Siddaganga Institute of Technology

(An Autonomous Institution affiliated to Visvesvaraya Technological University, Belgaum, Approved by AICTE, New Delhi)

B.H. Road, Tumkur, 572103, Karnataka

TEST-1 Scheme and Solutions

Course Code:	S5CSI01	Course Title:	Artificial Intelligence and Machine Learning

I hereby certify that
- I don't have any blood relatives appearing for this paper.
- I have written down the scheme and solution myself.

Signature of the Faculty	Dr. Ashwini B P Name of the Faculty
Signature of the Chairperson [BOE]	Dr. N R Sunitha Name of the Chairperson [BOE]

2024 – 2025	√		
Academic Year	Odd	Even	Summer
	CIE		

√				
BE	B.Arch.	MCA	MBA	M.Tech.
Degree				

05
Semester

Total number of pages used

Q.No.	SCHEME AND SOLUTIONS	Marks
1.a)	Define Artificial Intelligence with respect to all four categories.	4

Thinking Humanly	Thinking Rationally
"The exciting new effort to make computers think … *machines with minds*, in the full and literal sense." (Haugeland, 1985) "[The automation of] activities that we associate with human thinking, activities such as decision-making, problem solving, learning …" (Bellman, 1978)	"The study of mental faculties through the use of computational models." (Charniak and McDermott, 1985) "The study of the computations that make it possible to perceive, reason, and act." (Winston, 1992)
Acting Humanly	**Acting Rationally**
"The art of creating machines that perform functions that require intelligence when performed by people." (Kurzweil, 1990) "The study of how to make computers do things at which, at the moment, people are better." (Rich and Knight, 1991)	"Computational Intelligence is the study of the design of intelligent agents." (Poole *et al.*, 1998) "AI … is concerned with intelligent behavior in artifacts." (Nilsson, 1998)

Figure 1.1 Some definitions of artificial intelligence, organized into four categories.

1 x 4 = 4 marks

1.b)	With a neat diagram, explain agent integration with the environment through sensors and actuators.	4

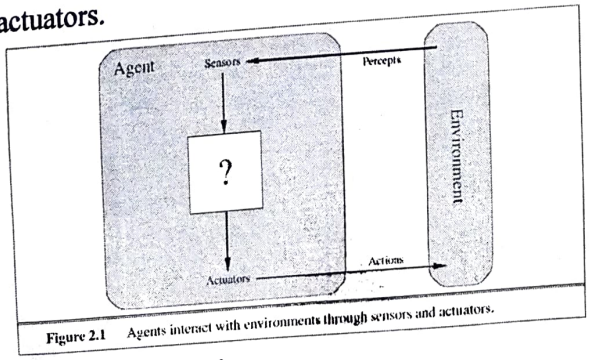


Figure 2.1 Agents interact with environments through sensors and actuators.

Diagram 2 marks

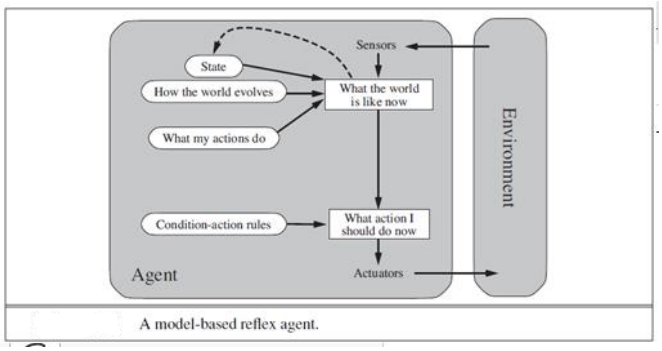
1.c) Identify the task environment specifications for the following agents: 6

i. Automated Taxi driver
ii. Medical diagnosis system
iii. Interactive English tutor

Agent Type	Performance Measure	Environment	Actuators	Sensors
Taxi driver	Safe, fast, legal, comfortable trip, maximize profits	Roads, other traffic, pedestrians, customers	Steering, accelerator, brake, signal, horn, display	Cameras, sonar, speedometer, GPS, odometer, accelerometer, engine sensors, keyboard
Medical diagnosis system	Healthy patient, reduced costs	Patient, hospital, staff	Display of questions, tests, diagnoses, treatments, referrals	Keyboard entry of symptoms, findings, patient's answers
Interactive English tutor	Student's score on test	Set of students, testing agency	Display of exercises, suggestions, corrections	Keyboard entry

