Lecture 9/5: Decision Trees

Tuesday, September 3, 2019 4:20 PM

$|X| = 2 \times 2 \times 3 \times 2 = 24$

(A/B, red/green, large/small/medium, Crunchy/Soft)

$|Y| = 2$

$|X|$

$x_1, x_2, \ldots, x_{24}$

Yes.. No ..... Yes/No 24.

$2 \times 2 \times \ldots \times 2 = 2$

$|F| = 2^{24}$

(?, red, ?, Crunchy)

$(3, 3, 4, 3) = 108 \ll 2^{24}$

Subset of (A, red, Small, Crunchy) ✓

VS(H, S) = (?, ., ., .., ., .) ✓

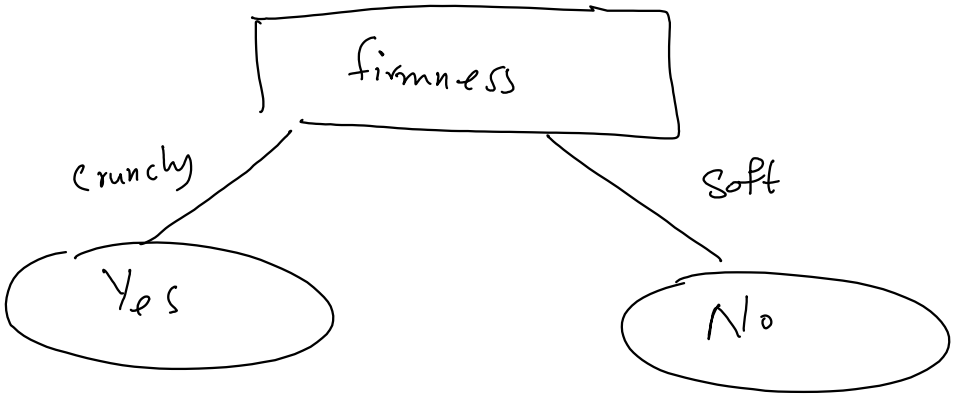
(?, red, ?, Crunchy) ✓

