Student ID:					Ι	Duratio	n: 1	5 mins		Date: 18	3/04/2023
										Score	: /3
		-		#	Der	nsity	(Grain	Н	ardness	Class
				1 Light		,	Small		Hard	Oak	
	•	,		2	He	avy	ı	Large		Hard	Oak
				3	Li	ght	I	Large		Hard	Oak
_				4	He	eavy		Small	1	Medium	Oak
decision tree from the given data. Fill in the following tables with your numerical results, each of which is rounded to three					Li	ght	,	Small	1	Medium	Pine
											Pine
decimal places. Attributes having the same best metric values are chosen in											Pine
alphabetical order.											Pine
Evaluate all attributes and circle the attribute t									tho		
					lioue or	ше		on tree.			
dataset	Heavy	 	nt	La			all	Hard		Medium	Soft
	-										
		ı									L
at still con	tains a mix	xture o	f po	sitive	and 1	negativ	e ex	amples,	eva	aluate the	remaining
Whole	Der	nsity		Grain		Hardness					
subset	Heavy	Ligh	nt	La	rge	Sma	all	Hard Medium		Soft	
			eren	ce) sı	ıpervi	sed lea	rnin	g and ur	ısuı	pervised le	arning.
	A robot in the appear are aside to the appear are aside to the aside to the aside to the area are at still content at still content are at still content are at a still content are a subset the area area area area area area area ar	A robot in a lumber rate Oak wood from the appearance of a gate aside table shows are aside table shows on the given data. For the subset of the attributes having the subset of the attribute that is the attribute that is the attribute that is the attribute decision. A robot in a lumber on the appearance of a gate as a gate of a gate as a large of a gate at a still contains a minute the attribute that is the attribute that is the attribute decision are complete decision.	A robot in a lumber yard nate Oak wood from Pine the appearance of a given he aside table shows the D3 algorithm to build a som the given data. Fill in ables with your numerical which is rounded to three at Attributes having the ric values are chosen in der. Ittes and circle the attribute to the dataset Heavy Light dataset Heavy Light whole Density subset Heavy Light subset Heavy Light	A robot in a lumber yard late Oak wood from Pine the appearance of a given le aside table shows the late of the appearance of a given le aside table shows the late of the aside table shows the late of the appearance of a given le aside table shows the late of the appearance of a given le aside table shows the late of the appearance of a given le aside table shows the late of the aside table shows the late of the attributes having the late of the attribute that in late of the attribute that is selected for late of the attribute that is	A robot in a lumber yard tate Oak wood from Pine the appearance of a given as a side table shows the 2 3 3 3 3 algorithm to build a om the given data. Fill in ables with your numerical which is rounded to three and the complete decision tree. 4 test and circle the attribute that is selected for the whole between the attribute that is selected for the whole between the attribute that is selected for the whole between the attribute that is selected for the whole between the attribute that is selected for the whole between the attribute that is selected for the whole between the attribute that is selected for the whole between the attribute that is selected for the whole between the attribute that is selected for the whole between the attribute that is selected for the whole between the attribute decision tree.	A robot in a lumber yard atte Oak wood from Pine the appearance of a given are aside table shows the 2 He 3 Li 3 Li 3 Li 3 Li 3 Li 3 Li 4 He 3 Li 4 He 4 He 5 Li 5 Li 6 He 5 Li 6 He 6 He 7 Li 6 He	A robot in a lumber yard nate Oak wood from Pine the appearance of a given ne aside table shows the Date of the given data. Fill in tables with your numerical which is rounded to three of the Attributes having the ric values are chosen in der. Whole Density Grain dataset Heavy Light Large Small Heavy Light Large Sma	A robot in a lumber yard nate Oak wood from Pine the appearance of a given the aside table shows the 2 Heavy 3 Light 4 Heavy 3 Light 5 Light 6 Heavy 6 Heavy 1	A robot in a lumber yard ate Oak wood from Pine the appearance of a given a saide table shows the 2 Heavy Large 3 Light Large 4 Heavy Small at the piven data. Fill in ables with your numerical which is rounded to three at Attributes having the ric values are chosen in a ler. The complete decision tree and complete decision tree. The complete decision tree and complete decision tree. The complete decision tree are a given as a light Small and the piven data. Fill in a light Large The piven and	A robot in a lumber yard ate Oak wood from Pine the appearance of a given the aside table shows the 2 Heavy Large 3 Light Large 3 Light Small the given data. Fill in tables with your numerical which is rounded to three increase. Attributes having the ric values are chosen in the dataset Heavy Light Large Small Hard 1 Light Small Individual Smal	A robot in a lumber yard atte Oak wood from Pine the appearance of a given the aside table shows the attribute that is selected for the next node (you may leave irrelevant ce the attribute that is selected for the next node (you may leave irrelevant ce the attribute that is selected for the next node (you may leave irrelevant ce the attribute that is selected for the next node (you may leave irrelevant ce the attribute that is selected for the next node (you may leave irrelevant ce the attribute that is selected for the next node (you may leave irrelevant ce the attribute that is selected for the next node (you may leave irrelevant ce the attribute that is selected for the next node (you may leave irrelevant ce the attribute that is selected for the next node (you may leave irrelevant ce the attribute that is selected for the next node (you may leave irrelevant ce the attribute that is selected for the next node (you may leave irrelevant ce the attribute that is selected for the next node (you may leave irrelevant ce the attribute that is selected for the next node (you may leave irrelevant ce the attribute that is selected for the next node (you may leave irrelevant ce the attribute that is selected for the next node (you may leave irrelevant ce the attribute that is selected for the next node (you may leave irrelevant ce the attribute that is selected for the next node (you may leave irrelevant ce the attribute that is selected for the next node (you may leave irrelevant ce the attribute that is selected for the next node (you may leave irrelevant ce the attribute that is selected for the next node (you may leave irrelevant ce the attribute that is selected for the next node (you may leave irrelevant ce the attribute that is selected for the next node (you may leave irrelevant ce the attribute that is selected for the next node (you may leave irrelevant ce the attribute that is selected for the next node (you may leave irr

