32. Adevarat : ~~B~~ Putem construi un arbore de decizie pentru orice funcție booleană. Pentru orice funcție putem construi un arbore care să aibă max 2^n frunze ~~…~~ pentru cele n variabile de intrare. Astfel putem crea un arbore binar complet care parcurs in adâncime ~~…~~ fiecare variantă va reprezenta o instanță de test. (înălțimea = nr de variabile)

33. Set(all) = [5+, 4−]

Set(S+) = [3+, 2−], Set(S−) = [2+, 2−]

Set(A+) = [5+, 1−], Set(A−) = [0+, 3−]

$$H(all) = H[5+, 4-] = \frac{1}{5+4} \log_2 \frac{(5+4)^{5+4}}{5^5 4^4}$$

$$= \frac{1}{9} \log_2 \frac{9^9}{5^5 4^4} = \cancel{2{,}1768853836} \; 0{,}991076059$$

~~H(all|S)~~

$$H(S+) = H[3+, 2-] = \frac{1}{3+2} \log_2 \frac{(3+2)^{3+2}}{3^3 \cdot 2^2}$$

$$= \frac{1}{5} \log_2 \frac{5^5}{108}$$

$$= \cancel{\frac{1}{5}\log_2}$$

$$= \cancel{1{,}231} \; 0{,}9709505944$$

$$H(S-) = H[2+, 2-] = \frac{1}{4} \log_2 \frac{4^4}{16}$$

$$= \frac{1}{4} \log_2 \frac{256}{16}$$

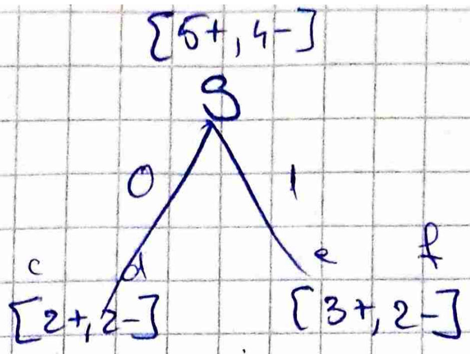
$$= \frac{1}{4} \log_2 16$$

$$= \frac{4}{4} = 1$$

~~Comparăm $\frac{(3+2)^{3+2}}{3^3 \cdot 2^2}$; $\frac{(2+2)^{2+2}}{2^2 \cdot 2^2}$ și $\frac{(5+1)^{5+1}}{5^5 \cdot 1^1}$; $\frac{(0+3)^{0+3}}{0^0 \cdot 3^3}$~~

~~Alegem atributul~~

IG



~~Nod I atribut~~

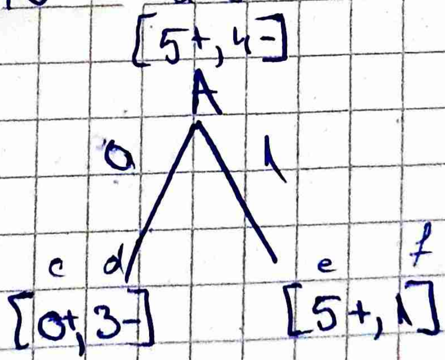
$$IG_{nod,\,atribut} = \frac{1}{5+4}\cdot\log_2\frac{(5+4)^{5+4}}{5^5 4^4} - \frac{1}{5+4}\cdot\log_2\left(\frac{(2+2)^{2+2}}{2^2\cdot 2^2}\cdot\frac{(3+2)^{3+2}}{3^3 2^2}\right)$$

$$= \frac{1}{5+4}\cdot\log_2\left(\frac{(5+4)^{5+4}}{5^5 4^4}\cdot\frac{2^2\cdot 2^2}{(2+2)^{2+2}}\cdot\frac{3^3\cdot 2^2}{(3+2)^{3+2}}\right)$$

$$= \frac{1}{9}\log_2\left(\frac{9^9}{5^5 4^4}\cdot\frac{2^2\cdot 2^2}{(2+2)^{2+2}}\cdot\frac{3^3\cdot 2^2}{(3+2)^{3+2}}\right)$$

$$= \frac{1}{9}\log_2\left(\frac{9^9}{5^5 4^4}\cdot\frac{\cancel{4^2}\,1}{4^{\cancel{4}\,2}}\cdot\frac{3^3\cdot \cancel{2^2}}{5^5}\right)$$

$$= 0,0072146$$



$$IG_{nod,\,atribut} = \frac{1}{5+4}\cdot\log_2\frac{(5+4)^{5+4}}{5^5 4^4} - \frac{1}{5+4}\log_2\left(\frac{(5+1)^{5+1}}{5^5\cdot 1^1}\right)$$

Alegem A

$$= \frac{1}{9}\log_2\left(\frac{(5+4)^{5+4}}{5^5 4^4}\cdot\frac{5^5}{(5+1)^{5+1}}\right)$$

$$= \frac{1}{9}\log_2\left(\frac{9^9}{\cancel{5^5}4^4}\cdot\frac{\cancel{5^5}}{6^6}\right)$$

