IIV-CLA33	L/L	CISE (I	٦)					
Student ID:					Duration	: 15 mins	Date: 20	0/04/2023
Student name:							Score	e: / 3
Q1 (2pts) A nu				#	Ago/20	Eat Pizza	Exercise	Result
developing a new		-	-	1	Age<30 Yes	Yes	Yes	Fit
Thus, they set out t	o study ho	ow age and life	estyle		Yes	Yes	No	
affect an individual	s body sha	pe. The follow	ing is	3				Fit
the training data se	t.				Yes	No	Yes	Fit
a) (1.5pts) Use l	D3 algor	rithm to bui	ild a	4	Yes	No	Yes	Fit
decision tree fr	om the giv	ven data. Fill i	n the	5 6	No	Yes	Yes	Unfit
•	following tables with your numerical results,				No	Yes	No	Unfit
each of which is rounded to three decimal places. Attributes having the same best metric				7	No	No	Yes	Fit
places. Attribute values are chose	_		netric	8	No	No	No	Fit
	•		to that i	a aolaat	ad fan tha na	ot nodo of t	ho ID2 dogigi	on troo
Evaluate all attribu	Whole	Age<		<u>is seiect</u>	Eat Pizz	1	Exerci	
	dataset	No Age\	Yes		No	Yes	No	Yes
Entropy								
Average Entropy								
Information Gain								
For the branch that	t still con	tains a mixtur	e of po	sitive a	nd negative	examples, o	evaluate the	remaining
attributes and circl	<u>e the attril</u>	oute that is sel	ected fo	r the ne	ext node (you	<u>u may leave</u>	<u>irrelevant ce</u>	lls blank).
	Whole	Age<	30		Eat Pizza		Exerci	ise
	subset	No	Yes		No	Yes	No	Yes
Entropy								
Average Entropy								
Information Gain								
a) (0.5pt) Draw the Q2 (1pt) Identify when the Pentagon (US) for a specific depart their envelopes. A second	vhich type i) meeting i tment. Pap	of learning sho room, there is a pers belonging	ould be cabined to differ	t with te rent dep	n drawers, eo oartments ha	ach contains we different	confidential patterns and	documents d colors for

Student ID:					Duration:	15 mins	Date: 20/04/2023	
Student name:							30016	: / 3
Q1 (2pts) We have		•	•	#	Weekend?	Company?	Weather	Go Hiking?
go hiking. The data				1	Υ	N	R	N
hike is on a weeken			•	2	Υ	Υ	R	N
or sunny, and if the the hike.	e person na	as company u	uring	3	Υ	Υ	S	Υ
				4	Υ	N	S	Υ
b) (1.5pts) Use l	_			5	Υ	Υ	R	N
decision tree fr	_			6	Υ	Υ	S	Υ
following tables with your numerical results, each of which is rounded to three decimal			7	N	Y	S	N	
places. Attributes having the same best metric				8	N	Υ	R	N
values are chosen in alphabetical order.			9	N	N	S	N	
Evaluate all attribu	tes and cire	cle the attribu	te that i	s select	ed for the ro	ot node of th	ie ID3 decisi	ion tree.
	Whole	Compa			Weathe		Weeke	
	dataset	N	Υ		R	S	N	Υ
Entropy								
Average Entropy		<u> </u>			'		<u></u>	
Information Gain								
For the branch tha	nt still cont	ains a mixtur	e of po	sitive a	nd negative	examples, e	valuate the	remaining
attributes and circl	e the attrib	oute that is sel	ected fo	r the ne	xt node (you	ı may leave i	<u>rrelevant ce</u>	ells blank).
	Whole	Compa	-		Weathe		Weeke	
	subset	N	Υ		R	S	N	Υ
Entropy								
Average Entropy								
Information Gain								
Q2 (1pt) Identify v A teaching assistar similar writing style time he finds more	vhich type o nt is gradin es and bugs	of learning sh ng his student committed. Ho	ould be s' codin e does no	g assigr ot know	nments. He r precisely hov	ecognizes th v many such	at several v	works have

INI CLACC EVED CICE (IE)

Student ID:		••••			Duration: 15	mins	Date: 20/	04/2023
Student name:							Score:	/ 3
Q1 (2pts) A stud		•		#	Hangover	Exam	Weekend	Party
go to the party whether he may		_		1	No	Easy	No	Yes
next morning, w		•				•		
weekend, and ho	w difficult	the incomin	g exam	2	No	Hard	No	No
is.				3	No	No	No	Yes
a) (1.5pts) Use	ID3 algo	orithm to b	ouild a	4	No	No	Yes	Yes
decision tree f	rom the g	iven data. Fil	l in the	5	Yes	Easy	No	No
_	following tables with your numerical results, each of which is rounded to three decimal					·		
				6	Yes	Hard	No	No
places. Attrib metric values		_		7	Yes	No	No	No
order.			8	Yes	No	Yes	No	
Evaluate all attrib	outes and o	circle the attr	ibute that	is selected	for the root	node of th	e ID3 decision	ı tree.
	Whole	Hango		Weekend			Exam	
	dataset	No	Yes	No	Yes	Easy	Hard	No
Entropy								
Average Entropy								
For the branch the			_		· ·	•		Ŭ
attributes and cir	1	I		1		<u>ay leave i</u>		s blank).
	Wholes subset	Hango No	Yes	No	eekend Yes	Easy Hard		No
Entropy	Jubset	INO	163	110	163	Lasy	Tiaru	INO
Average Entropy								
Q2 (1pt) Identify You are training y treats. Eventually possible to gain a	which typ your dog to the dog u	oe of learning o get the stick nderstands ti	should b Each tim	ne the dog r ever the ma	eturns a stick ster throws a	successfu	lly, you offer it	t favorite