114 CL/ (55		(CISE (I					
Student ID:				Durat	ion: 15 mins	Date:	18/04/2023
Student name:						Sco	re: <u>/ 3</u>
Question 1 (2pts) We hav	ve some data	#	Weekend?	Company?	Weather	Go Hiking?
about when peopl	e go hiki	ng. The data		γ	N	R	N N
takes into effect, w			2	Y	Y	R	N
weekend or not, if		•		Y	Y		Y
sunny, and if the	person	has company				S	
during the hike.			5	Y	N	S	Y
	decision tree from the given data. Fill in			Y	Y	R	N
				Y	Y	S	Y
the following tables with your numerical results, each of which is rounded to three decimal places. Attributes having the same best metric values are chosen			7	N	Y	S	N
			8	N	Υ	R	N
			1 9	N	N	S	N
in alphabetical o							
Evaluate all attribu				1	ı		
	Whole	Compa			ather		kend?
	dataset	N	Υ	R	S	N	Y
Entropy							
Average Entropy	\sim						
Information Gain					. ,		
For the branch tha			_	_	_		_
attributes and circle	Whole	Compa		`	you may leav		
	subset	N	···y: ✓	R	S	Weekend?	
Entropy	Jubset	14	'	K	3	IN	
Average Entropy							
Information Gain	\bigcirc						
b) (0.5pt) Draw the							
Question 2 (1pt)	Compare (s	similarity and o	difference) supervised le	earning and re	einforcement	t learning.

