|--|



## PES UNIVERSITY, BENGALURU-560085 ( Estd. Under Karnataka Act 10 of 2013)

**UE16CS353** 

## MAY 2019: END-SEMESTER ASSESSMENT (ESA) B.TECH. VI SEMESTER UE16CS353 -MACHINE LEARNING

Time: 3 Hrs

Answer All Questions.

Max Marks: 100

1.	a)	Define Inductive bias. What is the inductive bias of the Candidate-Elimination algorithm?							
-	b)	Trees							
	c)	Briefly explain the following ways of selecting chromosomes in a typical Genetic Algorith  a) Roulette wheel  b) Ranking  c) Tournament selection							
	d) Consider the following dataset. Using Shannon's Entropy, find out which attribute ap as the root node when the ID3 algorithm is applied. What is the max gain at the root Show calculations clearly.								
		BP	Sugar	levels	Haemoglobin	Risk?			
		High	Nor	mal	Low	No			
		High	Hi	gh	Normal	Yes			
		Very High	Nor	mal	Low	Yes			
		High	Ĥi	gh	Normal	No			
	***	Very High	Hi	gh	Low	Yes			
2.	a)	a) Explain three methods of avoiding local minima in an Artificial Neural Network.							
	b)	activation unit, show that an output neuron in an	6						
		$\Delta w_{ji} = \eta^*(t_d - o_d) * \sigma(net_j) * x_{ji}$ (with usual conventions)							
	where $\sigma$ is the sigmoid function and $\text{net}_j$ is the output of the $j^{th}$ neuron measured the activation unit.								
		Assume Stochastic Gradient Descent is used and the Error term used is the Square Er							
3	c)	For the following data points, use the SVM technique to find the marginal and the optimal hyperplanes. Hence prove that the dot product of any point on the optimal hyperplane with any point on the line $y = x$ , is 0.							
			Attr1	Attr2	target				
		Instance x1	-2	0	-1	æ			
	1	I IIIStatice XI				J			