$= \cancel{0,0518985352}$ $0,5577277787$

35 a $H[a+, b-] = \frac{a}{a+b} \log_2 \frac{a+b}{a} + \frac{b}{a+b} \log_2 \frac{a+b}{b}$

$$= \frac{a}{a+b}\left(\log_2 a+b - \log_2 a\right) + \frac{b}{a+b}\left(\log_2 a+b - \log_2 b\right)$$

$$= \underbrace{\frac{a}{a+b} \log_2 a+b} - \frac{a}{a+b} \log_2 a + \underbrace{\frac{b}{a+b} \log_2 a+b} - \frac{b}{a+b} \log_2 b$$

$$= \frac{a+b}{a+b} \log_2 a+b - \left(\frac{a}{a+b} \log_2 a + \frac{b}{a+b} \log_2 b\right)$$

$$= \cancel{\log_2 a+b}$$

$$= \frac{1}{a+b} \log_2 (a+b)^{a+b} - \frac{a}{a+b} \log_2 a - \frac{b}{a+b} \log_2 b$$

$$= \cancel{\left(\frac{1}{a+b} \log_2 (a+b)^{a+b}\right) - \left(\log_2 a^{\frac{a}{a+b}} + \log_2 b^{\frac{b}{a+b}}\right)}$$

$$= \cancel{\left(\frac{1}{a+b} \log_2 (a+b)^{a+b} - \log_2 a^{\frac{a}{a+b}} b^{\frac{b}{a+b}}\right)}$$

$$= \cancel{\left(\frac{1}{a+b} \log_2 \frac{(a+b)^{a+b}}{a^{\frac{a}{a+b}} b^{\frac{b}{a+b}}}\right)}$$

$$= \frac{1}{a+b} \log_2 (a+b)^{a+b} - \left(\frac{1}{a+b} \log_2 a^a + \frac{1}{a+b} \log_2 b^b\right)$$

$$= \frac{1}{a+b} \log_2 (a+b)^{a+b} - \frac{1}{a+b}\left(\log_2 a^a + \log_2 b^b\right)$$

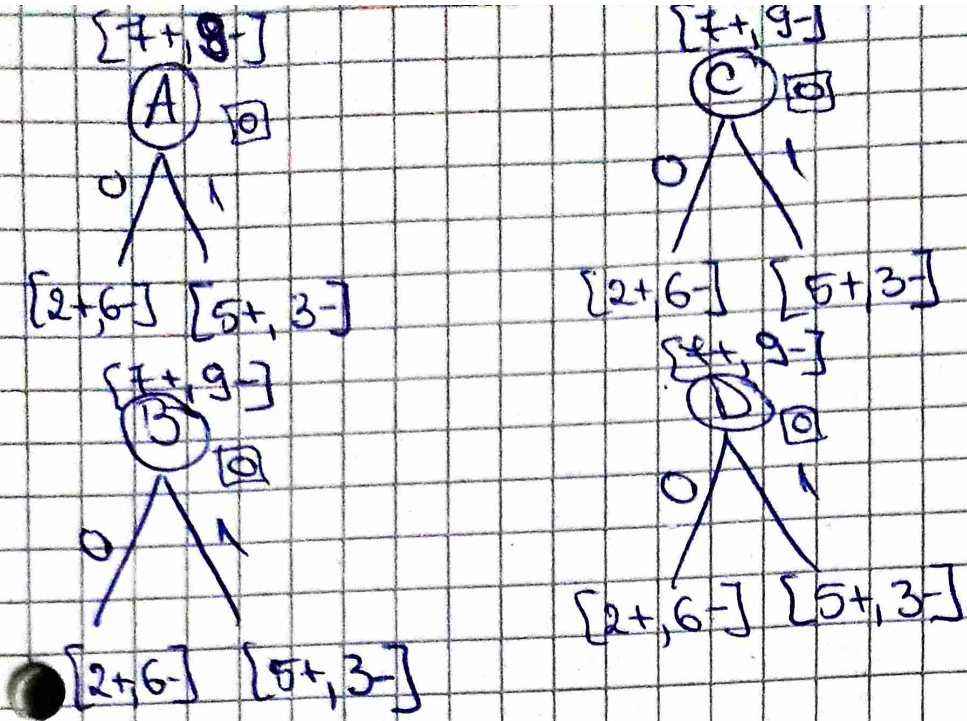
$$= \frac{1}{a+b}\left(\log_2 (a+b)^{a+b} - \log_2 a^a b^b\right)$$

