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Sardar Patel Institute of Technology

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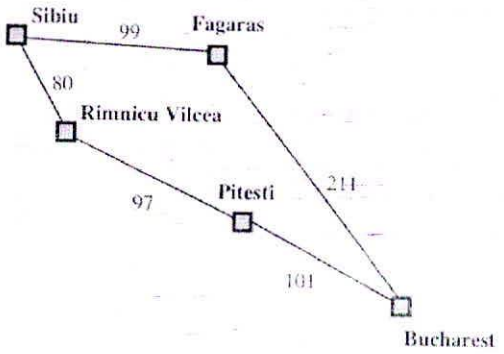
(An Autonomous Institute Affiliated to University of Mumbai

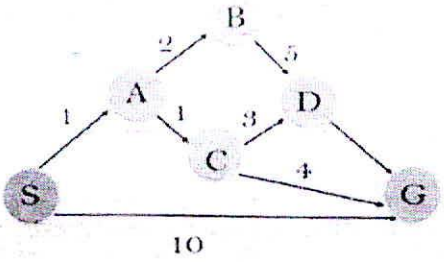
End Semester Examination
December 2022

Max. Marks: 100
Class: TEIT/TECOMP
Course Code: IT303B/CS303B
Course: Artificial Intelligence and Machine Learning

Duration: 3 hrs
Semester: V
Branch: IT/COMP

Instructions:
(1) All Questions are Compulsory
(2) Draw neat diagrams
(3) Assume suitable data if necessary

Question No.		Max. Marks	CO	BL
Q1(a)	Why is it necessary for AI to think rationally? Can there be more than one agent program that implements a given agent function? Why? Write PEAS for vacuum cleaning ROBOT.	4+ 2+ 4	1	2
Q1 (b)	Differentiate between Informed and uninformed search technique? Find the path from Sibiu to Bucharest using uniform cost search algorithm. 	5+ 5	2	4

Q2(a)	Traverse the given graph using A* algorithm. The heuristic values for all states is given in the table. S is the start state and G is goal state. Find cost at each node? Find the optimal path? How many iterations are needed to reach the goal state?  State / h(n): S 5; A 3; B 4; C 2; D 6; G 0	10	2	4
	OR			
Q2 (a)	Solve the following 8 Puzzle problem using A* algorithm. The heuristic used is no of misplaced tiles. Give State Space at each level and path from Start to goal state. Start state g=0, h=3, f=g+h=3 1 2 3 / 4 6 / 7 5 8 Goal state h=0 1 2 3 / 4 5 6 / 7 8	10(8+ 2)	2	6
Q2(b)	Define Hill Climbing Search giving suitable example. Discuss different types of hill-climbing search. Why a hill climbing search is called a greedy local search?	10(4+ 3+ 2)		

Q3A	Find the overall impulse response of the system if following given systems are connected in cascade. $h_1(n) = \left(\frac{1}{4}\right)^n u(n-1)$, $h_2(n) = \left[1 + \left(\frac{1}{2}\right)^n\right] u(n)$ Comment on stability of the overall system.	10	CO3	L2
Q3B	Given $H(z) = \frac{10\ z}{z - 0.5}$ (1) Find the response of the system to the input $x[n] = 10 - 5 \sin(0.2\pi n) + 20 \cos(0.4\pi n + 0.5\pi)$. (2) Identify the filter based on passband of the filter	10	CO4	L2
Q4A	A Linear – time invariant system is characterized by the system function: $H(z) = \frac{3 - 4z^{-1}}{1 - 3.5z^{-1} + 1.5z^{-2}}$ 1. Specify ROC of H(z) and determine h(n) for following conditions: (i) The system is stable. (ii) The system is causal. (iii) The system is anti-causal 2. Find the difference equation of above system. 3. Show Parallel realization diagram of system using minimum number of unit delay blocks.	10	CO4	L3
Q4B	Frequency response of FIR filter is given below: $H(e^{jw}) = e^{-3jw}(2 + 1.8\cos 3w + 1.2\cos 2w + 0.5\cos w)$ Find: (i) Impulse Response of the filter. (ii) Response of the filter to the input $x[n] = (0.5)^n u[n]$. **OR** Contradict Or justify the following statement. 1) Impulse Invariant method is not suitable for LPF and HPF.	10	CO5	L3

	2) Frequency warping is needed to perform in BLT technique but not in Impulse Invariance Technique (IIT).			
Q5A	Impulse response of desired Linear Phase High Pass FIR filter is given below- $hd[n] = \left[\frac{\sin[(n-2)\pi]}{[(n-2)\pi]} - \frac{7}{10} \frac{\sin\left((n-2)0.7\pi\right)}{\left((n-2)\ 0.7\pi\right)} \right]$ (1) Truncate the values of hd[n] using following window function and obtain realizable finite length h[n]. $w[n] = \left[0.54 - 0.46 \cos\left(\frac{2\pi n}{N-1}\right)\right]$ (2) Plot Magnitude & Phase spectrum of the designed filter.	10	CO5	L3
Q5B	A Digital Butterworth is required to meet the following specifications: $0.85 \leq \lvert H(e^{jw}) \rvert \leq 1.0$ for $0 \leq F \leq 0.22\pi$ $\lvert H(e^{jw}) \rvert \leq 0.25$ for $0.72\pi \leq F \leq \pi$ Fs = 1 KHz. 1. Design a filter using BLT 2. Draw filter realization diagram 3. What is the value of magnitude response of the designed filter at w = 0 and w = π	10	CO5	L3