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AI - Quiz

Q-1

Paper reading	Project Assesment	Endsem	Result
No	Yes	Yes	Fail
Yes	Yes	No	Pass
No	Yes	No	Fail
Yes	No	No	Fail
Yes	Yes	Yes	Pass
No	No	No	Fail
No	No	Yes	Fail
Yes	No	Yes	Fail

--- Entropy Calculation ---

~~Paper reading~~

Total entropy (2P, 6F) :

$$= \frac{2}{8} \log\left(\frac{2}{8}\right) + \frac{6}{8} \log\left(\frac{2}{8}\right)$$

$$= 0.81127$$

- Papers reading

Yes 2P 2F ● entropy: 1

No 0P 4F entropy: 0

- Prog Assesment

  Yes 2P 2F entropy 1

  No 0 P 4F entropy 0

- End Sem

  Yes 1P 3F entropy 0.81127

  No 1P 3F entropy 0.81127

* Weighted average

- Paper reading 0.5
- Prog assessment 0.5
- end sem 0.81127

Maximal change in entropy can be observed by asking either paper reading or Prog assessment

- Choosing paper reading

• Paper reading → Yes

Prog ass	End sem	Result
Yes	NO	Pass
NO	NO	Fail
Yes	Yes	Pass
NO	Yes	Fail

Total entropy : 1

Programming Assessment	entropy
• Yes	2P 0F 0
• NO	0P 2P 0

weighted sum = 0

End sem	entropy
• Yes	1P 1F 1
• NO	1P 1P 1

weighted sum = 1

Maximal change in entropy can be achieved by asking programming assessment

→ Choosing programming assessment

Programming assessment → Yes

End sem	Result
NO	Pass
Yes	Pass

Programming Assessment → No

End sem	Result
NO	Fail
Yes	Fail

⇒ Both are leaf nodes as entropy is zero.

• Paper reading → NO

Prog. Ass	End sem	Result
Yes	Yes	Fail
Yes	NO	Fail
NO	NO	Fail
NO	Yes	Fail

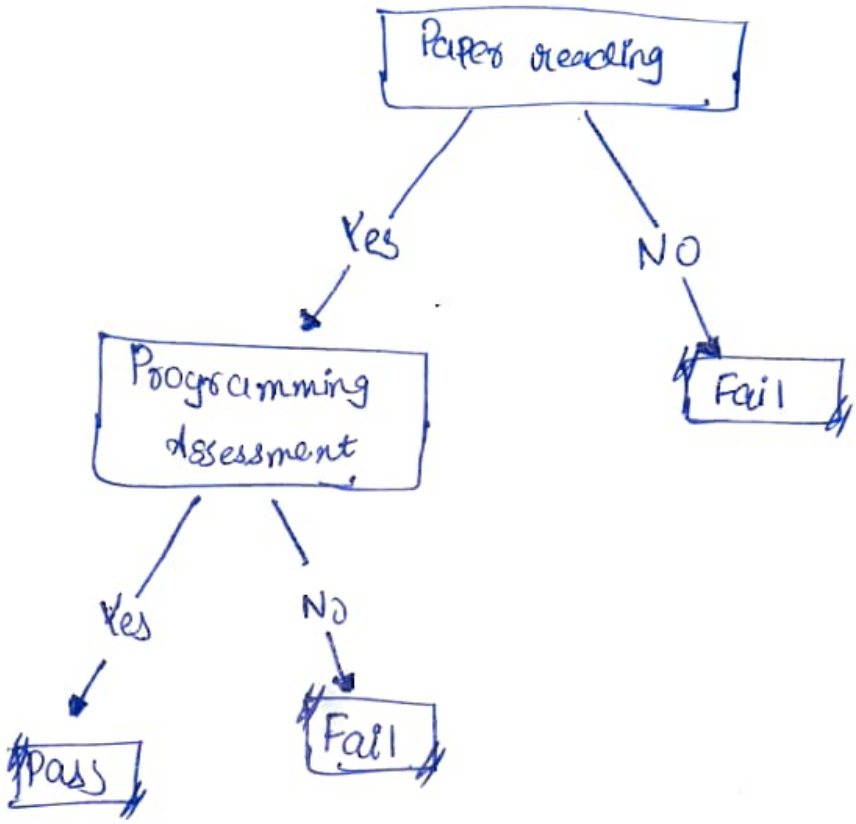
Total entropy : 0

~~Programming Assessment~~

this is Leaf node

entropy is zero

★ Resulting Decision Tree.