$$= \frac{1}{a+b} \log_2 \frac{(a+b)^{a+b}}{a^a b^b}$$

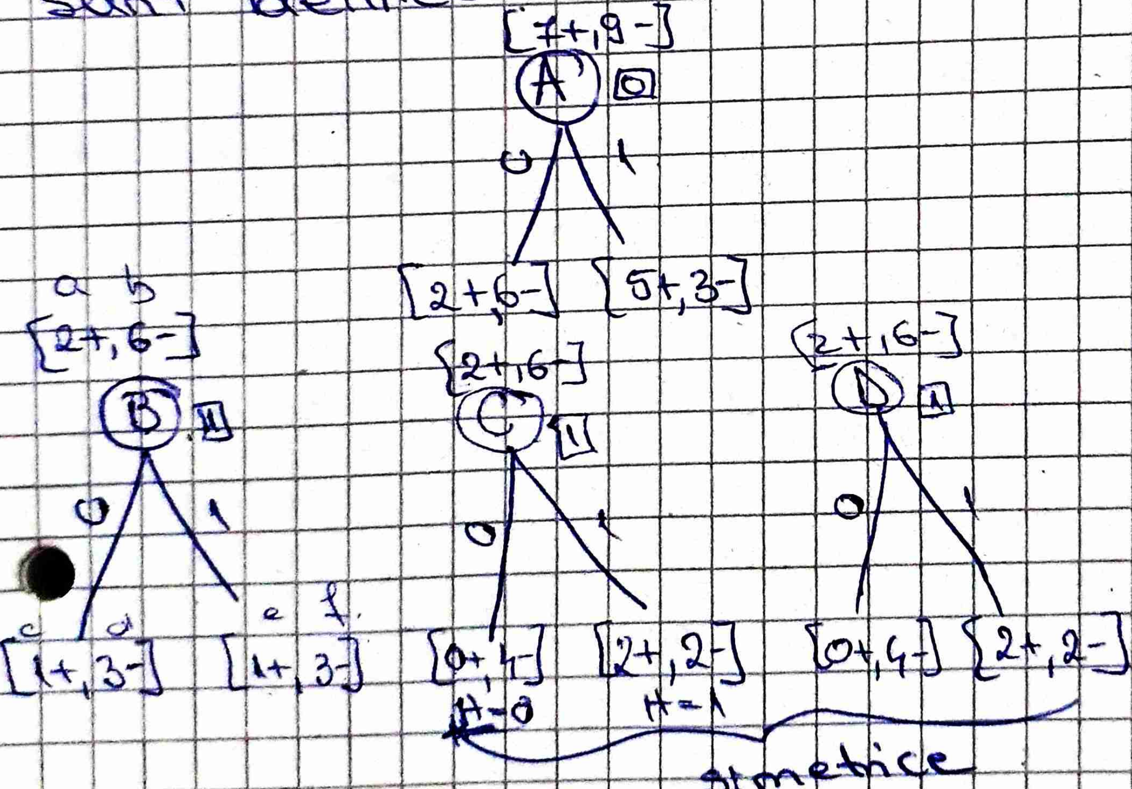
37.

A	B	C	D	X
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

✓ 4



Toate reprezentările pt nodul rădăcină sunt identice



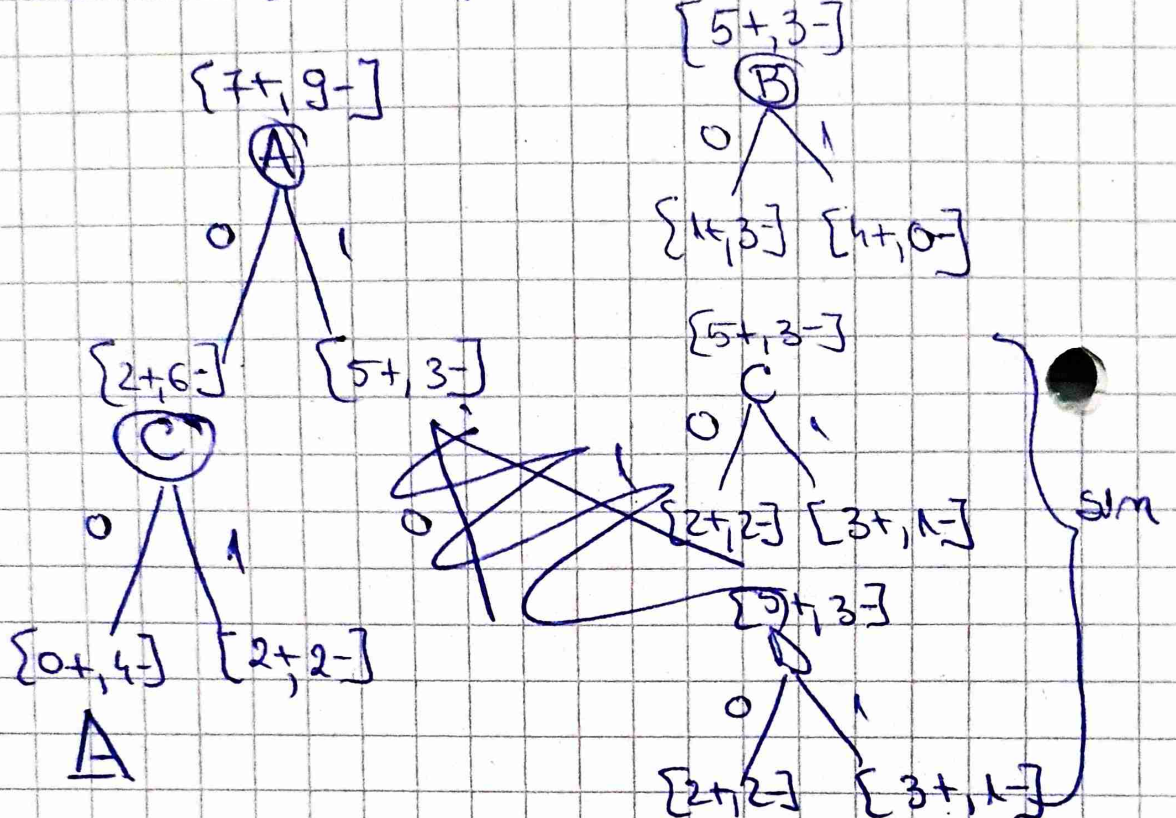
$$IG_{1/8} = \frac{1}{2+6} \log_2 \left(\frac{(2+6)^{2+6}}{2^2 6^6} \cdot \left(\frac{1^1 \cdot 3^3}{(1+3)^{1+3}} \right)^2 \right)$$

$$= \frac{1}{8} \log_2 \left(\frac{8^8}{4 \cdot 36} \cdot \frac{27}{3^3} \right)$$

$$= \frac{1}{8} \log_2 \left(\frac{8^8}{2^2 6^6} \cdot \frac{27^2}{4^8} \right) = 0$$

$iG_{1,C} = \frac{1}{8}\log_2\left(\frac{8^8}{2^2\cdot 6^6}\cdot\frac{2^2\cdot 2^2}{4^4}\right) = 0,3112$

$\Rightarrow$ alegem C sau D.



