outlook

sunny   overcast   Rain

↓
4 values

wind

Temp

strong   weak.
↓   ↓
26·5   47·7

cool	Hot	mild.
↓	27·5	41·5
38		

Average $= (25+30+48+45+52+23+43+35+38+48$
$+48+52+44+30)/14$

$(\bar{x}) = \dfrac{561}{14} = 40.07$

Standard deviation $= \sqrt{\dfrac{(x-\bar{x})^2}{n}}$

$= \sqrt{\dfrac{\begin{array}{l}(25-40.07)^2+(30-40.07)^2+(48-40.07)^2+(45-40.07)^2\\+(52-40.07)^2+(23-40.07)^2+(43-40.07)^2+(35-40.07)^2\\+(38-40.07)^2+(48-40.07)^2+(48-40.07)^2+(52-40.07)^2\\+(44-40.07)^2+(30-40.07)^2\end{array}}{14}}$

$SD = \sqrt{\dfrac{1272.74}{14}} = \sqrt{90.91} = \boxed{9.53}$

outlook → (sunny, overcast, rain)

Average for Sunny $= \dfrac{45+52+23+48+30}{5} = 39.6$

$(SD)_{sunny} = \sqrt{\dfrac{(45-39.6)^2+(52-39.6)^2+(23-39.6)^2+(48-39.6)^2+(30-39.6)^2}{5}}$

$(SD)_{sunny} = \sqrt{124.24} \qquad \boxed{(SD)_{sunny} = 11.14}$

Average of overcast = $\frac{48+43+52+44}{4} = 46.75$

$(SD)_{overcast} = \sqrt{\frac{(48-46.75)^2+(43-46.75)^2+(52-46.75)^2+(44-46.75)^2}{4}}$

$(SD)_{overcast} = \sqrt{12.68} \implies (SD)_{overcast} = 3.56$

Average of Rain = $\frac{25+30+35+38+48}{5} = 35.2$

$(SD)_{rain} = \sqrt{\frac{(25-35.2)^2+(30-35.2)^2+(35-35.2)^2+(38-35.2)^2+(48-35.2)^2}{5}}$

$(SD)_{rain} = \sqrt{60.56}$ $(SD)_{rain} = 7.78$

weighted $SD' = \left(\frac{5}{14} \times 11.14\right) + \left(\frac{4}{14} \times 3.56\right) + \left(\frac{5}{14} \times 7.78\right) = 7.76$

SO Reduction = $9.53 - 7.76 = 1.77$ for outlook

Temperature = (Hot, mild, cool) :
Average of Hot = $\frac{25+30+48+44}{4} = 36.75$

$(SD)_{Hot} = \sqrt{\frac{(25-36.75)^2+(30-36.75)^2+(48-36.75)^2+(44-36.75)^2}{4}}$

$(SD)_{Hot} = 9.53$

Average of mild = $\frac{45+35+48+48+52+30}{6} = 43$

$(SD)_{mild} = \sqrt{\frac{(45-43)^2+(35-43)^2+(48-43)^2+(48-43)^2+(52-43)^2+(30-43)^2}{6}}$

$(SD)_{mild} = 7.83$

Average of cool = $\frac{52+23+43+38}{4} = 39$

$(SD)_{cool} = \sqrt{\frac{(52-39)^2+(23-39)^2+(43-39)^2+(38-39)^2}{4}}$

$(SD)_{cool} = 10.41$

weighted standard deviation for Temperature = $\frac{4(9.53)+6(7.13)+4(10.41)}{14}$
$= 9.05$

standard deviation reduction = $9.53 - 9.05 \implies 0.46$

Humidity = (High, Normal) Average of high = $\frac{25+30+48+45+35+52+30}{7} = 37.85$

$(SD)_{high} = \sqrt{\frac{(25-37.85)^2+(30-37.85)^2+(48-37.85)^2+(45-37.85)^2 + (35-37.85)^2+(52-37.85)^2+(30-37.85)^2}{7}}$