Q-2

Paper reading	Programming Assessment	Endsem	Result
No	Satisfactory	Above Average	Fail
Yes	satisfactory	Below Average	Pass
No	Satisfactory	Below Average	Fail
Yes	Not satisfactory	Below Average	Fail
Yes	satisfactory	Above Average	Pass
No	not satisfactory	Below Average	Fail
No	Not satisfactory	Above Average	Fail
Yes	Not satisfactory	Above Average	Fail

Total entropy : (2P, 6F) = 0.81127

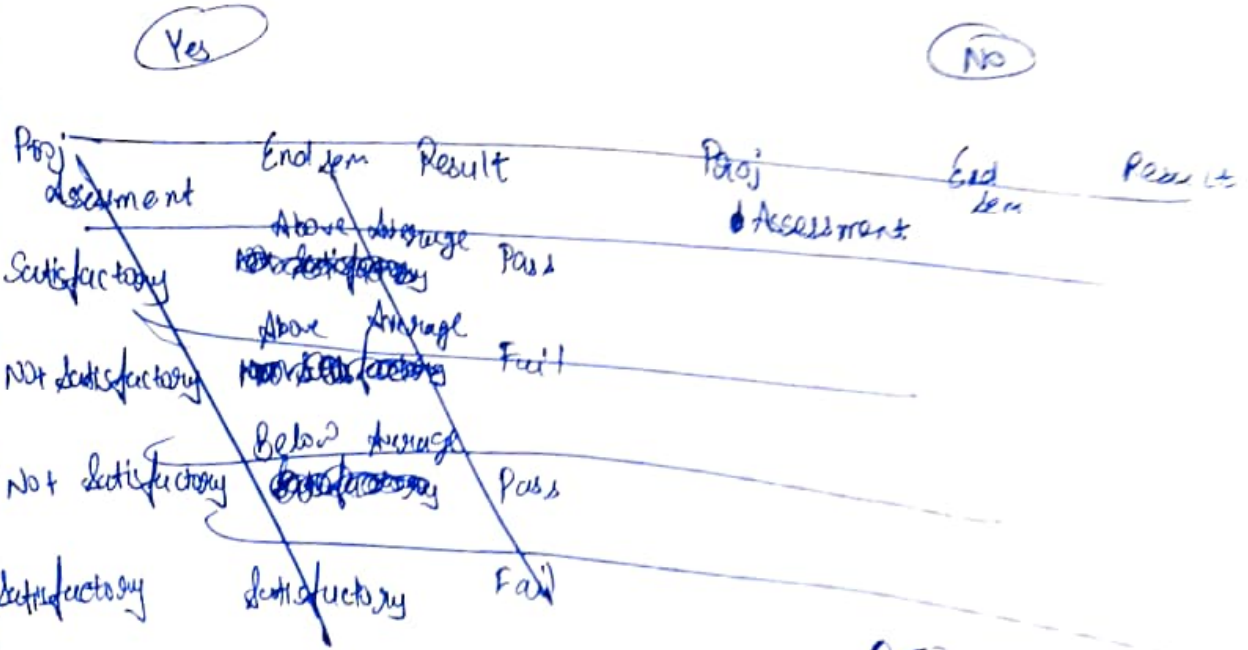
• Paper reading			entropy	weighted avg
Yes	2P	2F	1	0.5
No	0P	4F	0	

• Proj' assessment			entropy	weighted average
Satisfactory	2P	2F	1	0.5
Not satisfactory	0P	4F	0	

• End Sem			entropy	weighted average
Above Average	1P	3F	0.81127	0.81127
Below Average	1P	3F	0.81127	

• * Maximal change can be observed when one asks either paper reading or projected assessment.

Choosing paper reading



PTO

Choosing paper Reading

Yes

Project Assessment	End Sem	Result
S	BA	Pass
NS	BA	Fail
S	AA	Pass
NS	AA	Fail

Total entropy = 1

- Proj Assessment — entropy — weighted Avg

S	2P	0F	0
NS	0P	2P	0

- End Sem — entropy — weighted Avg

AA	1P	1F	1
BA	1P	1F	1

(1)

maximal change in entropy can be observed for project Assessment.

- choosing project Assessment (P To)

ND

Proj	Endsem	Result
S	AA	F
S	BA	F
NS	BA	F
NS	AA	F

(leaf node)