$iG_{1,B} = \frac{1}{8}\log_2\left(\frac{8^8}{3^3 5^5}\cdot\frac{2^2\cdot 2^2}{4^4}\cdot\frac{3^3 1^1}{4^4}\right)$

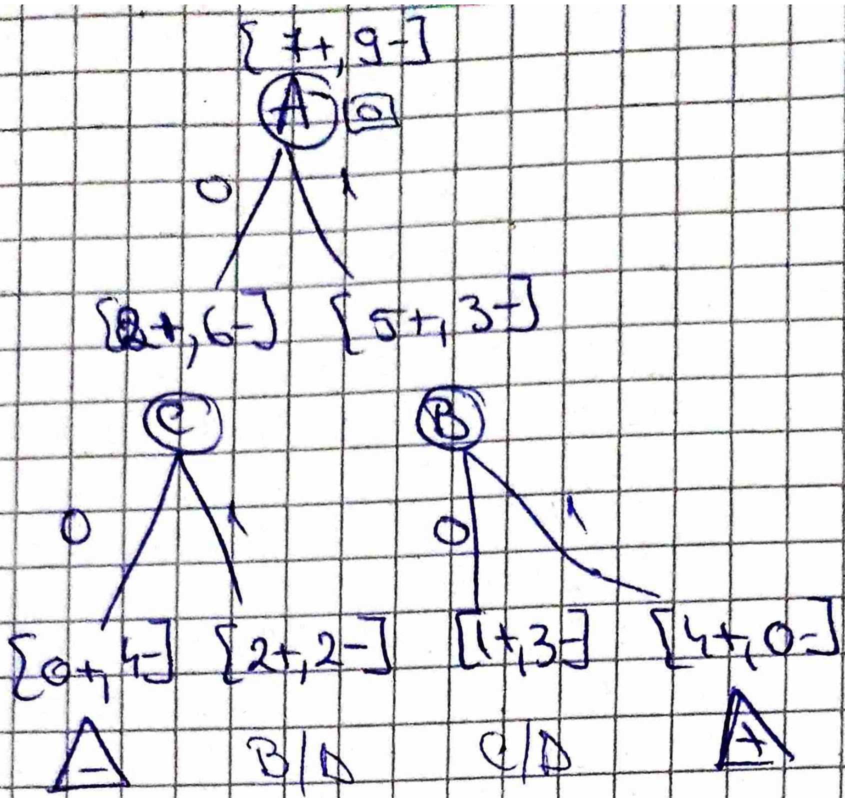
$= \frac{1}{8}\log_2\left(\frac{8^8}{\cancel{3^3}5^5}\cdot\frac{4^2}{4^4}\cdot\frac{\cancel{3^3}}{4^4}\right)$

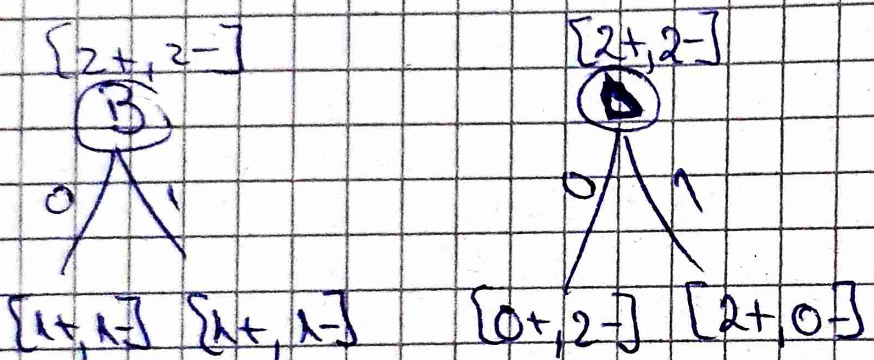
$= 0,5487$

$iG_{1,C} = \frac{1}{8}\log_2\left(\frac{8^8}{3^3 5^5}\cdot\frac{2^2\cdot 2^2}{4^4}\cdot\frac{3^3\cdot 1^1}{4^4}\right)$