$(SD)_{high} = 9.64$

Average of Normal = $(52+23+43+38+48+48+44)/7 = 42.28$

$(SD)_{Normal} = \sqrt{\frac{(52-42.28)^2+(23-42.28)^2+(43-42.28)^2+(38-42.28)^2 + (48-42.28)^2+(48-42.28)^2+(44-42.28)^2}{7}}$

$(SD)_{Normal} = 8.89$

weighted standard deviation $= \frac{7}{14}(9.64) + \frac{7}{14}(8.89) = 9.265$

standard deviation reduction = $9.53 - 9.26 = 0.27$

• Wind (True, false) Average of True = $\frac{30+23+43+48+52+44}{6} = 40$

$(SD)_{True} = \sqrt{\frac{(30-40)^2+(23-40)^2+(43-40)^2+(48-40)^2+(52-40)^2+(44-40)^2}{6}}$

$(SD)_{True} = 10.18$

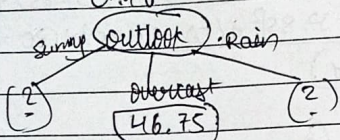Average of false = $\frac{25+30+48+45+52+35+38+48}{8} = 40.12$

$$SD_{false} = \sqrt{\frac{(25-40.17)^2 + (30-40.12)^2 + (48-40.12)^2 + (45-40.12)^2}{+ (52-40.17)^2 + (35-40.17)^2 + (38-40.17)^2 + (48-40.12)^2}{8}}}$$

$$\boxed{SD_{false} = 9.019}$$

weighted standard deviation $= \frac{6}{14}(10.18) + \frac{8}{14}(9.019) = 9.51$

standard deviation reduction for wind $= 9.53 - 9.51 = 0.02$

$(SD)_{outlook}$ $(SD)_{temperature}$ $(SD)_{humidity}$ $(SD)_{wind}$
0.77 0.46 0.27 0.02

Sunny [Outlook] Rain
     Overcast
   [46.75]   (2)

Sunny	mild	High	false	45
Sunny	cool	Normal	false	52
Sunny	cool	Normal	true	23
Sunny	mild	Normal	false	48
Sunny	mild	High	false	30

Temperature = (mild cool)
Average of mild
$= \frac{45+48+30}{3} = 41$

$(SD)_{mild} = \sqrt{\frac{(45-4)^2 + (48-4)^2 + (30-4)^2}{3}}$

$\boxed{(SD)_{sunny\ mild} = 7.87}$

Average of (sunny cool) $= \frac{52+23}{2} = 37.5$

$(SD)(sunny\ cool) = \sqrt{\frac{(52-37.5)^2 + (23-37.5)^2}{2}} = 14.5$

weighted SD of temp $= \frac{3}{5}(7.87) + \frac{2}{5}(14.5) = 10.52$

$\boxed{Standard\ deviation\ reduction\ for\ sunny = 11.14 - 10.52 = 0.62}$

humidity attribute = (High, Normal)
Average (sunny, High) $= \frac{45+30}{2} = 37.5$

$SD(sunny, High) = \sqrt{\frac{(45-37.5)^2 + (30-37.5)^2}{2}}$ $\boxed{(SD)_{sunny\ High} = 7.5}$

Average (sunny, Normal) $= \frac{52+23+48}{3} = 41$

$(SD)(sunny\ Normal) = \sqrt{\frac{(52-41)^2 + (23-41)^2 + (48-41)^2}{3}}$ $\boxed{(SD)_{sunny\ Normal} = 12.83}$

weighted standard deviation $= \frac{2}{3}(7.5) + \frac{3}{5}(12.83) = 10.69$
standard deviation reduction $11.14 - 10.69 = 0.43$

wind attribute = (false, true)
Average (sunny, false) $= \frac{45+52+48+30}{4} = 43.75$