Student ID:				Duration: 1	5 mins	Date: 18/	04/2023
						-	-
Student name:						score.	/ 3
Question 1 (2pts whether to go to the	-		_	Hangover	Exam	Weekend	Party
about whether he			·	No	Easy	No	Yes
the next morning,		• •	1 2	No	Hard	No	No
weekend, and how is.	difficult	the incoming exam	3	No	No	No	Yes
a) (1.5pts) Use l	ID3 algo	rithm to build	a 4	No	No	Yes	Yes
decision tree fr	om the gi	ven data. Fill in th r numerical result	ne 5	Yes	Easy	No	No
each of which	·	Yes	Hard	No	No		
places. Attribu	1 /	Yes	No	No	No		
metric values order.	al 8	Yes	No	Yes	No		
Evaluate all attribu	utes and c	ircle the attribute	that is select	ed for the root	node of the	e ID3 decision	<u>1 tree.</u>
	Whole	Hangover	V	Weekend		Exam	
	dataset	No Ye	es No	Yes	Easy	Hard	No
Entropy							
Average Entropy	><						
	><						
For the branch the	at still co	ntains a mixture	of positive ar	<u>nd negative ex</u>	amples, ev	valuate the re	emaining
attributes and circ	<u>le the attr</u>	ibute that is select	ted for the ne	<u>xt node (you n</u>	<u>ıay leave ir</u>	relevant cells	s blank).
	Whole	Hangover	V	Veekend	Exam		
	subset	No Ye	es No	Yes	Easy	Hard	No
Entropy							
Average Entropy	><						
Question 2 (1pt)	Give an e	-				-	context.
		-					Describe the problemove its performance.

Student ID:	tudent ID:						15 mins	Date: 18/04/2023		
Student name:								Scor	e: / <u>3</u>	
Question 1 (2pts)				#	5	Shape	Skin	Hardness	Class	
to determine whet Bad by observing th			-	1	F	Round	Rough	Soft	Tasty	
aside table shows th			icc. The	2	F	Round	Rough	Hard	Tasty	
a) (1.5pts) Use I	D3 algor	i thm to l	nuild a	3		Oval	Smooth	Soft	Tasty	
decision tree from	_			4		Oval	Rough	Hard	Tasty	
following tables	5		Long	Rough	Soft	Bad				
each of which i	3			_		Dau				
places. Attribut	6	F	Round	Smooth	Soft	Bad				
metric values are chosen in alphabetical order.				7	F	Round	Smooth	Hard	Bad	
				8		Long	Rough	Soft	Bad	
Evaluate all attribu	tes and cir	cle the attr	ibute that	t is select	ed fo	or the roo	ot node of t	he ID3 decis	ion tree.	
	Whole	Sk	kin	H	lard	ness		Shape		
	dataset	Smooth	Rough	Hard	I	Soft	Long	Oval	Round	
Entropy										
Average Entropy										
Information Gain										
For the branch tha			-			O	•		<u> </u>	
attributes and circl							may leave		<u>ells blank).</u>	
	Whole		kin	Hardness			Shape			
	subset	Smooth	Rough	Hard	ı	Soft	Long	Oval	Round	
Entropy										
Average Entropy	\sim									
Information Gain										
Question 2 (1pt) V				that we c	hoo	se the sir	nplest cons	istent hypo	thesis?	

SOLUTION

Student ID:	Duration: 15 mins	Date: 12/04/2023
Student name:		Score: <u>/ 3</u>

Question 1 (2pts) A robot in a lumber yard learns to discriminate Oak wood from Pine wood by observing the appearance of a given piece of wood. The aside table shows the training data set.

a) (1.5pts) Use **ID3 algorithm** to build a decision tree from the given data. Fill in the following tables with your numerical results, each of which is rounded to three decimal places. Attributes having the same best metric values are chosen in alphabetical order.

	1			
#	Density	Grain	Hardness	Class
1	Light	Small	Hard	Oak
2	Heavy	Large	Hard	Oak
3	Light	Large	Hard	Oak
4	Heavy	Small	Medium	Oak
5	Light	Small	Medium	Pine
6	Heavy	Large	Soft	Pine
7	Light	Large	Soft	Pine
8	Heavy	Small	Soft	Pine

Evaluate all attributes and circle the attribute that is selected for the root node of the ID3 decision tree.