Student ID:				D	uration: 15 r	nins	Date: 20	0/04/2023
Student name:							Score	e: / 3
Q1 (2pts) Let's say	y after you	r encounter	#	Casts shadov	s Eat garlic	Skin comp	lexion	Vampire
with several peo	ple, you	don't want	1	Dont knov		Pale		No
vampires to be you	ur friend i	n future. So	2			Rudd		No
you made a list of s	•		3	Dont knov	Yes No	Rudd	•	Yes
their characteristic		they turned	4	No	No	Avera	•	Yes
out to be a vampire	or not.		5	Dont knov		Averag		Yes
a) (1.5pts) Use ID :	3 algorith	m to build a	6	Yes	No	Pale		No
	_		7	Yes	No	Avera		No
decision tree from the given data.			8	Dont knov		Rudd		No
Attributes having t Evaluate all attribu	ites and cii	rcle the attribu	ite that	is selected fo	r the root no	de of the ID		
	Whole dataset	Casts sh			nt garlic		comple	
Entropy	dataset	Dont know	Yes	S No	Yes	Average	Pale	Ruddy
Entropy								
Average Entropy Information Gain								
	at atill con	taina a mintur	no of no	saitive and m	acativa avan	anles erreli	ata tha	
For the branch that attributes and circle			_		_	_		_
	Whole	Casts sha			t garlic	Skin complexion		
	subset	Dont know	Yes	No	Yes	Average	Pale	Ruddy
Entropy								
Average Entropy								
Information Gain								
Q2 (1pt) Give an clearly the rewards	example o	f the reinforce	ement l			_		ntext. State

SOLUTION

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

Q1 (2pts) A nutritional food company is developing a new product in the ABC country. Thus, they set out to study how age and lifestyle affect an individual's body shape. The following is the training data set.

b) (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.

#	Age<30	Eat Pizza	Exercise	Result
1	Yes	Yes	Yes	Fit
2	Yes	Yes	No	Fit
3	Yes	No	Yes	Fit
4	Yes	No	Yes	Fit
5	No	Yes	Yes	Unfit
6	No	Yes	No	Unfit
7	No	No	Yes	Fit
8	No	No	No	Fit

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

	Whole	Age<30		Eat I	Pizza	Exercise	
	dataset	No	Yes	No	Yes	No	Yes
Entropy	0.811	1	0	0	1	0.918	0.722
Average Entropy		0.5		0.5		0.796	
Information Gain		0.311		0.311		0.015	

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	Age<30		Eat F	Pizza	Exercise		
	subset	No	Yes	No	Yes	No	Yes	
Entropy	1			0	0	1	1	
Average Entropy				0		1		
Information Gain					1		0	

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

```
Age<30 = No
|----- Eat Pizza = No: Fit
|---- Eat Pizza = Yes: Unfit
Age < 30 = Yes: Fit
```

Q2 (1pt) Identify which type of learning should be used to solve the following task. Explain your choice. In the Pentagon (US) meeting room, there is a cabinet with ten drawers, each contains confidential documents for a specific department. Papers belonging to different departments have different patterns and colors for their envelopes. A secretary is holding a pile of documents, delivering every document to one of the drawers.

Supervised learning. The number of classes is defined, which is ten drawers. The attributes characterizing each drawer is the pattern and color of envelopes. Each envelope can only go to one of the designated drawer following its pattern and color.

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?		Weather		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	0.2				0.971	

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

Weather = S |----- Weekend? = No: No |---- Weekend? = Yes: Yes Weather = R: No

Q2 (1pt) Identify which type of learning should be used to solve the following task. Explain your choice. A teaching assistant is grading his students' coding assignments. He recognizes that several works have similar writing styles and bugs committed. He does not know precisely how many such groups. However, every time he finds more than two similar assignments, he marks them as a new group.

Unsupervised learning. The number of classes is not defined in advance. A different combination of writing style and bug introduce a new group and more combinations can be found during the grading.

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

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		Wee	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) Identify which type of learning should be used to solve the following task. Explain your choice. 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.

Reinforcement learning. It is a trial-and-error process in which the agent only receives signal indicating success (found stick -> receive treats) or failure (not found stick -> no treats) and itself determines how to update the policy (find sticks in lesser time to get treats sooner)

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

Q1 (2pts) Let's say after your encounter with several people, you don't want vampires to be your friend in future. So you made a list of several people you met, their characteristics and if they turned out to be a vampire or not.

c) (1.5pts) Use **ID3 algorithm** to build a decision tree from the given data.

1				
#	Casts shadows	Eat garlic	Skin complexion	Vampire
1	Dont know	Yes	Pale	No
2	Yes	Yes	Ruddy	No
3	Dont know	No	Ruddy	Yes
4	No	No	Average	Yes
5	Dont know	No	Average	Yes
6	Yes	No	Pale	No
7	Yes	No	Average	No
8	Dont know	Yes	Ruddy	No

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.

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

	Whole	Casts shadow		Eat garlic		Skin complexion			
	dataset	Dont know	Yes	No	No	Yes	Average	Pale	Ruddy
Entropy	0.954	1	0	0	0.971	0	0.918	0	0.918
Average Entropy		0.5		0.60	07		0.689		
Information Gain		0.454		0.348		0.266			

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	Casts shadow		Eat garlic		Skin complexion		on	
	dataset	Dont know	Yes	No	No	Yes	Average	Pale	Ruddy
Entropy	1				0	0	0	0	1
Average Entropy					0			0.375	
Information Gain					1			0.625	

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

Casts shadows? = Dont know |----- Eat garlic? = Yes: No |---- Eat garlic? = No: Yes Casts shadows? = Yes: No Casts shadows? = No: Yes

Q2 (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.

Refer to Q2 in the previous page.		