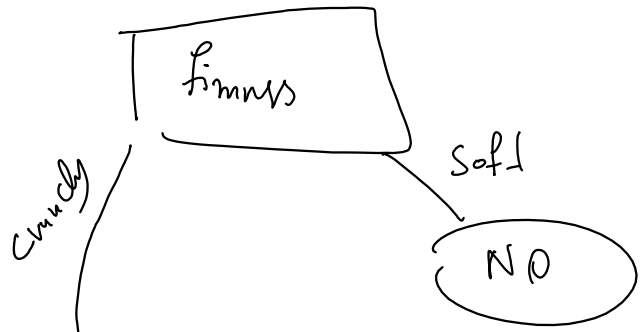
(A , " " " ") ✓

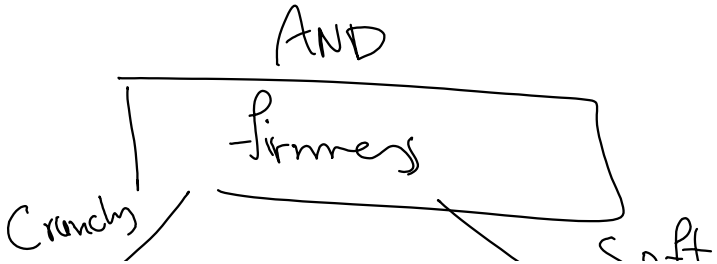
f(B, Green, Large, Crunchy) = Yes

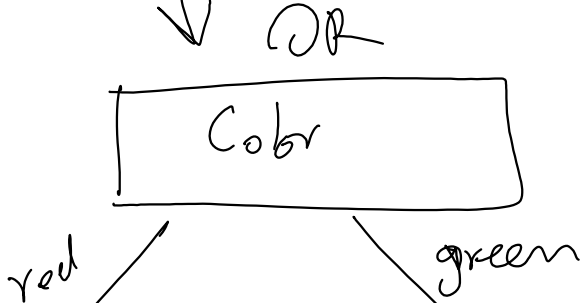
f(B, red, Large, Soft) = No

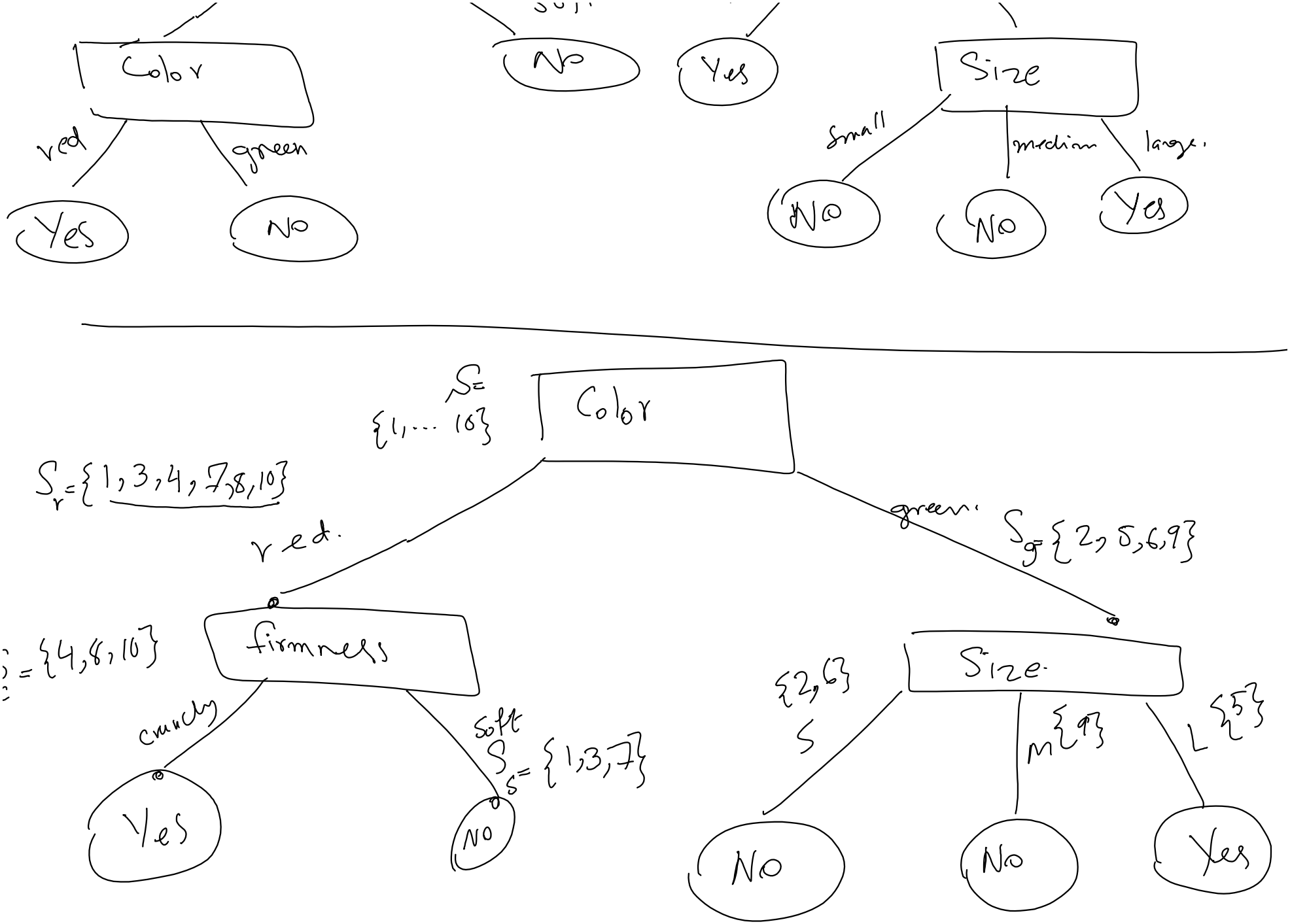
f(A, Green, Small, Crunchy) = NO

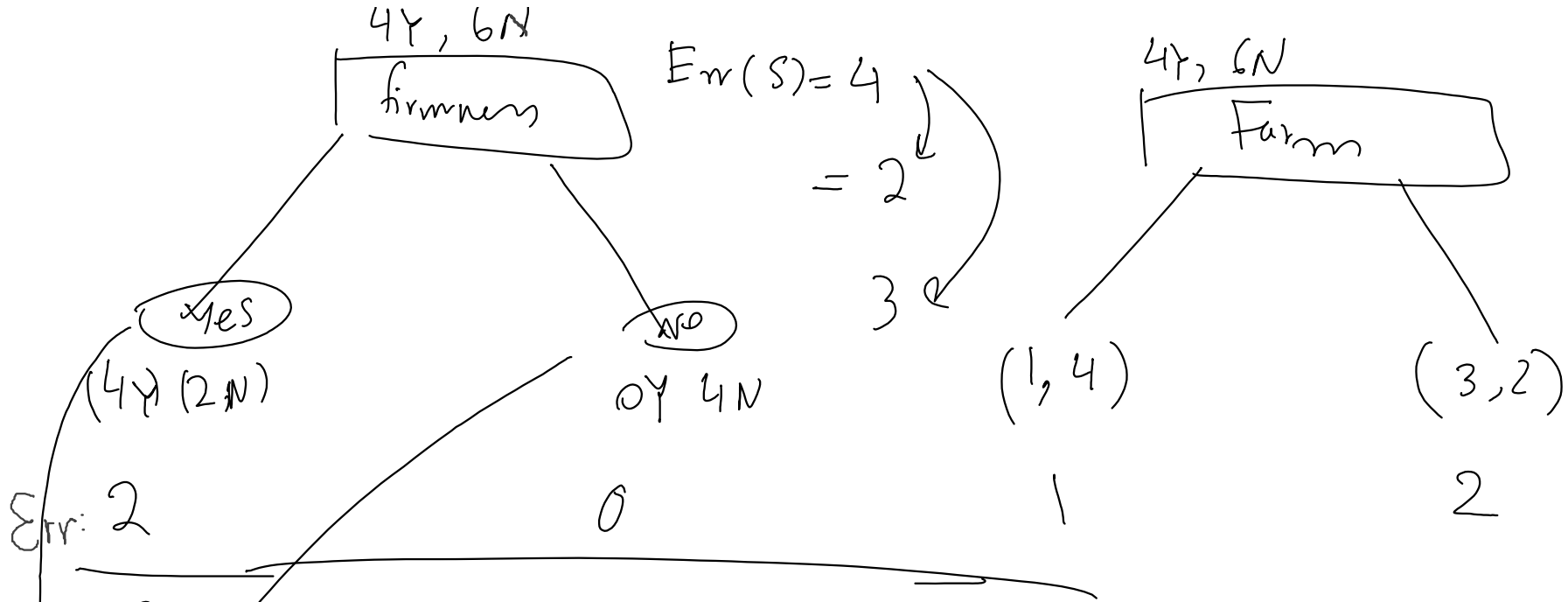









Color
red
green
Yes
No
No
Yes
Size
Small
medium
large
No
No
Yes
S=
{1,... 10}
Color
$S_r = \{1,3,4,7,8,10\}$
red.
green.
$S_g = \{2,5,6,9\}$
firmness
$= \{4,8,10\}$
crunchy
soft
$S_s = \{1,3,7\}$
Yes
NO
Size.
{2,6}
S
M {9}
L {5}
NO
No
Yes



Entropy Based:

$$H(S) = -\frac{4}{10}\log\left(\frac{4}{10}\right) - \frac{6}{10}\log\left(\frac{6}{10}\right) = 0.97$$

1 Firmness $H(4,2) = \frac{-4}{6}\log\left(\frac{4}{6}\right) - \frac{2}{6}\log\left(\frac{2}{6}\right) = 0.92$

$$H(0,4) = \frac{-0}{4}\log(0) - \frac{4}{4}\log\left(\frac{4}{4}\right) = 0$$

$$H(S|A) = \frac{6}{16} \times 0.92 + \frac{4}{16} \times 0 = 0.55$$

② Size: 0.97 ⟶ 0.485 (Practice at home)