$= 0,048$

$\Rightarrow$ alegem B





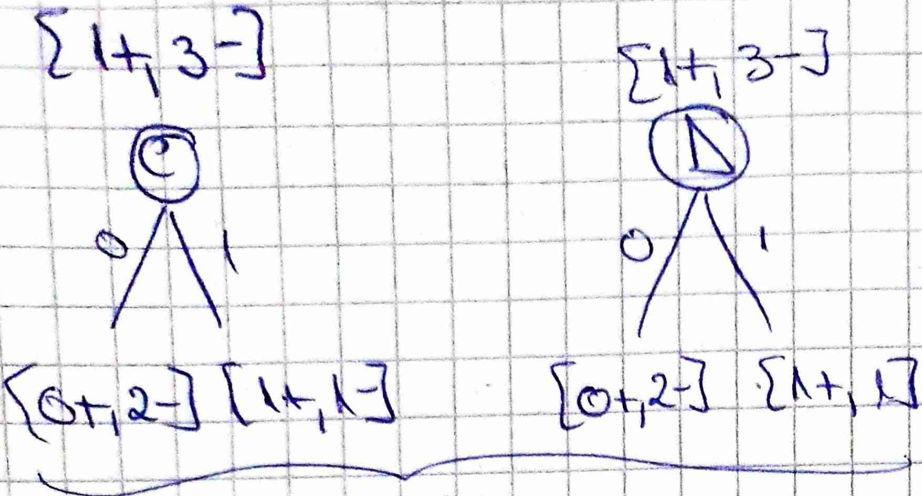
$$IG_{2|B} = \frac{1}{4}\log_2\left(\frac{\cancel{4^4}}{2^2 2^2}\cdot\underbrace{\frac{1^1\cdot 1^1}{2^2}\cdot\frac{1^1\cdot 1^1}{2^2}}\right) = 0$$

$$IG_{2|D} = \cancel{\frac{1}{4}\log_2\left(\frac{4^4}{2^2 2^2}\cdot 0^1 \cdot 2\right)}$$

$$= \frac{1}{4}\log_2\left(\frac{4^4}{2^2 2^2}\cdot\frac{0^0\cdot 2^2}{2^2}\cdot\frac{2^2\cdot 0^0}{2^2}\right)$$