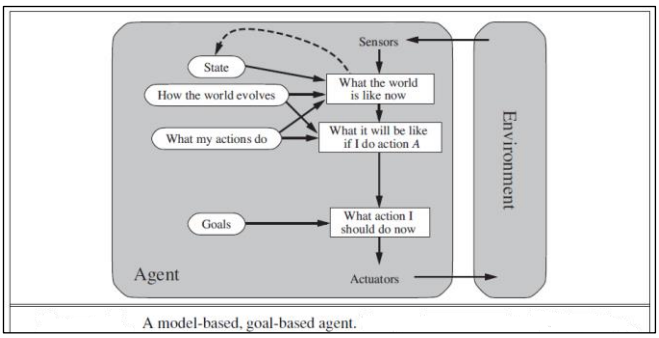
2 marks each

2 a.) Distinguish model-based reflex agent and goal-based agent with necessary diagrams and suitable examples. **6**



A model-based reflex agent.

A model based reflex agent maintains some sort of **internal state** that depends on the percept history and thereby reflects at least some of the unobserved aspects of the current state.

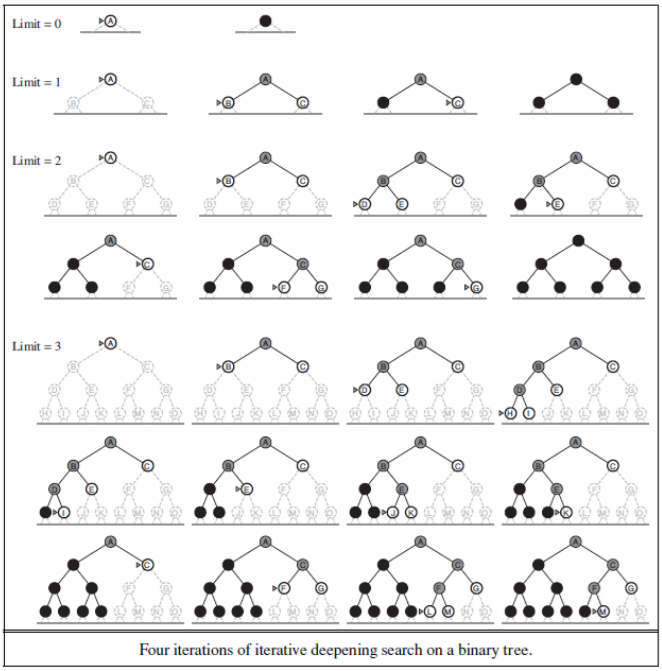


A model-based, goal-based agent.

A goal based agent keeps track of the world state as well as a set of goals it is trying to achieve and chooses an action that will (eventually) lead to the achievement of its goals.

Diagrams: 2 marks
Difference:2 marks
Examples: 2 marks

2.b) Illustrate the iterative deepening depth-first search algorithm with a suitable example. **6**



Four iterations of iterative deepening search on a binary tree.

An iterative deepening search algorithm repeatedly applies depth-limited search with increasing limits. It terminates when a solution is found or if the depth-limited search returns failure, meaning that no solution exists.

Illustration :3marks
Suitable example:

