	4	1	5	8		3	3		4		10	18	15	19	16	14
32	204710336		0					5	3								8	3	3	0	0
33	204710337		5	5	5	2	3	5	8	3	4	4	3	4		10	23	15	24	18	17
34	204710338		1	1		2	1		6	4	4	4	3	3		10	8	8	21	18	16
35	204710339							5		3	2	3	2	2		5	5	0	8	10	9
36	204710341		2	1	1	2	2	5	5	2	3	1	1		5	7	13	8	21	16	8
37	204710343							5		2	3			3		9	5	0	11	12	12
38	204710344		2	3	1	3	1		4		3	2		3	5	10	9	8	20	20	13
39	204710345		0					5	6	2	3			3		9	11	6	17	12	12
40	204710346		3	2	5	1	2	4	6	4	3	3			5	5	15	12	22	16	5
41	204710348		5	5	5	5	5	5	9	5	5	5	5	5	5	9	24	19	33	24	19
42	204710349		2	3	5	5	5	5	7	3	2	3	3	2	5	6	17	17	26	16	11
43	204710350		3	2	3	5	5	5	7	3	2	3	2	2	5	5	17	15	25	15	9
44	204710352		1	1	2		1	5	7			3	2	3	5	9	14	9	22	17	14
45	204710353		2	1		1	1		2	2	3				5	10	5	3	20	18	10
46	204710354		2	3	1	2	2	5	7	3	3	3	2	2	3	10	17	10	25	19	14
47	204710356		2	1	1	3	1	5	7	0					5	10	15	11	23	15	10

48	204710357		2	3	4	1	2	5	7	3	4	3	4	3	5	7	17	12	24	19	14
49	204710358		5	4	1	4	3	5	9	3	3	3	3	3	5	9	23	14	29	20	15
50	204710359		1		2			5	8			3	4	3	5	9	14	10	22	17	16
51	204710360		1		2	1	1	5	9	4	3	3			5	7	15	12	26	18	7
52	204710361		2	3	1	2	2	5	8	3	4	3	4	3	5	6	18	11	24	18	13
53	204710362		4	3	2	5	3	5	6	3	4	4	3	4	5	9	18	13	26	22	16
54	204710363		3	2	4	1	5	5	7	5	4	4	3	4	5	9	17	12	31	22	16
55	204710364		2	3	1	4	3	5	8	3	3	4			5	7	18	13	26	19	7
56	204710365							5				3	2			0	5	0	0	3	2
57	204710366		5	5	4	5	4	5	9	4	5	4	5	4	5	10	24	18	32	24	19
58	204710367		5	4	5	4	5		8	4	4	5	5	5	5	8	17	17	30	22	18
59	204710368		2	3	5	3	2	5	3	2	3			3		10	13	11	17	13	13
60	204710369		3	2	4	4	5	5	9	4	3	3	1	2	5	8	19	17	31	19	11
61	204710370		2	1	3	2	2		7			2	3	3		8	10	12	17	10	14
62	204710371		3	3	2	4	3	5	5	4	5	4	5	4	5	9	16	11	26	23	18
63	204710372		5	5	5	5	5	5	7	5	5	5	4	4	5	10	22	17	32	25	18
64	204710373		3	2	3	1	4	5	6	5	4	4	5	4	5	9	16	10	29	22	18
65	204710374		3	2	4	1	3	5	8						5	9	18	13	25	14	9
66	204710375		1	2		1	1	5	7	2		3		3		8	15	8	18	11	11
67	204710376		3	2	5	5	5	5	6	1		2	3	1		7	16	16	19	9	11
68	214750301		5	4	4	5	5	5	8	4	5	4	3	4	5	10	22	17	32	24	17
69	214750302		5	5	5	5	5	5	10	5	5	5	5	5	5	10	25	20	35	25	20
70	214750303		3	5	5	5	5	5	7	3	4	3	4	3	5	8	20	17	28	20	15
71	214750304							5			3	3		4		7	5	0	7	13	11
72	214750305		2	4	3	3	3	5	9	4	3	3	4	3	5	7	20	15	28	18	14
73	214750306		5	5	5	5	5	5	9	4	5	4	5	4	5	10	24	19	33	24	19
74	214750307		4	5	3	3	3		9	3	2	3	4	3		8	18	15	23	13	15
75	214750308		3	3	3	3		5	9	3	4	2	3	3		8	20	15	20	14	14