0

Yes

End sem	Result
BA	Pass
AA	Pass

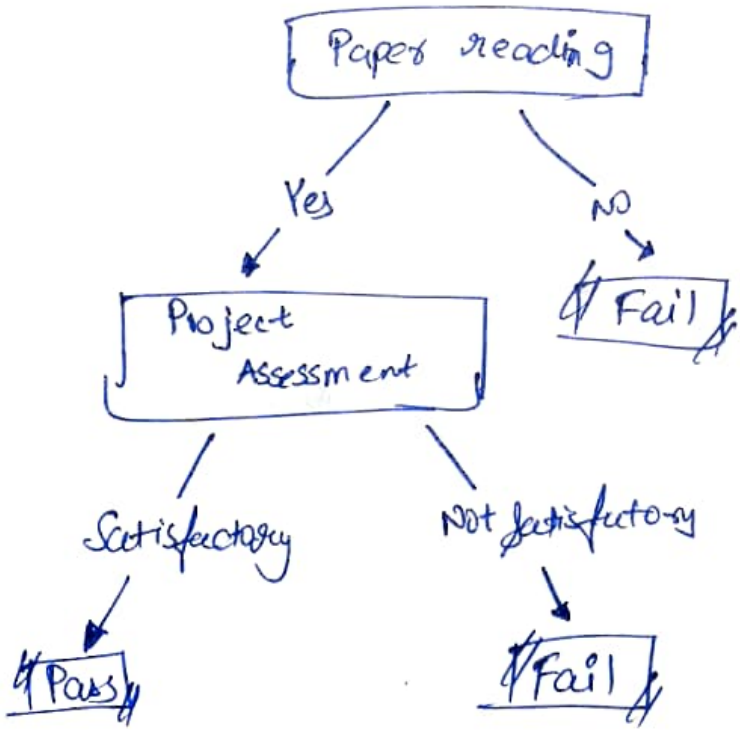
leaf node

No

End sem	Result
BA	F
AA	F

leaf node

Resulting Decision tree



[PTO]

Q-3

Size	Orbit	Temp	Humidity	Sustainable ?
Big	Near	20	20	
Big	Far	17	70	Yes
Small	Near	13	80	Yes
Small	Far	45	90	Yes
Big	Near	130	10	NO
Big	Far	2	40	No
Small	Near	5	80	No
Small	Far	300	50	No
Big	Far	30	50	Yes

Total Entropy : (4Y, 4N)

$$\frac{1}{2}\log\left(\frac{1}{2}\right) + \frac{1}{2}\log\left(\frac{1}{2}\right) = 1.$$

(i) Considering only three columns

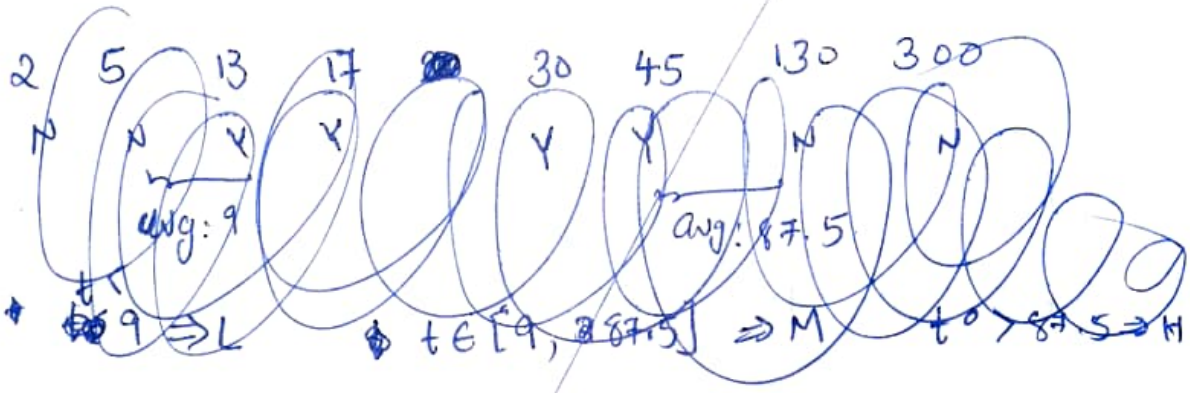
Orbit		Entropy	weighted average
Near	1Y 2N	0.9829	0.9511
Far	3Y 2N	0.9709	

Size

		Entropy	weighted average
B	2Y 2N	1	1
S	2Y 2N	1	

Temperature

⇒ Arranging in ascending order



temperature

Arranging in ascending order

N N Y Y Y Y N N

2, 5, 13, 17, 30, 45, 130, 300

taking avg of temperature = 67.5

$t < 67.5 \Rightarrow$ Low

$t > 67.5 \Rightarrow$ High

		Entropy	weighted avg.
Low	2N 4Y	0.9183	0.688725
High	2N	0	

maximal difference is in temperature

choosing temperature

low

Size	Orbit	Sustainability
B	F	Y
S	N	Y
S	F	Y
B	F	N
S	N	N
B	F	Y

High

Size	orbit	Sustainability
B	N	N
S	F	N

{leaf node}

total entropy: (2N, 4Y) 0.9183

Size			Entropy	weighted avg: 0.91829
B	2Y	1N	0.91829	
S	2Y	1N	0.91829	

Orbit			Entropy	weighted avg =
F	3Y	1N	0.8127	0.8741
N	1Y	1N	1	

Maximal difference in entropy is in orbit

Q-3

Size	Orbit	Temperature	Humidity	Sustainable
Big	Near	20	20	?
Big	Far	17	70	Yes
Small	Near	13	80	Yes
Small	Far	45	90	Yes
Big	Near	130	10	No
Big	Far	2	40	No
Small	Near	5	60	No
Small	Far	300	50	No
Big	Far	30	50	Yes