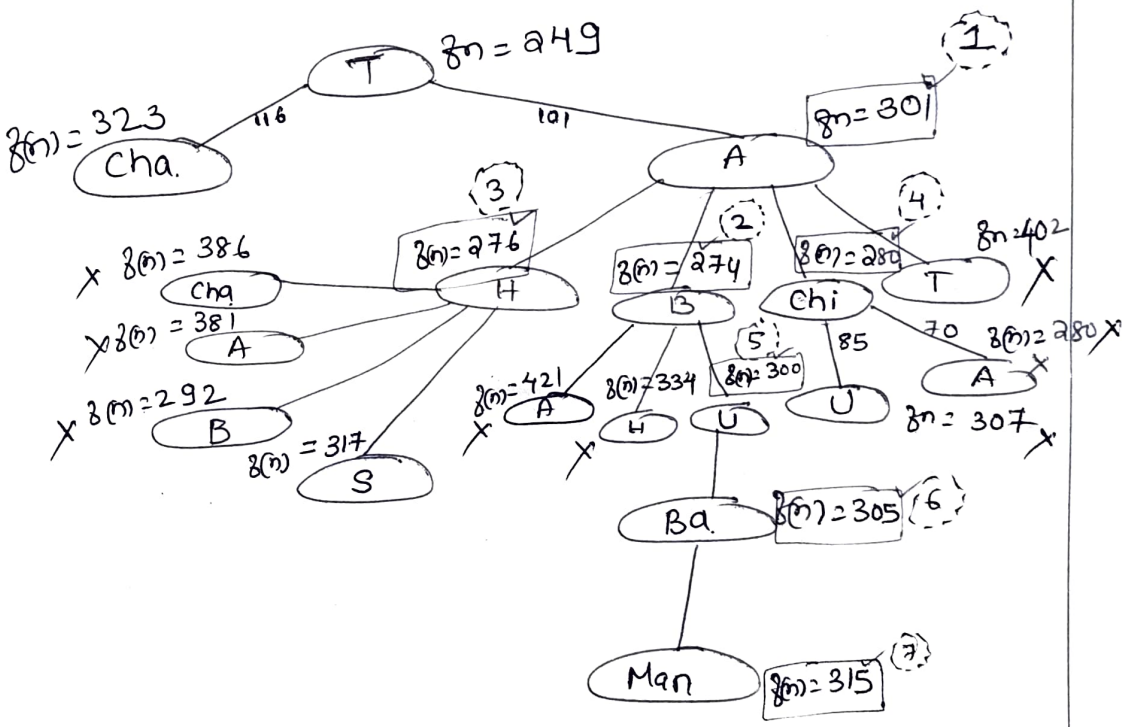
2.c) Apply uniform cost search algorithm to find the route from Tumkur to Mangalore using the graph given in Figure 1, and show the results **8**

Sl. No	Frontier list	Expand list	Explored List
1	{{T,0}}	T	Null
2	{{T,**A**,101}, {T,Cha,116}}	A	{T,A}
3	{{T,**Cha**,116},{T,A,H,141}, {T,A,B,161}, {T,A,Chi,171}}	Cha	{T,A, Cha}
4	{{T,A,**H**,141}, {T,Cha,H,154}, {T,A,B,161}, {T,A,Chi,171}, {T,Cha,K,208} }	H	{T,A, Cha,H}
5	{{~~T,Cha,**H**,154),~~ {T,A,**B**,161}, {T,A,Chi,171}, {T,A,H,B,179} {T,Cha,K,208},,{T,A,H,S,217} } H already explored	B	{T,A, Cha,H,B}
6	{ ~~{T,A,H,B,179)~~ {T,Cha,**K**,208},{T,A,H,S,217}, {T,A,B,U,249}, {T,A,Chi,U,256} } B already explored	K	{T,A, Cha,H,B,K}
7	{{T,A,H,**S**,217}, {T,Cha,K,Mad,238},{T,A,B,U,249}, {T,A,Chi,U,256} }	S	{T,A, Cha,H,B,K,S}
8	{{T,Cha,K,**Mad**,238},{T,A,B,U,249}, {T,A,Chi,U,256} {T,A,H,S,Ba,320} }	Mad	{T,A, Cha,H,B,K,S,Mad}
	{{T,A,B,U,249}, {T,A,Chi,U,256} {T,A,H,S,Ba,320},{T,Cha,K,Mad,Ba,347}}	U	{T,A, Cha,H,B,K,S,Mad,U}
9	{~~{T,A,Chi,U,256}~~{T,A,B,U,**Ba**, 287}{T,A,H,S,Ba,320} ,{T,Cha,K,Mad,Ba,347}, U already explored	Ba	{T,A, Cha,H,B,K,S,Mad,Ba}
10	{{T, A, B, **U**, Ba, **Man**, 315} ,{T,A,H,S,Ba,320} ,{T,Cha,K,**Mad**,Ba,347},} Final path T→ A→ B→**U**→Ba→**Man**, 315}	Man	{T,A, Cha,H,B,K,S,Mad,Ba, Man} Goal Reached