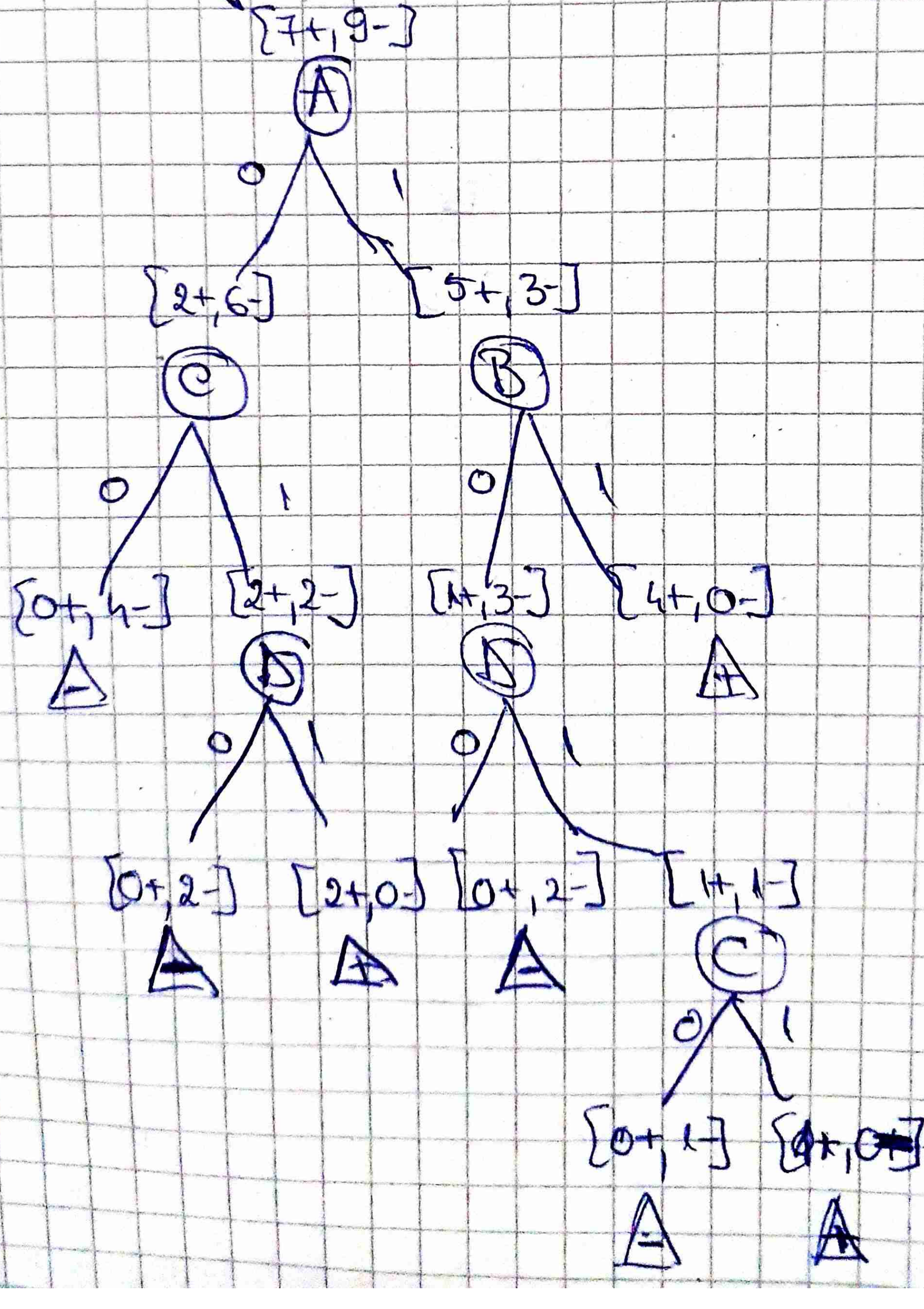
$$= \frac{1}{4}\cdot 4 = 1$$

$\Rightarrow$ alegem D

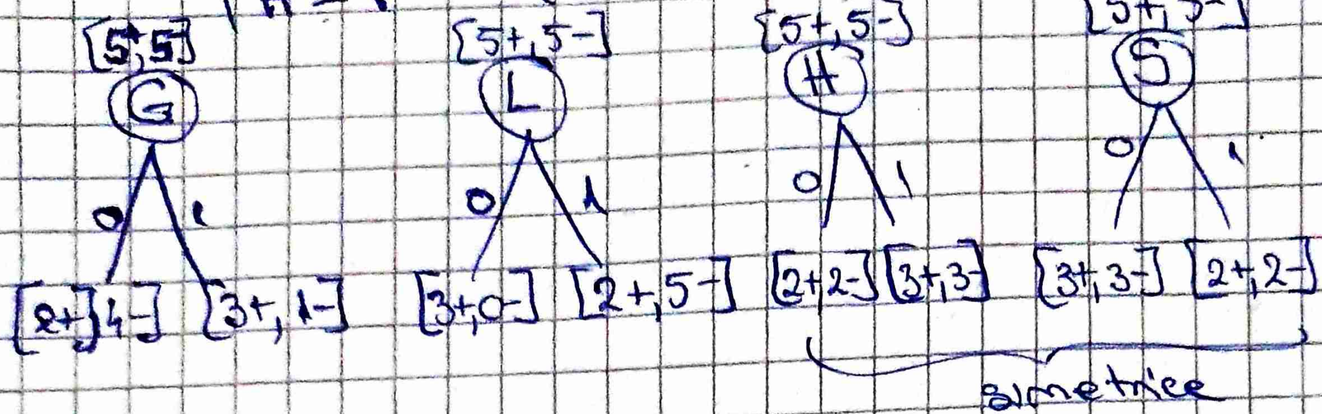


simetrice

putem alege ori C ori D



38. a) $\begin{cases} M = - \\ H = + \end{cases}$ $\begin{cases} N = 0 \\ Y = 1 \end{cases}$ $\begin{matrix} 3 = 0 \\ 2 = 1 \end{matrix}$ $\begin{matrix} S = 0 \\ T = 1 \end{matrix}$ $\begin{matrix} N = 0 \\ Y = 1 \end{matrix}$



~~Iter 1~~

$$iG_{0|G} = \frac{1}{10}\log_2\left(\frac{10^{10}}{5^5 5^5}\cdot\frac{2^2 4^4}{6^6}\cdot\frac{3^3 1^1}{4^4}\right)$$

$$= \frac{1}{10}\log_2 2,3703 = \frac{1,24506}{10} = 0,124506$$

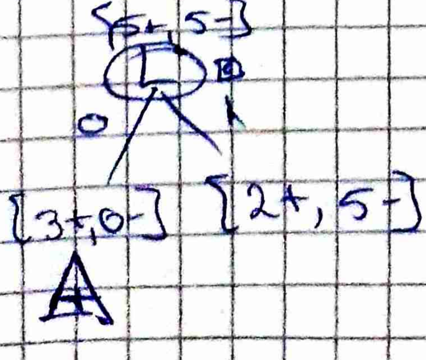
$$\cancel{iG_{0|L} = \frac{1}{10}\log_2\left(\frac{10^{10}}{5^5 5^5}\cdot\frac{7^7}{2^2 5^5}\right)}$$

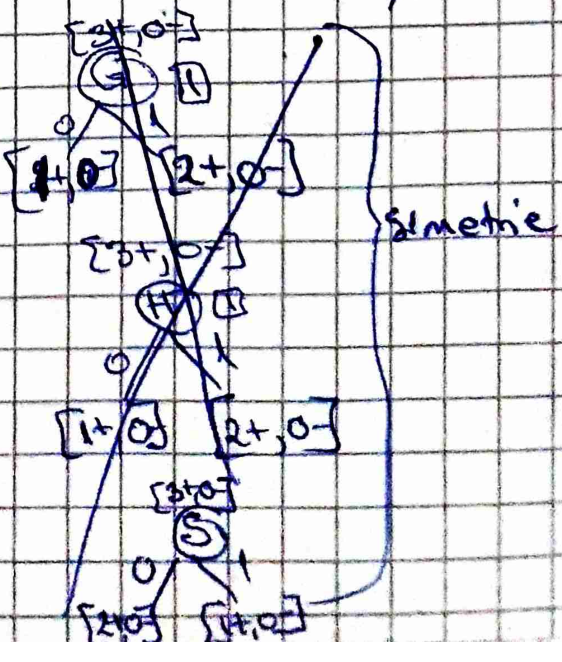
$$iG_{0|L} = \frac{1}{10}\log_2\left(\frac{10^{10}}{5^5 5^5}\cdot\frac{2^2 5^5}{7^7}\right) = 0,39581$$

$$iG_{0|H} = \frac{1}{10}\log_2\left(\frac{10^{10}}{5^5 5^5}\cdot\frac{2^2 2^2}{4^4}\cdot\frac{3^3 3^3}{6^6}\right)$$