a) Consider the following 1-D data. Decision stumps are used for this data is part of this data of part of the following 1-D data. Decision stumps are used for this data of part of the first learner?  i) What are the starting weights of the instances? ii) What is the weight of the first learner? iii) What are the weights of the instances for the second learner? iii) What are the weight of the second learner?  What is the weight of the second learner?  If a new instance is to be classified now, one of the learners is useless. Which one? Why? NOTE: You can eyeball the data for the decision-stump splits.  b) Explain the terms "Naïve" and "Bayes" in the Naïve Bayes Classifier. For the tabular data shown below, apply the Naïve Bayes Classifier and give the classification for a person who has a runny nose, has mild headache, does not suffer from fever and has chills.  Headache Fever Chills Runny nose Flu?  Strong N N Y Y N N N N N N N N N N N N N N N	, 1	- 11 11 6 11	don't Distant	icion ctumpo are	SRN	as part of an			
i) What are the starting weights of the instances? ii) What is the weight of the first learner? iii) What is the weight of the first learner? iii) What is the weight of the instances for the second learner? iii) What are the weight of the instances for the second learner? iv) What is the weight of the second learner?  If a new instance is to be classified now, one of the learners is useless. Which one? Why?  NOTE: You can eyeball the data for the decision-stump splits.  Explain the terms "Naïve" and "Bayes" in the Naïve Bayes Classifier. For the tabular data shown below, apply the Naïve Bayes Classifier and give the classification for a person who has a runny nose, has mild headache, does not suffer from fever and has chills.  Headache Fever Chills Runny nose Flu?  Strong N N Y Y Y  Mild Y Y Y N N N  No N Y Y Y  Strong Y Y N N N  Strong Y N N Y  Mild Y N Y Y  Mild Y N Y Y  NO N N N N N N  Strong Y N N Y  The mood of a human being is modeled as a first-order Hidden Markov process. The moods are <happy, unhappy="">. The possible observations are <smile, frown="">. Calculate the likelihood of the observation sequence <frown, smile="">. Show that the likelihood is the same if you use any of the following methods.  i) Brute Force ii) Froward Rule only iii) Forward and Backward rule together (with t = 1).  <math display="block">\pi = \{0.6, 0.4\}</math> <math display="block">A = \frac{Happy}{Happy} \frac{Unhappy}{Uohappy}</math> <math display="block">Happy [0.7 0.3]</math> <math display="block">Unhappy [0.4 0.6]</math> <math display="block">B = \frac{Smile}{Happy} \frac{Frown}{Happy} [0.8 0.2]</math></frown,></smile,></happy,>	a)	Consider the following 1-D data. Decision stumps are used for this data as part of an Adaboost setup.							
i) What are the starting weights of the instances? ii) What is the weight of the first learner? iii) What are the weight of the first learner? iii) What is the weight of the instances for the second learner? iv) What is the weight of the second learner?  If a new instance is to be classified now, one of the learners is useless. Which one? Why?  NOTE: You can eyeball the data for the decision-stump splits.  b) Explain the terms "Naïve" and "Bayes" in the Naïve Bayes Classifier. For the tabular data shown below, apply the Naïve Bayes Classifier and give the classification for a person who has a runny nose, has mild headache, does not suffer from fever and has chills.  Headache Fever Chills Runny nose Flu?  Strong N N Y Y N N  Mild Y Y Y N N N  No N Y Y Y Y  Strong Y Y N N N  Strong Y Y N N N  Strong Y Y N N Y  Mild Y N N Y Y  Mild Y N N Y Y  Mild Y N N Y Y  The mood of a human being is modeled as a first-order Hidden Markov process. The moods are <happy, unhappy="">. The possible observations are <smile, frown="">. Calculate the likelihood of the observation sequence <frown, smile="">. Show that the likelihood is the same if you use any of the following methods.  i) Brute Force ii) Forward Rule only iii) Forward Rule only iii) Forward Rule only iii) Forward and Backward rule together (with t = 1).  <math display="block">\pi = \{0.6, 0.4\}</math> <math display="block">A = \frac{Happy}{Happy} = \frac{Unhappy}{U.0.4}</math> <math display="block">Happy = \frac{Frown}{U.0.4}</math> <math display="block">Happy = \frac{Frown}{U.0.4}</math></frown,></smile,></happy,>		X 8 ·	2 9	3 7	4 6	5 1			
ii) What is the weight of the first learner? iii) What are the weights of the instances for the second learner? iv) What is the weight of the second learner?  If a new instance is to be classified now, one of the learners is useless. Which one? Why?  NOTE: You can eyeball the data for the decision-stump splits.  b) Explain the terms "Naïve" and "Bayes" in the Naïve Bayes Classifier. For the tabular data shown below, apply the Naïve Bayes Classifier and give the classification for a person who has a runny nose, has mild headache, does not suffer from fever and has chills.    Headache   Fever   Chills   Runny nose   Flu?		target +		- +	- +	- +			
has a runny nose, has mild headache, does not suffer from fever and has chills.    Headache	b)	ii) What i iii) What i iv) What i  If a new instance is NOTE: You can eye	is the weight of the are the weights of is the weight of the sto be classified neeball the data for "Naïve" and "Bave	e first learner? the instances for e second learner  ow, one of the le the decision-stur es" in the Naïve B	the second learn arners is useless. np splits. ayes Classifier. Fo	Which one? Why?			
Headache   Fever   Chills   Runny nose   Flu?		shown below, app	ly the Naïve Bayes	Classifier and give	e the classificatio	n for a person who			
Strong N Y Y Y Y N N N N N N N N N N N N N N				A STATE OF THE PARTY OF THE PAR					
