$$E(\{x_1, x_2, x_3, x_4, x_5\}) = \left(-\frac{2}{5}\log_2 \frac{2}{5}\right) + \left(-\frac{3}{5}\log_2 \frac{3}{5}\right)$$

$$= 0.971$$

Choosing A_1

$A_1 = 0$ $(p = 1/5)$

$E(\{x_3\}) = 0$

$A_1 = 1$ $(p = 4/5)$

$E(\{x_1, x_2, x_4, x_5\})$

$= \left(-\frac{1}{2}\log_2 \frac{1}{2}\right) + \left(-\frac{1}{2}\log_2 \frac{1}{2}\right)$

$= 1$

$E[\text{Entropy}] = \frac{1}{5} \times 0 + \frac{4}{5} \times 1$

$= \frac{4}{5}$

$IG = 0.971 - \frac{4}{5} = 0.171$

Choosing A_2

$A_2 = 0$ $(p = 2/5)$

$E(\{x_1, x_2\}) = 0$

$A_2 = 1$ $(p = 3/5)$

$E(\{x_3, x_4, x_5\})$

$= \left(-\frac{1}{3}\log_2 \frac{1}{3}\right) + \left(-\frac{2}{3}\log_2 \frac{2}{3}\right)$

$= 0.918$

$E[\text{Entropy}] = \frac{2}{5} \times 0 + \frac{3}{5} \times 0.918$

$= 0.551$

$IG = 0.971 - 0.551 = \boxed{0.42}$

best

Choosing A_3

$A_3 = 0$ $(p = 3/5)$

$E(\{x_1, x_3, x_5\})$

$= \left(-\frac{1}{3}\log_2 \frac{1}{3}\right) + \left(-\frac{2}{3}\log_2 \frac{2}{3}\right)$

$= 0.918$

$A_3 = 1$ $(p = \frac{2}{5})$

$E(\{x_2, x_4\})$

$= \left(-\frac{1}{2}\log_2 \frac{1}{2}\right) + \left(-\frac{1}{2}\log_2 \frac{1}{2}\right)$

$= 1$

$E[\text{Entropy}] = \frac{3}{5} \times 0.918$

$+ \frac{2}{5} \times 1$

$= 0.9508$

$IG = 0.971 - 0.9508$

$= 0.0202$

Subtree $A_2 = 0$ $\{x_1, x_2\}$

$y(x_1) = y(x_2) = 0$

$\therefore$ Leaf is $A_2 = 0$

Subtree $A_2 = 1$ $\{x_3, x_4, x_5\}$

Choose A_1

$A_1 = 0$ $(p = \frac{1}{3})$,

$E(\{x_3\}) = 0$

$A_1 = 1$ $(p = \frac{2}{3})$

$E(\{x_4, x_5\}) = 0$

$E[\text{Entropy}] = 0$

$IG = 0.918 - 0 = \boxed{0.918}$

Leaf [$\because$ Entropy = 0]

Choose A_3

$A_3 = 0$ $(p = \frac{2}{3})$

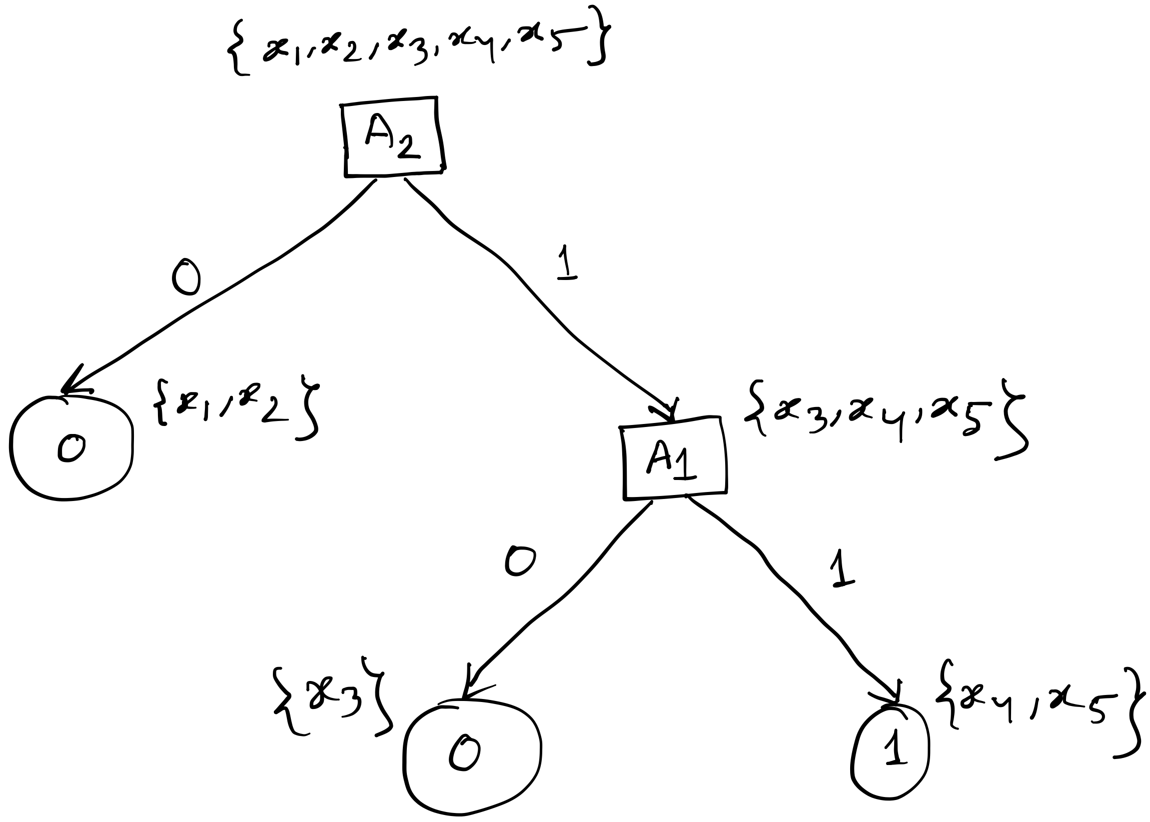
$E(\{x_3, x_5\})$

$= \left(-\frac{1}{2}\log_2 \frac{1}{2}\right) + \left(-\frac{1}{2}\log_2 \frac{1}{2}\right) = 1$

$A_3 = 1$ $(p = \frac{1}{3})$

$E(\{x_4\}) = 0$

$E[\text{Entropy}] = \frac{2}{3}$, $IG = 0.25$


{x1, x2, x3, x4, x5}
A2
0
1
0
{x1, x2}
A1
{x3, x4, x5}
0
1
{x3}
0
1
{x4, x5}