19KU1A0520

Sec - A

Assignment - 1

Draw a decision tree diagram to predict number of hours to play based on weather conditions like outlook, temperature, humidity.

Outlook	Temperature	Humidity	windy	Hours to play
Rainy	Hot	high	False	25
Rainy	Hot	high	True	20
Overcast	Hot	high	False	46
Sunny	mild	high	False	45
Sunny	cool	normal	False	52
Sunny	cool	normal	True	23
Overcast	cool	normal	True	43
Rainy	mild	high	False	35.
Rainy	cool	normal	False	38
Sunny	mild	normal	False	46
Rainy	mild	normal	True	48.
Overcast	mild	high	True	52
Overcast	hot	normal	False	44.
Sunny	mild	high	True	30

windy. consider dataset shown below.

Termination criteria: cv <= 10% or minimum number of samples 4

520 10

8/11/24.

⇒ Calculate SD, CV, mean

$$\text{mean} = \frac{\Sigma x}{n}$$

$$= \frac{25+30+46+45+52+23+43+35+38+46+48+52+44+30}{14}$$

$$= \frac{557}{14} = 39.78$$

$$SD = \sqrt{\frac{\Sigma(x-\text{mean})^2}{n}} = 9.67.$$

$$CV = \frac{SD}{\text{mean}} \times 100 = \frac{9.67}{39.78} \times 100 = 24.30.$$

⇒ The dataset is then split on different attributes. The SD for each branch is calculated.

$$SD(\text{attribute}) = \sum_{\text{Branch} \in \text{Attribute}} W(\text{branch})\, SD(\text{branch}).$$

Result of standard deviation Reduction.

$$SDR = SD - SD(\text{attr}).$$

$$\therefore SD(\text{target}) = 9.67.$$

Outlook:

	Mean	SD	CV	n	w(v)
Rainy	35.2	8.7	24.7	5	$\frac{5}{14}$
Overcast	46.25	4.03	8.72	4	$\frac{4}{14}$
Sunny	39.2	12.2	31.0	5	$\frac{5}{14}$

SD(outlook) = $\frac{5}{14} \times 8.7 + \frac{4}{14} \times 4.03 + \frac{5}{14} \times 12.2$

= 8.59.

SDR (outlook) = SD(Target) − SD(outlook).

= 9.61 − 8.59

= 1.08.

Temp :

	mean	SD	CV	n	ω(v)
hot	36.25	10.34	30.6	4	$\frac{4}{14}$
cool	39	12.14	31.1	4	$\frac{4}{14}$
mild	42.6	3.38	19.65	6	$\frac{6}{14}$

SD (Temp) = $\frac{4}{14} \times 10.34 + \frac{4}{14}(12.14) + \frac{6}{14}(3.38)$.

= 10.01

SDR (Temp) = SD(Target) − SD(Temp).

= 9.67 − 10.01

= −0.34

Humidity :

	mean	SD	CV	n	ω(v)
high	37.51	10.11	26.92	7	$\frac{7}{14}$
Normal	42	9.14	27.4	7	$\frac{7}{14}$

SD(humidity) = $\frac{7}{14}(10.11) + \frac{7}{14}(9.14)$

= 9.77

SDR (humidity) = 9.67 − 9.77

= −0.1

windy :

	Mean	SD	CV	n	w(v)
True	37.6	11.6	30.8	6	$\frac{6}{14}$
False	41.3	8.41	20.3	8	$\frac{8}{14}$

$SD(windy) = \frac{6}{14}(11.6) + \frac{7}{14}(8.41) = 9.77$

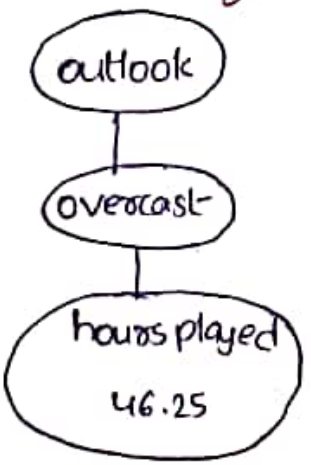
$SDR(windy) = 9.67 - 9.77 = -0.1$

The value that has highest SDR is considered as root node, (i.e, decision node)

considering termination criteria.

CV is 10% or CV is ($n \leq u$)

Overcast has CV of 8%. which is less than threshold value. Therefore, we need not to fusture split.



we need to split node sunny and rainy.

Outlook	Temp	humidity	windy	Hours played
Sunny	mild	high	false	45
Sunny	cool	normal	false	52
Sunny	cool	normal	True	23
Sunny	mild	normal	false	46
Sunny	mild	high	True	30

mean = 39.2, SD = 12.2, CV = 31.0.