	Whole	Density		Gr	ain	Hardness			
	dataset	Heavy	Light	Large	Small	Hard	Medium	Soft	
Entropy	1	1	1	1	1	0	1	0	
Average Entropy		1		1		0.25			
Information Gain		(0		0		0.75		

For the branch that still contains a mixture of positive and negative examples, evaluate the remaining attributes and circle the attribute that is selected for the next node (you may leave irrelevant cells blank).

	Whole	Density		Gr	Grain		Hardness		
	subset	Heavy	Light	Large	Small	Hard	Medium	Soft	
Entropy	1	0	0	0	1				
Average Entropy		0		1					
Information Gain		1		0					

b) (0.5pt) Draw the complete decision tree.

Hardness = Hard: Class = Oak Hardness = Soft: Class = Pine

Hardness = Medium

|----- Density = Heavy: Class = Oak |----- Density = Light: Class = Pine

Question 2 (1pt) Compare (similarity and difference) supervised learning and unsupervised learning.

Similarity: both requires training data to build the mode

Difference: SL requires labeled training data while USL works on unlabeled data. SL generalizes the mapping from features to labels, while USL groups data points based on their features.

Student ID: Duration: 15 mins Date: 20/04/2023

Student name: Score: /3

Q1 (2pts) We have some data about when people go hiking. The data takes into effect, whether the hike is on a weekend or not, if the weather is rainy or sunny, and if the person has company during the hike.

a) (1.5pts) Use **ID3 algorithm** to build a decision tree from the given data. Fill in the following tables with your numerical results, each of which is rounded to three decimal places. Attributes having the same best metric values are chosen in alphabetical order.

#	Weekend?	Company?	Weather	Go Hiking?
1	Υ	N	R	N
2	Υ	Υ	R	N
3	Υ	Υ	S	Υ
4	Υ	N	S	Υ
5	Υ	Υ	R	N
6	Υ	Υ	S	Υ
7	N	Υ	S	N
8	N	Υ	R	N
9	N	N	S	N

Evaluate all attributes and circle the attribute that is selected for the root node of the ID3 decision tree.

	Whole	Company?		Wea	ther	Weekend?	
	dataset	N	Υ	R	S	N	Υ
Entropy	0.918	0.918	0.918	0	0.971	0	1
Average Entropy		0.918		0.539		0.667	
Information Gain		0		0.379		0.252	

For the branch that still contains a mixture of positive and negative examples, evaluate the remaining attributes and circle the attribute that is selected for the next node (you may leave irrelevant cells blank).

	Whole	Company?		Wea	ther	Weekend?		
	subset	N	Υ	R	S	N	Υ	
Entropy	0.971	1	0.918			0	0	
Average Entropy		0.951					0	
Information Gain		0.2				0.9	71	

b) (0.5pt) Draw the complete decision tree.

Weather = S

|----- Weekend? = No: No

|----- Weekend? = Yes: Yes

Weather = R: No

Q2 (1pt) Compare (similarity and difference) supervised learning and reinforcement learning.

Similarity: both has the feedback information, SL is guided by the difference between the actual value produced by the model and the ground truth, while RL is guided by the feedback from the environment

Difference: SL can precisely adjust the model based on the difference between the actual value produced by the model and the ground truth, while the feedback in RL is quite simple and not informative enough

Student ID:	Duration: 15 mins	Date: 12/04/2023
Student name:		Score: <u>/ 3</u>

Question 1 (2pts) A robot in a fruit farm learns to determine whether an avocado is Tasty or Bad by observing the avocado's appearance. The aside table shows the training data set.

c) (1.5pts) Use **ID3 algorithm** to build a decision tree from the given data. Fill in the following tables with your numerical results, each of which is rounded to three decimal places. Attributes having the same best metric values are chosen in alphabetical order.

