		10102 (10							
Student ID:					Duration	: 15 mins	Date: 14	4/08/2023	
Student name:							Score	: /3	
Q1 (2pts) A nu	tritional f	food company	is	#	Age<30	Eat Pizza	Exercise	Result	
developing a new	•		-	1	Yes	Yes	Yes	Fit	
Thus, they set out t	-	•	•	2	Yes	Yes	No	Fit	
affect an individual'		pe. The followir	ng is	3	Yes No		Yes	Fit	
the training data se			_	4	Yes	No	Yes	Fit	
a) (1.5pts) Use I	_			5	No	Yes	Yes	Unfit	
decision tree fr	•			6	No	Yes	No	Unfit	
following tables each of which		7	No	No	Yes	Fit			
places. Attribute		8	No	No	No	Fit			
values are chose									
Evaluate all attribu	tes and circ	cle the attribute	e that i	s select	ed for the ro	ot node of tl	ne ID3 decisi	on tree.	
	Whole Age<30				Eat Pizz	1	Exercise		
	dataset	No	Yes		No	Yes	No	Yes	
Entropy									
Average Entropy					<u>'</u>		<u> </u>		
Information Gain									
For the branch tha	t still cont	ains a mixture	of po	sitive a	nd negative	examples, e	valuate the	remaining	
attributes and circl	1	ute that is selec	cted fo	r the ne		_			
	Whole	Age<3			Eat Pizz		Exerci		
	subset	No	Yes		No	Yes	No	Yes	
Entropy									
Average Entropy									
Information Gain									
Q2 (1pt) Identify w In the Pentagon (Udocuments for a spectra assistant knows	which type o US) meeting	of learning show groom, there tment. Documen	is a co nts for	abinet v differei	vith ten dra nt departmen	wers, each on the state of the	containing c	onfidential and colors.	

				Duration:	15 mins	Date: 1	4/08/2023
						Score	e: <u>/ 3</u>
some data	about when p	eople	#	Weekend?	Company?	Weather	Go Hiking?
takes into	effect, whethe	er the					N
d or not, if t	he weather is	rainy					N
e person ha	as company d	uring		-	-		Υ
		_			-		Y
D3 algor	ithm to bui	ild a					N
_							Υ
with your	numerical re	sults,					N
is rounded	to three de	cimal			-		N
es having th	ie same best m	netric					N
en in alphal	oetical order.	ļ					
tes and circ	cle the attribu	<u>te that i</u>	s select	ed for the ro	ot node of t	he ID3 decis	ion tree.
Whole	Compa	any?		Weathe	r	Weeke	end?
dataset	N	Υ		R	S	N	Υ
				•		<u>'</u>	
t still cont	ains a mixtur	e of po	sitive a	nd negative	examples,	evaluate the	remaining
<u>e the attrib</u>	ute that is sel	ected fo	r the ne	xt node (you	<u>may leave</u>	<u>irrelevant ce</u>	ells blank).
Whole	Compa	any?		Weathe	r	Weeke	end?
subset	N	Υ		R	S	N	Υ
nt is gradin es and bugs	g his student. committed. He	s' coding e does no	g assigr ot know	nments. He r precisely hov	ecognizes t v many such	hat several ı	works have
	some data takes into d or not, if the person had algor om the gives with your is rounded as having the in alphalates and circ whole dataset Whole dataset Whole subset which type on the grading and bugs	some data about when per takes into effect, whether is a person has company described or not, if the weather is a person has company described at a signal or the person has c	some data about when people takes into effect, whether the dor not, if the weather is rainy experson has company during (ID3 algorithm to build a something the given data. Fill in the swith your numerical results, is rounded to three decimal eshaving the same best metric en in alphabetical order. Ites and circle the attribute that in the subset N Y At still contains a mixture of pose the attribute that is selected for the attribute that is selected for the attribute that is subset N Y Whole Company? The tribute that is selected for the attribute that is subset N Y Whole Company? The tribute that is selected for the attribute decision tree.	some data about when people takes into effect, whether the dor not, if the weather is rainy experson has company during 3 (D3 algorithm to build a som the given data. Fill in the swith your numerical results, is rounded to three decimal eshaving the same best metric en in alphabetical order. Ites and circle the attribute that is selected whole Company? dataset N Y Whole Company? dataset N Y Whole Company? subset N Y	some data about when people takes into effect, whether the dor not, if the weather is rainy eperson has company during a mixture of positive and negative ethe attribute that is selected for the next node (you whole Company? Weather subset N Y R which type of learning should be used to solve the fol at is grading his students' coding assignments. He rest and bugs committed. He does not know precisely how	some data about when people takes into effect, whether the dornot, if the weather is rainy e person has company during a person has company during a form the given data. Fill in the swith your numerical results, is rounded to three decimal eshaving the same best metric en in alphabetical order. Ites and circle the attribute that is selected for the root node of the attribute that is selected for the root node of the ethe attribute that is selected for the next node (you may leave the attribute that is selected for the next node (you may leave the attribute that is selected for the root node of the attribute that is selected for the next node (you may leave the attribute that is selected for the next node (you may leave the attribute that is selected for the next node (you may leave the attribute that is selected for the next node (you may leave the attribute that is selected for the next node (you may leave the attribute that is selected for the next node (you may leave the attribute that is selected for the next node (you may leave the attribute that is selected for the next node (you may leave the attribute that is selected for the next node (you may leave the attribute that is selected for the next node (you may leave the following task at is grading his students' coding assignments. He recognizes the person is grading his students' coding assignments. He recognizes the following task at its grading his students' coding assignments. He recognizes the person is grading his students' coding assignments. He recognizes the following task at its grading his students' coding assignments. He recognizes the following task at its grading his students' coding assignments. He recognizes the following task at its grading his students' coding assignments.	Score some data about when people takes into effect, whether the dor not, if the weather is rainy e person has company during a person has company a person has com