Mild       Y       Y       Y         Mild       Y       Y       N       N         No       N       Y       Y       Y         Mild       Y       N       Y       Y         No       N       N       N       N         Strong       Y       N       N       N         Strong       Y       N       N       N         No       N       N       N       N         Strong       Y       N       N       N         No       N       N       N       N         N       Y       Y       Y     The mood of a human being is modeled as a first-order Hidden Markov process. The moods are <\shappy   Calculate the likelihood of the observation sequence <\shappy   Frown - Calculate the likelihood is the same if you use any of the following methods.  I) Brute Force II) Forward Rule only III) Forward Rule only III) Forward Rule only III) Forward and Backward rule together (with t = 1).  III) The province of the province		Strong	N .	N	Y	N			
No N Y Y Y Y Y N Y Strong Y N N N Y Y Y N N Y N N N N N N N N N			Υ	Y	Υ	Υ			
Strong Y Y N Y  Mild Y N Y  No N N N N N  Strong Y N Y  No N N N N N  Strong Y N N Y  The mood of a human being is modeled as a first-order Hidden Markov process. The moods are <happy, unhappy="">. The possible observations are <smile, frown="">. Calculate the likelihood of the observation sequence <frown, smile="">. Show that the likelihood is the same if you use any of the following methods.  i) Brute Force ii) Forward Rule only iii) Forward and Backward rule together (with t = 1).  <math display="block">\pi = \{0.6, 0.4\}</math> <math display="block">A = \frac{\text{Happy}}{\text{Happy}} = \frac{\text{Unhappy}}{\text{Unhappy}}</math> <math display="block">\text{Happy} = [0.4   0.6]</math> <math display="block">B = \frac{\text{Smile}}{\text{Happy}} = \frac{\text{Frown}}{\text{Happy}}</math> <math display="block">\text{Happy} = [0.8   0.2]</math></frown,></smile,></happy,>		Mild	Y	Y	N	N			
Mild Y N Y Y  No N N N N N  Strong Y N Y Y  The mood of a human being is modeled as a first-order Hidden Markov process. The moods are <-Happy, Unhappy>. The possible observations are <-Smile, Frown>. Calculate the likelihood of the observation sequence <-Frown, Smile>. Show that the likelihood is the same if you use any of the following methods.  i) Brute Force ii) Forward Rule only iii) Forward and Backward rule together (with t = 1). $ π = {0.6, 0.4} $ $ A = \frac{\text{Happy}}{\text{Happy}} \frac{\text{Unhappy}}{\text{0.7}} $ $ \text{Happy} [0.7 0.3] $ $ \text{Unhappy} [0.4 0.6] $ $ B = \frac{\text{Smile}}{\text{Happy}} \frac{\text{Frown}}{\text{Happy}} $ $ \text{Happy} [0.8 0.2] $		No	N	Y	Y	Y			
Mild Y N N N N N N N N N N N N N N N N N N			Υ	Υ	N N	Y			
No N N N Y Y  Strong Y N N Y Y  The mood of a human being is modeled as a first-order Hidden Markov process. The moods are <happy, unhappy="">. The possible observations are <smile, frown="">. Calculate the likelihood of the observation sequence <frown, smile="">. Show that the likelihood is the same if you use any of the following methods.  i) Brute Force ii) Forward Rule only iii) Forward and Backward rule together (with t = 1).  <math display="block"> π = {0.6, 0.4} </math> <math display="block"> A = \frac{\text{Happy}}{\text{Happy}} \frac{\text{Unhappy}}{\text{Unhappy}} </math> <math display="block"> \text{Happy} [ 0.7                                  </math></frown,></smile,></happy,>			Υ	N	Υ	Υ			
Strong Y N Y  The mood of a human being is modeled as a first-order Hidden Markov process. The moods are <happy, unhappy="">. The possible observations are <smile, frown="">. Calculate the likelihood of the observation sequence <frown, smile="">. Show that the likelihood is the same if you use any of the following methods.  i) Brute Force ii) Forward Rule only iii) Forward and Backward rule together (with t = 1).  <math display="block"> π = {0.6, 0.4} </math> <math display="block"> A = \frac{\text{Happy}}{\text{Happy}} \frac{\text{Unhappy}}{\text{Unhappy}} </math> <math display="block"> \text{Happy} [0.7  0.3] </math> <math display="block"> \text{Unhappy} [0.4  0.6] </math> <math display="block"> B = \frac{\text{Smile}}{\text{Happy}} \frac{\text{Frown}}{\text{Happy}} [0.8  0.2] </math></frown,></smile,></happy,>			N	N	N	N			
c) The mood of a human being is modeled as a first-order Hidden Markov process. The moods are <happy, unhappy="">. The possible observations are <smile, frown="">. Calculate the likelihood of the observation sequence <frown, smile="">. Show that the likelihood is the same if you use any of the following methods.  i) Brute Force ii) Forward Rule only iii) Forward and Backward rule together (with t = 1).  <math display="block"> \pi = \{0.6, 0.4\} </math> <math display="block"> A = \frac{\text{Happy}}{\text{Happy}} \frac{\text{Unhappy}}{\text{Unhappy}} </math> <math display="block"> \text{Happy} [0.7  0.3] </math> <math display="block"> \text{Unhappy} [0.4  0.6] </math> <math display="block"> B = \frac{\text{Smile}}{\text{Erown}} \frac{\text{Frown}}{\text{Happy}} </math> <math display="block"> \text{Happy} [0.8  0.2] </math></frown,></smile,></happy,>			Y	N	Υ	Υ			
Happy [ 0.8 0.2 ]	c)	are <happy, a="" brute="" forwa="" forwa<="" i)="" if="" ii)="" iii)="" likelihood="" o="" of="" same="" th="" the="" unha="" use="" you=""><th>appy&gt;. The possible observation seque my of the following e Force ard Rule only</th><th>le observations a nce <b><frown, b="" smi<=""> g methods.</frown,></b></th><th>re <smile, frown=""> le&gt;. Show that th</smile,></th><th><ul> <li>Calculate the</li> </ul></th></happy,>	appy>. The possible observation seque my of the following e Force ard Rule only	le observations a nce <b><frown, b="" smi<=""> g methods.</frown,></b>	re <smile, frown=""> le&gt;. Show that th</smile,>	<ul> <li>Calculate the</li> </ul>			
		A = <u>Happy</u> Happy [ 0.7 Unhappy [ 0.4	0.3]						
omaphy Loro on 1		A = <u>Happy</u> Happy [ 0.7 Unhappy [ 0.4 B = <u>Smile</u>	0.3 ] 0.6 ] <u>Frown</u>						