3.a) **Explain** A* search algorithm in detail. **Apply** A* search algorithm to find the optimal route from Tumkur to Mangalore for the graph in Figure 1. Straight line heuristic values are given in Table 1. Show the results at every step. 8

Explanation:3 marks
Applying A* -5 marks

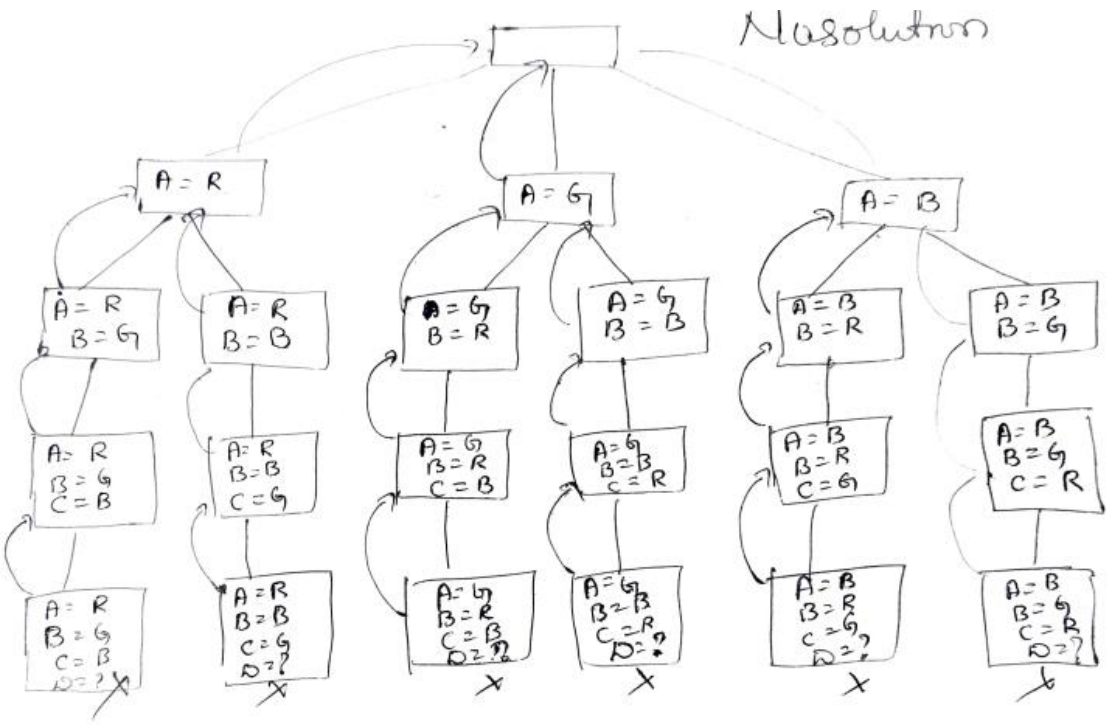
Node	h_{SLD}	Node	h_{SLD}
Tumkur	249	Kushalnagar	130
Channarayapatna	207	Madikeri	110
Arasikere	200	Sakleshpur	100
Hassan	135	Ujire	51
Belur	113	Bantwal	18
Chikmagalur	109	Mangalore	0



Final path

Tumkur → Arasikere → Belur → Ujre

Mangalore ← Bantwal ←

3. b)	Definition :2marks • A constraint satisfaction problem consists of three components, X, D, and C: a. X is a set of variables, $\{X_1, \ldots, X_n\}$. b. D is a set of domains, $\{D_1, \ldots, D_n\}$, one for each variable. c. C is a set of constraints that specify allowable combinations of values. • Each domain D_i consists of a set of allowable values, $\{v_1, \ldots, v_k\}$ for variable X_i. • Each constraint C_i consists of a **pair <*scope, rel*>** , where **scope** is a tuple of variables that participate in the constraint and **rel** is a relation that defines the values that those variables can take on. Illustration of Map-coloring problem with constraints: 2marks Backtracking solution:4 marks 	**8**