76	214750309		5	5	5	5	5	5	5	4	4	4	4	4	5	5	20	15	24	18	13
77	214750310		3	2	3	2		5	5	3	2	3	4	3	5	9	15	10	22	19	16
78	214750311		4	3	5			5	9	3	3	2	2	2	5	9	21	14	26	19	13
79	214750312		4	5	5	5	3	5	6	3	4	3	4	3	5	9	20	16	26	21	16
80	214750313		5	3	4	4	4	5	9	3	3	3	2	2	5	9	22	17	30	20	13
81	214750314		3	4	3	3	2	5		3	3	3	3	3	5	7	12	6	17	18	13
82	214750315		5	5	3	5	5	5	8						5	10	23	16	28	15	10
83	214750316		5	5	5	5	5	5	9	5	5	5	5	5	5	8	24	19	32	23	18
84	214750317		5	5	5	5	5		9	4	5	3	4	4	5	9	19	19	32	22	17
85	214750318		5	5	5	5	5	5	8	4	4	4	4	4	5	10	23	18	32	23	18
86	214750319		4	4	4	4	4	5	4	3	4	3	4	3	3	9	17	12	23	19	16
87	214750320		5	5	5	5	5	5	8	4	5	4	5	4	5	10	23	18	32	24	19
88	214750321		3	5	5	4	5	4	7	3	2	3	4	3		9	19	16	24	14	16
89	214750322		5	5	5	5	5	5	8	4	4	4	5	5	5	10	23	18	32	23	20
90	214750323		5	5	5	5	5	5	8	4	5	3	4	4	5	9	23	18	31	22	17
91	214750324		5	5	5	5	5	5	8	3	4	4	5	4	5	9	23	18	30	22	18
92	214750325		4	5	3	4	4	5	8	3	4	3	4	3		6	22	15	21	13	13
93	214750326		4	4	4	4	4	5	7							7	20	15	18	7	7
94	214750327		5	5	5	5	5	5	9	4	4	4	4	4	5	7	24	19	30	20	15
95	214750328		5	5	5	4	4	5	9	4	3	3			5	8	24	18	30	19	8
96	214750329		3	4	3	5	3	5	4	3	2	3	4	3		9	16	12	19	14	16
97	214750330		5	4	5	4	5	5	9	5	4	3	4	4	5	9	23	18	33	21	17
98	214750331		3	5	5	5	5	5	8	3	4	3	4	3	5	10	21	18	31	22	17
99	214750332		5	4	3	3	3	5	5	3	2	3	2	2	4	10	19	11	25	19	14
100	214750333		4	3	5	3	2	5	8	3	4	3	2	3		8	20	16	21	15	13
101	214750334		5	4	4	3	4	5	8	2	3	3		3		9	22	15	23	15	12
102	214750335		5	5	5	5	3	5	7	3	4	4	3	4	5	7	22	17	25	20	14
50% of maximum marks																	**12.5**	**10**	**17.5**	**12.5**	**10**

No. of Students crossed 50% of max. marks	83	78	84	82	82
% of students crossed 50% of max. marks	81	76	82	80	80
Attainment Level	3	3	3	3	3

Rubrics:

If 50% of the students crossed 50% of the marks: Attainment Level 1
If 60% of the students crossed 50% of the marks: Attainment Level 2
If 70% of the students crossed 50% of the marks: Attainment Level 3

1. **Enter the question wise marks for mid examinations, assignments & quiz.**
2. **Identify the CO of each question.**
3. **Calculate the maximum marks of each CO based mid exams, assignments and quiz.**
4. **Calculate the CO wise marks obtained by each student.**
5. **Calculate 50% of maximum marks of each CO.**
6. **Find number of students crossed 50% of maximum marks for each CO.**
7. **Find percentage of students crossed 50% of maximum marks for each CO.**
8. **Find the attainment level of each CO as per the above Rubrics.**

Course Code: C311	Course Name: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	Year/Sem: III/I

CO Attainment

CO	CO Attainment Level (Internal)	CO Attainment Level (External)	Direct CO Attainment Level (Internal * 30%) + (External * 70%)	Indirect CO Attainment Level	Total CO Attainment Level (Direct CO Attainment * 90% + Indirect CO Attainment * 10%)
C311.1	3	3	3.00	2.71	2.97
C311.2	3	3	3.00	2.57	2.96
C311.3	3	3	3.00	2.50	2.95
C311.4	3	3	3.00	2.62	2.96
C311.5	3	3	3.00	2.65	2.97
C311					2.96