		SRN							
$\top$	b)	Consider the following transactions.	5+2						
		i) Banana,							
		ii) Apple, Carrot, Banana							
		iii) Banana, Apple							
		iv) Banana, Apple, Orange							
		v) Carrot, Banana							
		vi) Apple, Banana							
		vii) Carrot, Orange, Apple							
		<ul> <li>Using the FP-Growth algorithm, build the FP-Tree for the above transaction set.</li> </ul>							
		<ul> <li>Hence find all the frequent itemsets ending with 'Apple'.</li> </ul>							
et .									
		Assume a support threshold of 25%	1.1						
	c)	For the following data, apply the k-means clustering algorithm and form 2 clusters.	4+1						
		(0,0), (0,1), (1,0), (1,1), (4,4), (4,5), (5,4), (5,5). Initial centroids are (0,0) and (0,1). Which							
		cluster has the lower mean square distance?							
		Note: Show calculations clearly. Use Euclidean distance measure	7						
5	a)	Briefly explain how SVD can be used for Data Compression. Perform SVD on the following	3+5						
		matrix and express it as a product of 3 matrices.							
		A = [ 3 0 ]	-						
		[4 5]							
		· ·	2+4						
	b)	With a schematic diagram clearly explain the main components of a Convolutional Neural Network.	2.7						
-	c)	Explain the architecture of a Generative Adversarial Network. What is the main challenge when implementing GANs?	4+2						