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Student ID:					Duration: 15	mins	Date: 14/	08/2023
Student name:							Score:	/ 3
Q1 (2pts) A stude	ent is con	sidering whe	ether to					
go to the party o		_	-	#	Hangover	Exam	Weekend	Party
whether he may l		J		1	No	Easy	No	Yes
next morning, wl weekend, and hov				2	No	Hard	No	No
is.	· ummoure		8 chair	3	No	No	No	Yes
a) (1.5pts) Use	ID3 algo	orithm to b	ouild a	4	No	No	Yes	Yes
decision tree fi	om the g	iven data. Fil	ll in the	5	Yes	Easy	No	No
following table	-					·		
each of which places. Attribu				6	Yes	Hard	No	No
metric values		7	Yes	No	No	No		
order.				8	Yes	No	Yes	No
Evaluate all attrib	utes and o	circle the attr	ibute that	is selected	for the root	node of th	e ID3 decision	ı tree.
	Whole	I	Hangover		Weekend		Exam	
	dataset	No	Yes	No	Yes	Easy	Hard	No
Entropy								
Average Entropy	><							
For the branch th			•		<u> </u>	•		•
attributes and circ		I				ay leave i		s blank).
	Whole	Hange	ı		ekend	Exam No.		
Entropy	subset	No	Yes	No	Yes	Easy	Hard	No
Entropy Average Entropy								
Average Entropy								
b) (0.5pt) Draw tQ2 (1pt) Identify	which typ	oe of learning	should b		eturns a stick	_	Explain your (t favorite

					Dul	ation: 15 n	11113	Date: 1	1,00,20
Student name:								Score	e:
Q1 (2pts) Let's say	after you	r encounter	#	Casts sh	adows	Eat garlic	Skin compl	exion	Vampir
with several peo _l	ple, you	don't want	1	Dont	know	Yes	Pale		No
vampires to be you			2	Ye	es	Yes	Rudd	y	No
you made a list of so			3	Dont	know	No	Rudd	y	Yes
their characteristic		they turned	4	N	О	No	Averag	ge	Yes
out to be a vampire	or not.		5	Dont	know	No	Averag	ge	Yes
a) (1.5pts) Use ID :	3 algorith	m to build a	6	Ye	es	No	Pale		No
decision tree fro	_		7	Ye	es	No	Averag	ge	No
			8	Dont	know	Yes	Rudd	y	No
Attributes having t Evaluate all attribu								<u>3 decis</u>	ion tree.
	Whole	Casts s	shadow		Ea	t garlic	Skin comple		exion
	dataset	Dont know	Yes	No	No	Yes	Average	Pale	Rud
Entropy									
Average Entropy									
Information Gain									
For the branch tha	at still con	tains a mixtu	re of po	sitive a	nd neg	ative exan	iples, evalu	ate the	remain
attributes and circl	1			or the ne					
	Whole		shadow		Eat garlic		Skin complex		
	subset	Dont know	Yes	No	No	Yes	Average	Pale	Rud
Entropy									
Average Entropy									
Information Gain									
b) (0.5pt) Draw th	ie compiet	e decision tre	e.						

SOLUTION

Student ID:	Duration: 15 mins	Date: 14/08	/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.

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.

#	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 F	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		0.3	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	

b) (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 containing confidential documents for a specific department. Documents for different departments have specific patterns and colors. The assistant knows this rule and thus he is in charge of delivering incomings documents to the drawers.

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

Student ID:	Duration: 15 mins	Date: 14/08	/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 Y		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	ather	Weekend?	
	subset	N	Υ	R	S	N	Υ
Entropy	0.971	1	0.918			0	0
Average Entropy		0.951				0	
Information Gain		0.3	0.2				71

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: 14/08	/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.

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.

#	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		Wee	kend	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	kend	Exam			
	subset	No	Yes	No	Yes	Easy	Hard	No	
Entropy	0.811			0.918	0	0	0	0	
Average Entropy				0.689		0			
				0.1	.23		0.811		

b) (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: 14/08/2023		
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.

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

#	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			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		Casts shadow		Eat g	arlic	Skin	complexi	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			

b) (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) Identify which type of learning should be used to solve the following task. Explain your choice. A robot enters a maze and finds a way to exit. He has not known what is at a specific square of the maze until he reaches it. He needs to explore different paths in the maze and sometimes he gets stuck with a dead end. However, he soon remembers the failures and tries not to repeat them.

Reinforcement learning. It is a trial-and-error process in which the agent must explore different paths and sometimes he gets stuck with a dead end. The more paths he has explored, the more knowledge he gets to update the policy (remember the failures and not repeat them)