1. Copy the Direct CO Attainment Level (Internal) and Direct CO Attainment Level (External) from the previous sheets and then find the Direct CO Attainment Level.
2. Find Direct CO attainment level using the formula:
   CO Attainment Level (Internal) * 30% + CO Attainment Level (External) * 70%
3. Copy Indirect CO Attainment Level.
4. Find the CO attainment level using the formula:
   Direct CO Attainment Level *90% + Indirect CO Attainment Level * 10%

Course Code: C311	Course Name: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	Year/Sem: III/I

CO-PO & CO-PSO Mapping

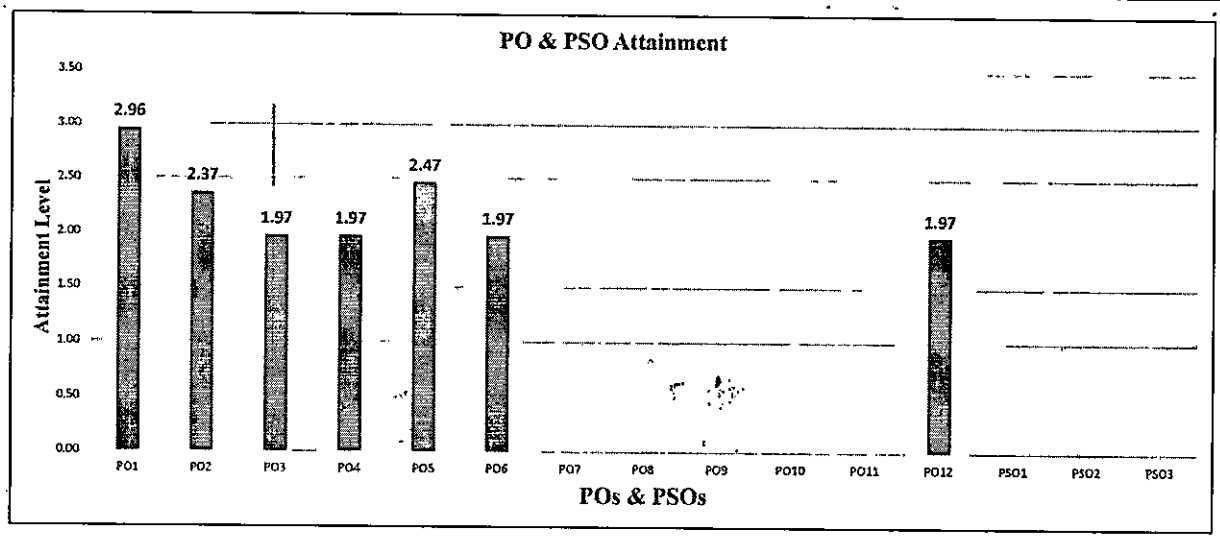
COs	POs & PSOs														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C311.1	3	2	-	-	-	2	-	-	-	-	-	2	-	-	-
C311.2	3	3	2	2	3	-	-	-	-	-	-	2	-	-	-
C311.3	3	2	2	2	2	-	-	-	-	-	-	2	-	-	-
C311.4	3	3	2	2	3	-	-	-	-	-	-	2	-	-	-
C311.5	3	2	2	2	2	-	-	-	-	-	-	2	-	-	-
C311	3.00	2.40	2.00	2.00	2.50	2.00	-	-	-	-	-	2.00	-	-	-

Total CO Attainment through Direct & Indirect Assessment

CO Attainment	2.96

PO & PSO Attainment

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PO Attainment	2.96	2.37	1.97	1.97	2.47	1.97	-	-	-	-	-	1.97	-	-	-



1. Copy CO - PO matrix and CO attainment matrix from previous pages and find PO attainment.
2. PO attainment is calculated as per the following formula:
   POi * Total CO attainment Level / 3 where 'i' ranges from 1 to 12

1. Copy CO - PSO matrix and CO attainment matrix from previous pages and find PSO attainment.
2. PSO attainment is calculated as per the following formula:
   PSOi * Total CO attainment Level / 3 where 'i' ranges from 1 to 3