Temp:

	mean	SD	CV	n	w(v)
mild	40.3	8.96	22.23	3	$\frac{3}{5}$
cool	37.5	20.50	54.66	2	$\frac{2}{5}$

SD(Temp) = $\frac{3}{5}(8.96) + \frac{2}{5}(20.50) = 13.576$.

SDR(Temp) = 12.2 − 13.576

= −1.37.

Humid:

	mean	SD	CV	n	w(v)
high	37.5	10.6	28.26	2	$\frac{2}{5}$
normal	40.3	15.30	37.96	3	$\frac{3}{5}$

SD(humid) = $\frac{2}{5}(10.6) + \frac{3}{5}(15.30)$

= 13.42.

SDR(humid) = 12.2 − 4.23

= 7.97

windy.

	mean	SD	CV	n	w(v)
False	47.66	3.78	7.94	3	$\frac{3}{5}$
True	26.5	4.94	18.65	2	$\frac{2}{5}$

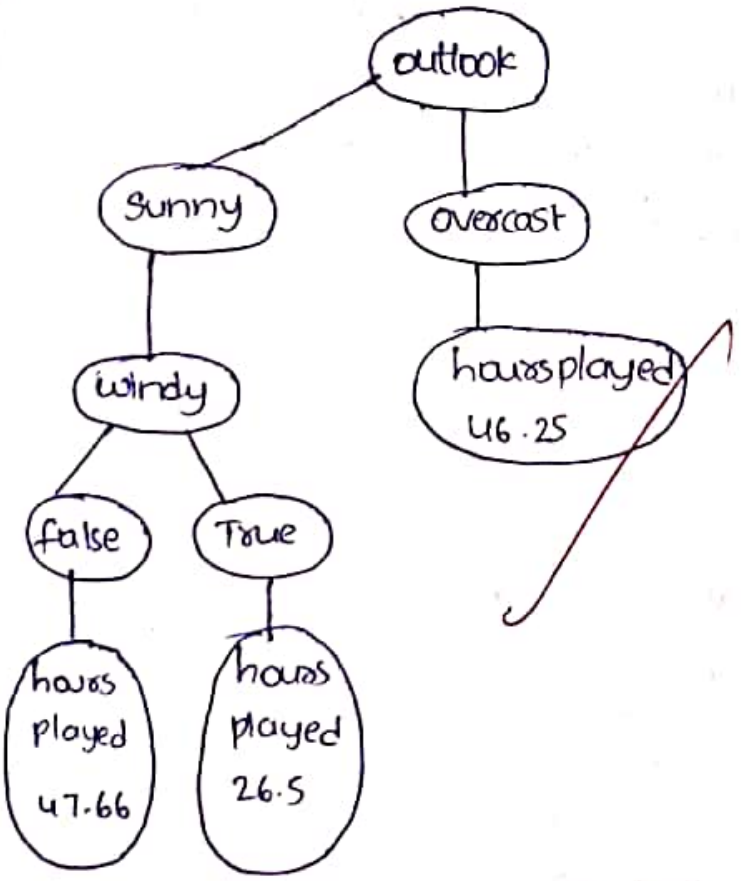
SD(windy) = $\frac{3}{5}$(3.78) + $\frac{2}{5}$(4.94) = 4.23

SDR(windy) = 12.2 − 4.23 = 7.97.

Check for highest SDR. In outlook, among temp, humidity and windy. SDR value is high for windy.

SDR = 7.97.

Then, check for cv value. both True and False satisfy cv value.



Rainy :

Outlook	Temperature	humidity	windy	hours to play
Rainy	hot	high	False	25
Rainy	hot	high	True	30
Rainy	mild	high	False	35
Rainy	cool	normal	false	38
Rainy	mild	normal	True	48

mean = 35.2 , SD = 8.7 , CV = 24.4.

Temperature .

Temperature	mean	SD	CV	n	w(V)
hot	27.5	3.53	12.83	2	$\frac{2}{5}$
mild	41.5	9.19	22.144	2	$\frac{2}{5}$
cool	38	0	0	1	$\frac{1}{5}$

$SD(Temp) = \frac{2}{5}(3.53) + \frac{2}{5}(9.19) + \frac{1}{5}(0)$.

$= 5.088$

$SDR(Temp) = SD - SD(Temp)$

$= 8.7 - 5.088$

$= 3.612$.