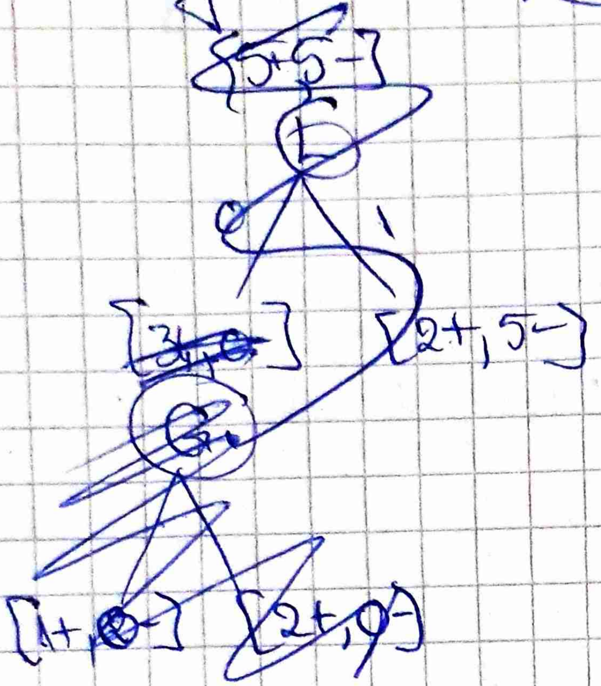
$$= 0,1$$

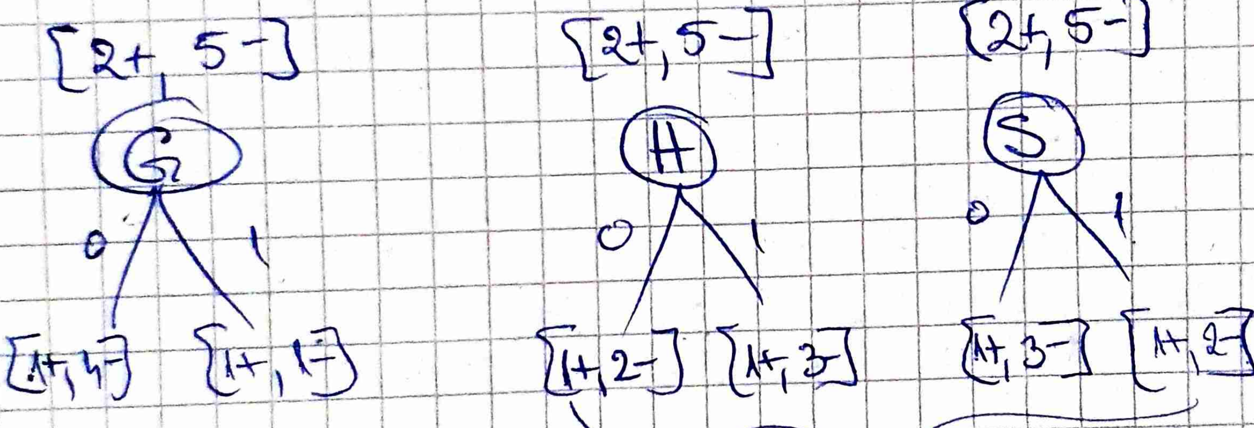
$iG \rightarrow$ L - rădăcină





$\Rightarrow$ alegem G_1 pt nodul 1





simetrice

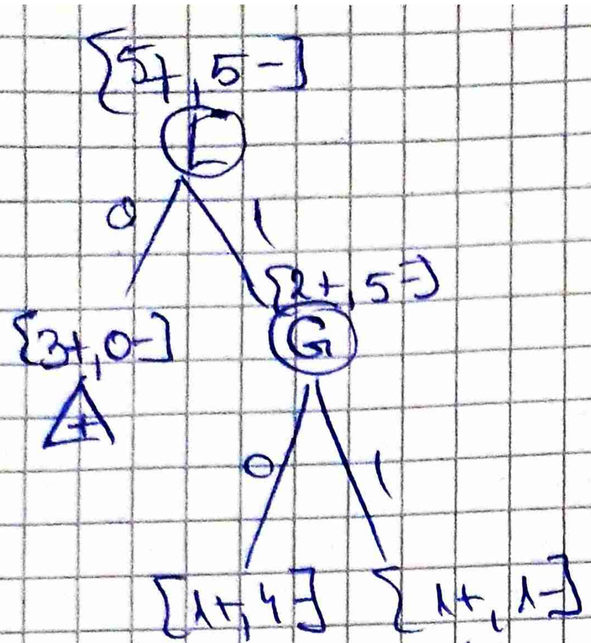
$$iG_{1/G_1} = \frac{1}{7}\log_2\left(\frac{7^7}{2^2 5^5}\cdot\frac{1^1 4^4}{5^5}\cdot\frac{1^1 1^1}{2^2}\right)$$

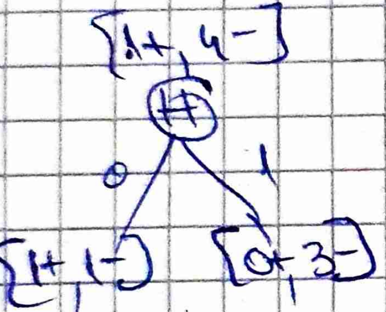
$$= 0{,}061772$$

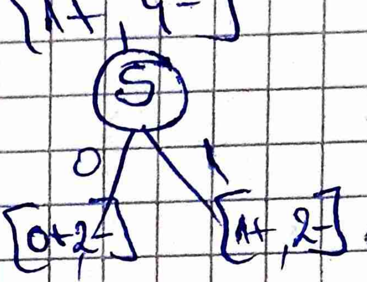
$$iG_{1/H} = \frac{1}{7}\log_2\left(\frac{7^7}{2^2 5^5}\cdot\frac{1^1 2^2}{3^3}\cdot\frac{1^1 3^3}{4^4}\right)$$

$$= 0{,}005971$$

$\Rightarrow G_1$ - nod 1







$$iG_{2|H} = \frac{1}{5}\log_2\left(\frac{5^5}{4^4}\cdot\frac{1}{2^2}\right) = 0,32192$$

$$iG_{2|S} = \frac{1}{5}\log_2\left(\frac{5^5}{4^4}\cdot\frac{2^2}{3^3}\right) = 0,17094$$