$(SD)(sunny, false) = \sqrt{\frac{(45-43.75)^2 + (52-43.75)^2 + (48-43.75)^2 + (30-43.75)^2}{4}}$

$\boxed{(SD)(sunny\ false) = 8.31}$

Average (sunny, true) $= 23$ $\boxed{SD(sunny\ true) = 0}$
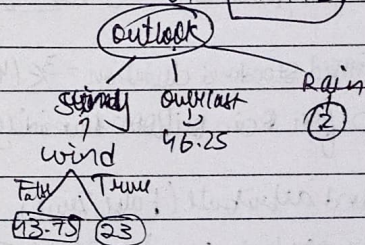
weight standard deviation $= \frac{4}{5}(8.31) + 0 = 6.648$
standard deviation reduction $= 11.14 - 6.64 = \boxed{4.472}$

$(SD)_{sunny\ Temp} = 0.62$
$(SD)_{sunny\ humidity} = 0.43$
$(SD)(sunny\ wind) = 4.472$

[Outlook]
  |
sunny   Overcast   Rain
  ?   46.25   (2)
wind
Folse / True
43.75   23

Rain	hot	High	false	25
Rain	hot	High	true	30
Rain	mild	high	false	35
Rain	cool	normal	false	38
Rain	mild	normal	true	18

Temp (Hot, mild, cool) =; Average (rain, Hot) = $\frac{25+30}{2}$ = 27.5

(SD) (rain hot) = $\sqrt{\frac{(25-27.5)^2 + (30-27.5)^2}{2}}$ = 2.5

Average (Rain, mild) = $\frac{35+48/2}{}$ = 41.5

(SD) $_{rain, mild}$ = $\sqrt{\frac{(35-41.5)^2 + (48-41.5)^2}{2}}$ = 6.5

(SD) (Rain cool) = 38 =) 0.

weighted standard deviation = $\frac{2(2.5) + 2(6.5) + 0.3.6}{5}$

SD for Rain outlook temp = 7.78 - 3.6 = 4.18

Humidity attribute = (High, Normal)

Average (Rain, High) = $\frac{25+30+35}{3}$ = 30

(SD) $_{rain, High}$ = $\sqrt{\frac{(25-30)^2 + (30-30)^2 + (35-30)^2}{3}}$ (SD) $_{Rain High}$ = 4.08

Average (Rain, Normal) = $\frac{38+48}{2}$ = 43

(SD) $_{rain, normal}$ = $\sqrt{\frac{(38-43)^2 + (48-43)^2}{2}}$ = (SD) $_{rain Normal}$ = 5

weighted standard deviation = $\frac{3}{5}(4.08) + \frac{2}{5}(5)$ = 4.48

SD for Rain outlook humidity = 7.78 - 4.48 = 3.32

wind attribute (False, True)

Average (rain, False) = $\frac{25+35+38}{3}$ = 32.66

(SD) $_{rain, False}$ = $\sqrt{\frac{(25-32.66)^2 + (35-32.66)^2 + (38-32.66)^2}{3}}$

(SD) $_{rain False}$ = 5.55

Average (Rain, True) = $\frac{30+48}{2}$ = 39.

SD $_{(rain, True)}$ = $\sqrt{\frac{(30-39)^2 + (48-39)^2}{2}}$ = 9

weighted standard deviation = $\frac{3}{5}(5.55) + \frac{2}{5}(9)$ = 6.93.

SD for Rain outlook & wind = 7.78 - 6.93 = 0.85

(SD) $_{rain temp}$ = 4.18 ✓

(SD) $_{rain, humidity}$ = 3.32

(SD) $_{rain, wind}$ = 0.85

[Diagram:]

Outlook
— stormy → Wind
— overcast → 46-25
— rain → Temperature

Wind → False (43.75), True (25)

Temperature → hot (27.5), mild (41.5), cool (38)