Humidity:

Humidity	mean.	SD	CV	n	w(v).
high	30	5	16.66	3	$\frac{3}{5}$
normal	43	7.07	16.44	2	$\frac{2}{5}$

SD(Humidity) = $\frac{3}{5}$ (5) + $\frac{2}{5}$ (7.07)

= 5.828

SDR (humidity = SD - SD(humidy) = 8.7 - 5.828 = 2.872.

windy

windy	mean	SD	CV	n	w(v)
false	32.66	6.80	20.85	3	$\frac{3}{5}$
True.	39	12.72.	32.5	2	$\frac{2}{5}$

SD(windy) = $\frac{3}{5}$ (6.80) + $\frac{2}{5}$ (12.72) = 9.168

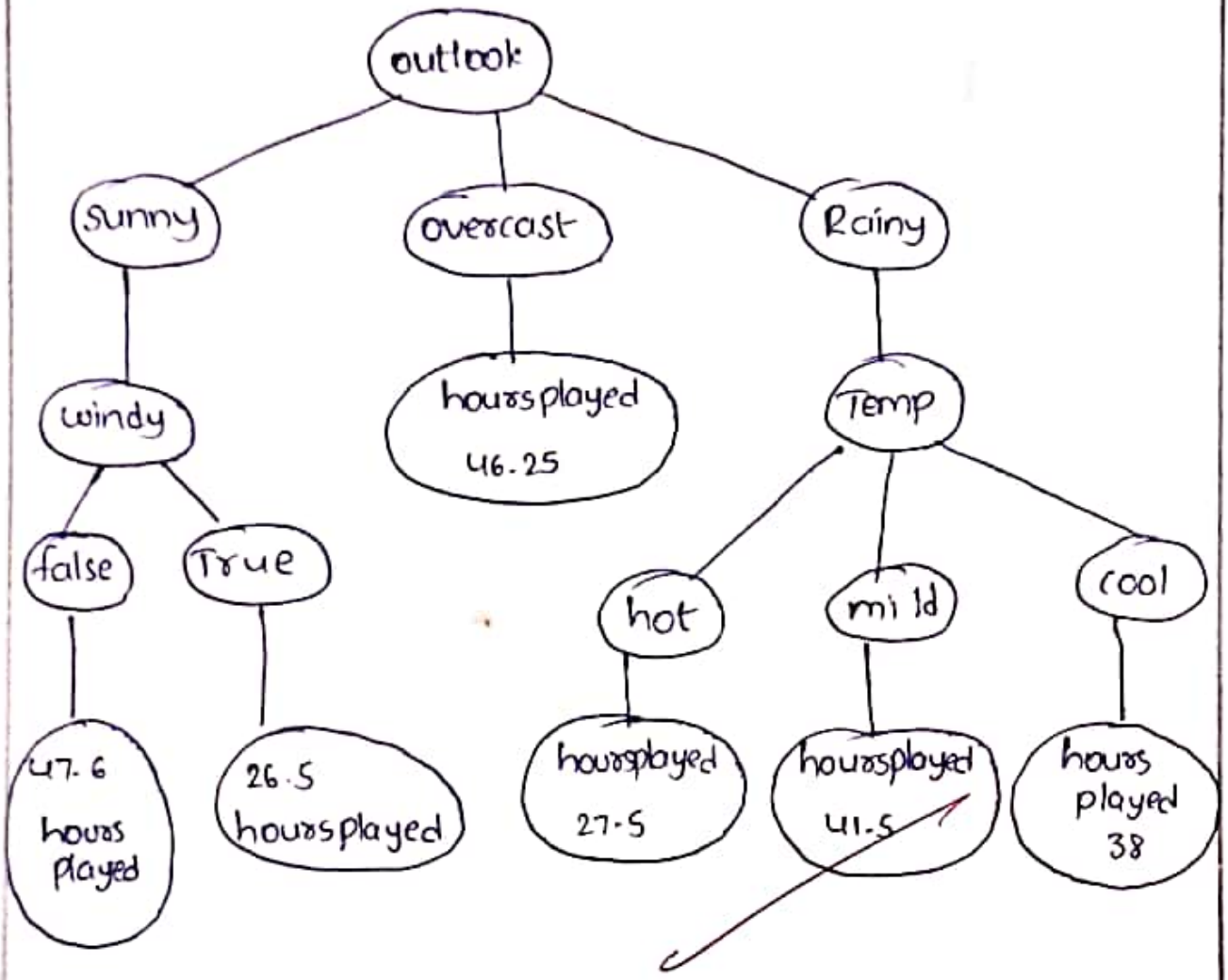
SDR (windy) = SD - SD(windy)

= 8.7 - 9.168

= -0.468

Among, Temp, humidity and windy, the SDR value is high for Temperature (i.e, 3.612).

Then check for cv value of hot, mild, and cool satisfy the cv value.


outlook
Sunny
overcast
Rainy
windy
hoursplayed
46.25
Temp
false
True
hot
mild
cool
47.6
hours
played
26.5
hoursplayed
hoursplayed
27.5
hoursplayed
41.5
hours
played
38

18/11/21