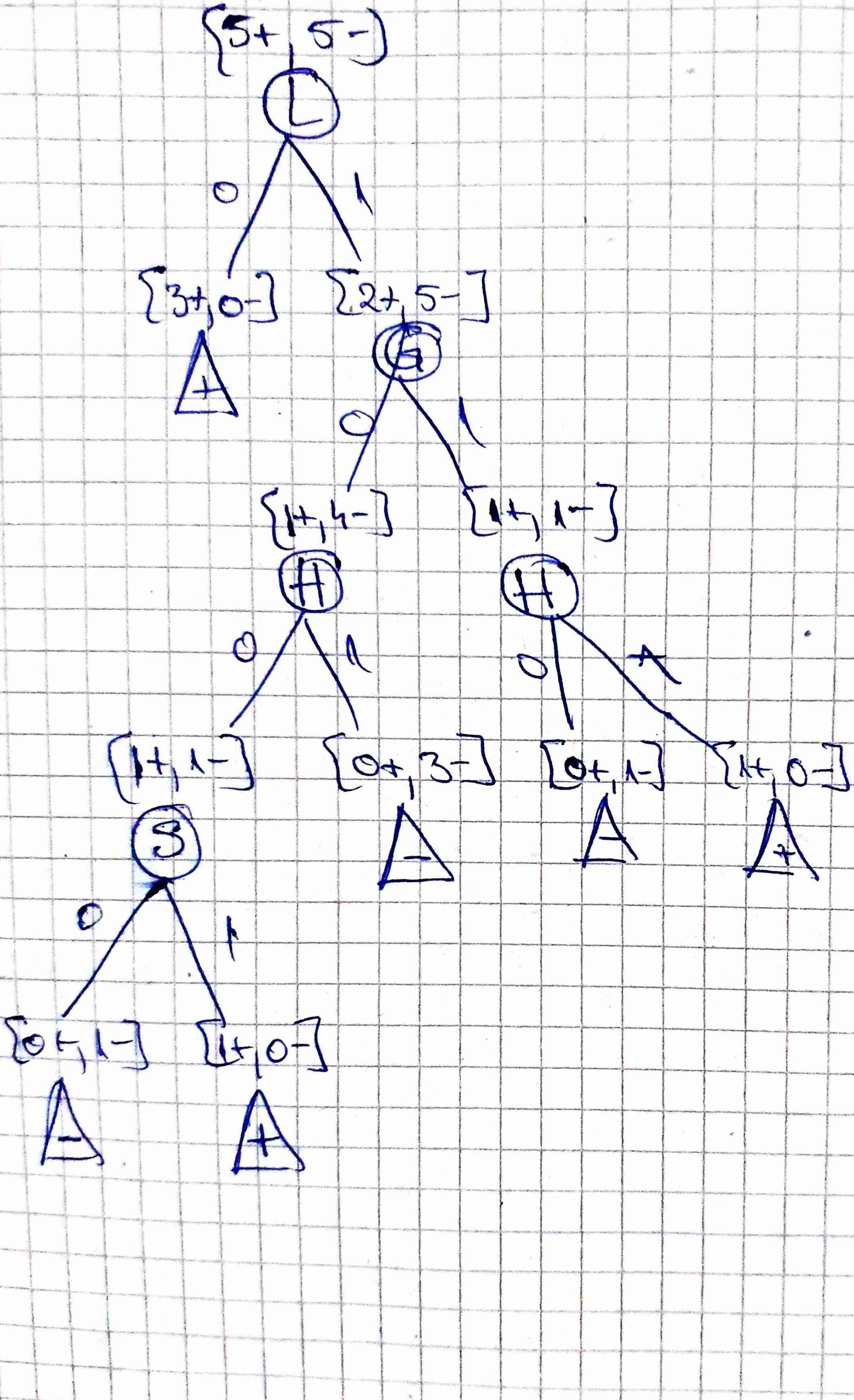
$\Rightarrow$ H - nod 2 pt [1+, 4-]

~~$iG_{2|H} = 1$~~

$$iG_{2|H} = \frac{1}{2}\log_2 2^2 = 1$$

$$iG_{2|S} = \frac{1}{2}\log_2\left(\frac{2^2}{1}\cdot\frac{1}{2^2}\right) = 0.$$

$\Rightarrow$ H - nod 2 pt [1+, 1-]


[5+, 5-]
L
0
1
[3+, 0-]
+
[2+, 5-]
G
0
1
[1+, 4-]
[1+, 1-]
H
H
0
1
0
1
[1+, 1-]
[0+, 3-]
[0+, 1-]
[1+, 0-]
-
-
+
S
0
1
[0+, 1-]
[1+, 0-]
-
+

b) if Legs = 3 then M;
else
if Legs = 2 and Green = N and Height = S
and Smelly = Y then M;
else
if Legs = 2 and Green = Y and Height = T
then M;
else H