Labeling temperature and Humidity

Temp

5	13	17	30	45	130	300
N	N	Y	Y	Y	Y	N	N

avg: 9 — avg: 87.5

Low — Medium — High

Humidity

10	40	50	50	60	70	80	90
N	N	Y	N	N	Y	Y	Y

avg: 45 — avg: 65

Low — Medium — High

(9)

Total entropy : (4Y, 4N)

$$-\left[\frac{4}{8}\log\left(\frac{4}{8}\right) + \frac{4}{8}\log\left(\frac{4}{8}\right)\right] = 1$$

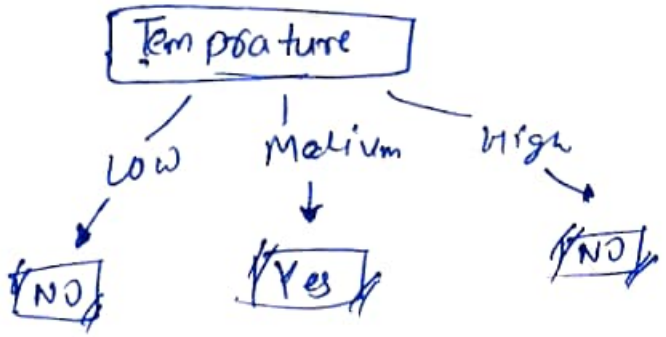
Size

			Entropy	weighted average
B	2Y	2N	1	1
S	2Y	2N	1	

Obsit			Entropy	weighted average
N	1Y	2N	0.9184	0.9511
F	3Y	2N	0.9184	

Temperature		Entropy	weighted average
L	2N	0	0
M	4Y	0	
H	2N	0	

* Decision tree



For data entry (1) temperature is medium so sustainability is Yes

(b) Categorizing temperature based on average

i.e $t \leq 67.75 \Rightarrow$ Low

$t > 67.75 \Rightarrow$ High

total entropy = 1

weighted avg.

Entropy of size, orbit are same $\Rightarrow$ 1, 0.9511

temperature		Entropy	weighted avg $\Rightarrow$ 0.6887
L	2N, 4Y	0.9183	
H	2N	0	

Humidity

		Entropy	weighted avg.
L	2N	0	
M	1Y 2N	0.91829	0.344
H	3Y	0	

Maximal change is observed in humidity.

Choosing humidity.

Here, Low and High are leaf nodes on. low sustainability is No and on high sustainability is Yes.

Medium humidity

Size	Orbit	temperature	Sustainibility
S	F	800	Y
B	F	80	N
S	N	5	N

Total entropy (2N, 1Y) = 0.9183

Size

		Entropy	weighted avg
S	1Y 1N	1	0.667
B	N	0	

Orbit		Entropy	weighted avg
F	1Y 1N	1	0.667
N	1N	0	

temperature		Entropy
H	2N	0
L	1Y	0

choosing temperature

High

Size	orbit	sustainability
B	F	N
S	N	N

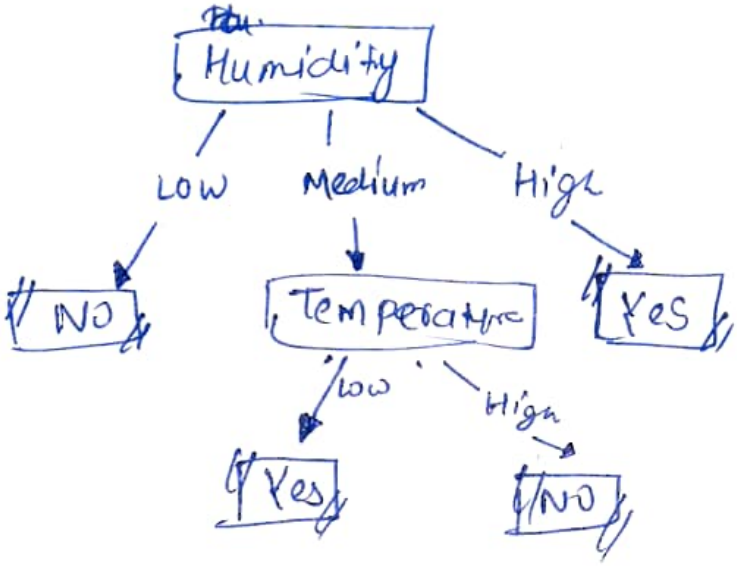
{leaf node}

low

Size	orbit	sustainability
S	F	Y

{leaf node}

Decision tree



For data entry (1) according to this decision tree, Humidity is low so Sustainability is NO