-				
#	Shape	Skin	Hardness	Class
1	Round	Rough	Soft	Tasty
2	Round	Rough	Hard	Tasty
3	Oval	Smooth	Soft	Tasty
4	Oval	Rough	Hard	Tasty
5	Long	Rough	Soft	Bad
6	Round	Smooth	Soft	Bad
7	Round	Smooth	Hard	Bad
8	Long	Rough	Soft	Bad

Evaluate all attributes and circle the attribute that is selected for the root node of the ID3 decision tree.

	Whole	Skin		Hardness		Shape		
	dataset	Smooth	Rough	Hard	Soft	Long	Oval	Round
Entropy	1	0.918	0.971	0.918	0.971	0	0	1
Average Entropy		0.951		0.951		0.5		
Information Gain		0.049		0.049		0.5		

For the branch that still contains a mixture of positive and negative examples, evaluate the remaining attributes and circle the attribute that is selected for the next node (you may leave irrelevant cells blank).

	Whole	Skin		Hardness		Shape		
	subset	Smooth	Rough	Hard	Soft	Long	Oval	Round
Entropy	1	0	0	1	1			
Average Entropy		0		1				
Information Gain		1		0				

d) (0.5pt) Draw the complete decision tree.

Shape = Oval: Class = Tasty Shape = Long: Class = Bad

Shape = Round

|----- Skin = Rough: Class = Tasty |----- Skin = Smooth: Class = Bad

Question 2 (1pt) Give an example of the reinforcement learning problem. Describe the problem context. State clearly the rewards and how the agent uses that information to improve its performance.

You are training your dog to get the stick. Each time the dog returns a stick successfully, you offer it favorite treats. Eventually, the dog understands that whenever the master throws a stick, it should get it as early as possible to gain a reward (a bone) from a master in a lesser time.

Student ID:	Duration: 15 mins	Date: 20/04/2023
Student name:		Score:/ <u>3</u>

Q1 (2pts) A student is considering whether to go to the party or not. He is thinking about whether he may have a terrible hangover the next morning, whether the party is held at weekend, and how difficult the incoming exam is.

c) (1.5pts) Use **ID3 algorithm** to build a decision tree from the given data. Fill in the following tables with your numerical results, each of which is rounded to three decimal places. Attributes having the same best metric values are chosen in alphabetical order.

#	Hangover	Exam	Weekend	Party
1	No	Easy	No	Yes
2	No	Hard	No	No
3	No	No	No	Yes
4	No	No	Yes	Yes
5	Yes	Easy	No	No
6	Yes	Hard	No	No
7	Yes	No	No	No
8	Yes	No	Yes	No

Evaluate all attributes and circle the attribute that is selected for the root node of the ID3 decision tree.

	Whole	Hangover		Weekend		Exam		
	dataset	No	Yes	No	Yes	Easy	Hard	No
Entropy	0.954	0.811	0	0.918	1	1	0	1
Average Entropy		0.406		0.939		0.75		
		0.548		0.015		0.204		

For the branch that still contains a mixture of positive and negative examples, evaluate the remaining attributes and circle the attribute that is selected for the next node (you may leave irrelevant cells blank).

	Whole	Hangover		Weekend		Exam			
	subset	No	Yes	No	Yes	Easy	Hard	No	
Entropy	0.811			0.918	0	0	0	0	
Average Entropy				0.689		0			
					0.123		0.811		

d) (0.5pt) Draw the complete decision tree.

Hangover = No |----- Exam = Easy: Yes |----- Exam = Hard: No |----- Exam = No: No Hangover = Yes: No

Q2 (1pt) What is a hypothesis? Why is it that we choose the simplest consistent hypothesis?

A hypothesis gives an estimation of the true underlying distribution of data, and it is needed to be verified.

The simplest consistent hypothesis can fit all the training data points while it is general enough to avoid overfitting