BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

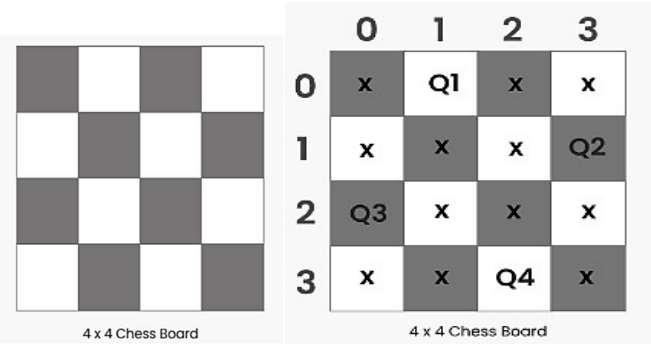
CLASS: M. TECH **SEMESTER : II**
BRANCH: AIML **SESSION : SP/2025**

SUBJECT: AI602 MODERN ARTIFICIAL INTELLIGENCE CONCEPTS

TIME: 3 HOURS **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a)	(I) Place each queen one by one in different rows, starting from the topmost row. While placing a queen in a row, check for clashes with already placed queens. For any column, if there is no clash then mark this row and column as part of the solution by placing the queen. In case, if no safe cell found due to clashes, then use DFS and backtracking (i.e, undo the placement of recent queen) and return false. Solve the following illustration of 4 Queens Solution.	**[3+3=6]**	**CO CO 1**	**BL BL 3, BL 4**



Initial state **Final state**

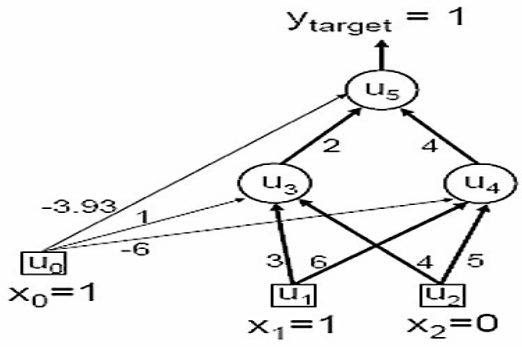
(II) How to differentiate Best first search and A* algorithm (take-8 puzzle as example). Explain the different properties of A* algorithm-admissible, consistency, triangular inequality, monotonicity and optimality.

Q.1(b)	A game tree for the game of tic-tac-toe. The top node is the initial state, and MAX moves first, placing an X in an empty square. We show part of the tree, giving alternating moves by MIN (O) and MAX (X), until we eventually reach terminal states, which can be assigned utilities according to the rules of the game. How minmax algorithm solve the tic-tac-toe problem by calculating backed up utility for winning X's or O's. And how Alpha-Beta pruning algorithm reduce the number of steps by pruning branches for this problem and how to measure the performance in terms of time complexity of alpha beta pruning.	**[4]**	**CO 1**	**BL 3, BL 4**
Q.2(a)	Describe the terms NLP, NLU and NLG. Explain briefly - Morphology analysis, syntactic processing, Semantic analysis, and Pragmatic analysis of NLP with examples.	**[4]**	**CO 2**	**BL 2**
Q.2(b)	(I) Explain Word Embedding, word to vector analysis, TF-IDF concepts. (II) Apply Recurrent Neural Networks solve NLP problem.	**[3+3=6]**	**CO 2**	**BL 2, BL 3**
Q.3(a)	Explain Robotics and different algorithms of robots for planning and control of its movement in certain and uncertain domain.	**[1+3=4]**	**CO 3**	**BL 3, BL 4**

PTO

Q.3(b) (I) Explain Gradient Descent and its types. **[2+4=6] CO 4 BL 2, BL 3, BL 4**

(II)



Solve this Artificial Neural Network problem. Calculate forward pass of hidden layer u3, u4 and output layer u5 with the help of sigmoidal activation function. Find out the first error of the above training example and then use back propagation algorithm to update the weights using generalize delta-rule and fill the below tables. Take- η=0.9 and finally calculate the new error.

i	j	w_{ij}	δ_j	y_i	Update w_{ij}
0	3				
1	3				
2	3				
0	4				
1	4				
2	4				
0	5				
3	5				
4	5				

Q.4(a) (I) Why under fitting is called high bias and over fitting is called high variance? **[1+2+1+2=6] CO 4 BL 3, BL 4, BL 5**

(II) Discuss the use of an activation function- sigmoidal and tanh in neural n/w.

(III) How does SVM going to higher dimension help data get linearly separable which was non linearly separable in actual dimension?

(IV) Example of logistic Regression:

Case	Purchasing behavic	Gender	Age	Time spent in onlin
1	Buy now	female	22	40
2	Buy now	female	25	23
3	Buy now	male	18	12
4	Buy now	male	45	28
5	Buy now	female	12	43
6	Buy now	male	43	23
7	Buy now	male	23	55
8	Buy now	male	33	34
9	Buy later	female	27	28
10	Buy later	female	27	15
11	Buy later	male	48	110
12	Buy later	male	34	28
13	Buy later	male	32	11
14	Buy later	male	66	32

You have find out accuracy, precision and recall for this data set using logistic regression. And accuracy of the data set based on two classes buy now/ buy later.

Q.4(b)	(I) The vanishing gradient problem in Recurrent Neural Networks (RNNs) makes it difficult to train on long sequences, as gradients can become extremely small as they are propagated back through time. How this problem can be solved by LSTM. Draw the block diagram of LSTM? (II) Describe the architecture of a typical Convolutional Neural Network (CNN)? And also mention the terms- Kernel, Max and Avg. Pooling and flatten fully connected network.	**[2+2=4]**	**CO 4**	**BL 5, BL 6**
Q.5(a)	(I) Can you compare and contrast different CNN architectures like AlexNet, VGG, and ResNet? How do their approaches to image classification differ? (II) Construct block diagrams of VGG -16 and RESNET-18.	**[2+2=4]**	**CO 5**	**BL 5, BL 6**
Q.5(b)	(I) Difference between computer graphics, Image Processing and Computer Vision. (II) What is computer vision, and why is it important? (II) What is object detection, and how does it differ from image classification? (III) What is the purpose of data augmentation in computer vision, and what techniques can be used?	**[1.5 x4= 6]**	**CO 5**	**BL 4, BL 2, BL 3**

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