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$S = [8+, 6-]$

Calculations: $Entropy(S) = -\frac{8}{14}\log_2\frac{8}{14} - \frac{6}{14}\log_2\frac{6}{14} = 0.985$

Attribute: EarlyRegisteration: $S_1 = [4+, 2-]$ $Entropy(S_1) = 0.918$

$S_0 = [4+, 4-]$ $Entropy(S_0) = -\frac{4}{8}\log_2\left(\frac{4}{8}\right) - \frac{4}{8}\log_2\left(\frac{4}{8}\right) = 1$

$Gain(S, EarlyRegisteration) = Entropy(S) - \sum \frac{|S_v|}{|S|} Entropy(S_v)$

$= 0.985 - \frac{6}{14} \times 0.918 - \frac{8}{14} \times 1 = \boxed{0.0201}$

Attribute (Finished Homework II): $S_1 = [5+, 2-] = 0.863$

$S_0 = [3+, 4-] = 0.985$

$Gain(S, Finished\ Homework\ II) = 0.985 - \frac{7}{14} \times 0.863 - \frac{7}{14} \times 0.985$

$= \boxed{0.061} \leftarrow$

Attribute: senior: $S_1\ [5+, 3-] = 0.954$ $S_0\ [3+, 3-] = 1$

$Gain(S, senior) = 0.985 - \frac{8}{14} \times 0.954 - \frac{6}{14} \times 1 = \boxed{0.011}$

Attribute: likes coffee: $S_1\ [3+, 1-] = 0.811$ $S_0\ [5+, 5-] = 1$

$Gain = 0.985 - \frac{4}{14} \times 0.811 - \frac{10}{14} \times 1 = \boxed{0.039}$

Attribute: Last home work: $S_1\ [5+, 4-] = 0.991$ $S_0\ [3+, 2-] = 0.971$

$Gain(S, Last\ home\ work) = 0.985 - \frac{9}{14} \times 0.991 - \frac{5}{14} \times 0.971 = \boxed{0.0011}$

Left subtree calculations:

[3+, 2-]

Entropy(S_1) = 0.863

Attribute: Early Reg: S_1[3+, 0] = 0 S_0[2+, 2-] = 1

Gain = $0.863 - \frac{4}{7} \times 1 =$ **0.292** ←

Attribute: senior: S_1[3+, 2-] = 0.971 S_0[2+, 0] = 0

Gain = $0.863 - \frac{5}{7} \times 0.971 =$ **0.169**

Attribute: coffee: S_1[1+, 1-] = 1 S_0[4+, 1-] = 0.721

Gain = $0.863 - \frac{2}{7} \times 1 - \frac{5}{7} \times 0.721 =$ **0.062**

Attribute: Last homework: S_1[3+, 2-] = 0.971 S_0[2+, 0-] = 0

Gain = $0.863 - \frac{5}{7} \times 0.971 =$ **0.169**

Right subtree calculations:

S_0 = [3+, 4-) Entropy(S_0) = 0.985

Attribute: Early Reg: S_1[1+, 2-] = 0.918 S_0[2+, 2-] = 1

Gain = $0.985 - \frac{3}{7} \times 0.918 - 1 \times \frac{4}{7} =$ **0.0201**

Attribute: senior S_1[2+, 1-] = 0.918 S_0[1, 3-] = 0.811

Gain = $0.985 - \frac{3}{7} \times 0.918 - \frac{4}{7} \times 0.811 =$ **0.128**

Attribute: coffee: S_1[2+, 0] = 0 S_0[1+, 4-] = 0.721

Gain = 0.47 ←

Attribute: Last homework S_1[2+, 2-] = 1 S_0[1+, 2-] = 0.918

Gain = 0.201

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Left → Right subtree calculation:

$S_0[2+, 2-]$ Entropy $(S_0) = 1$

Attribute: senior: $S_1[1+, 2-] = 0.918$ $S_0[1+, 0] = 0$

Gain $= 1 - \frac{3}{4} \times 0.918 = \boxed{0.3115}$ ←

Attribute: coffee $S_1[1+, 1-] = 1$ $S_0[1+, 1-] = 1$

Gain $= 1 - \frac{2}{4} \times - \frac{2}{4} \times 1 = 0$

Attribute: Last homework $S_1[1+, 2-] = 0.918$ $S_0[1+, 0] = 0$

Gain $= 1 - \frac{3}{4} \times 0.918 = 0.3115$

Right → Right subtree calculation

$S_0 = [1+, 4-]$ Entropy $= 0.721$

Attribute: Early Reg: $S_1[0, 2-] = 0$ $S_0[1+, 2-] = 0.918$

Gain $= 0.721 - \frac{3}{5} \times 0.918 = \boxed{0.1702}$

Attribute: Senior: $S_1[1+, 1-] = 1$ $S_0[0, 3-] = 0$

Gain $= 0.721 - \frac{2}{5} \times 1 = \boxed{0.321}$ ←

Attribute: Last homework: $S_1[1+, 2-] = 0.918$ $S_0[0, 2-] = 0$

Gain $= 0.721 - \frac{3}{5} \times 0.918 = \boxed{0.1702}$

Left → Right → Left subtree calculations

$S_1 = [1+, 2-]$ Entropy $(S_1) = 0.918$

Attribute: Coffee → $S_1[0+, 1-] = 0$ $S_0[1+, 1-] = 1$

$0.918 - \frac{2}{3} \times 1 = 0.251$

Attribute: Last homework: $S_1[0, 2-] = 0$ $S_0[1+, 0] = 0$

Gain = $\boxed{1}$ ←

Right → Right → ~~Right~~ Left subtree calculations:

$S_1 = [1+, 1-]$ Entropy $(S_1) = 1$

Attribute: Early Registration: $S_1 = 0$ $S_0 = [1+, 1-] = 1$

Gain $1 - \frac{2}{2} \times 1 = \boxed{0}$

Attribute: Last homework: $S_1[1+, 0] = 0$ $S_0 = [0, 1-] = 0$

Gain = $1 - 0 = \boxed{1}$ ←

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Tree Result