

Assignment 5

Q.1

X_{t-1}	X_t	$P(X_t X_{t-1})$
1	1	2/3
1	2	1/3
2	1	1/2
2	2	1/2

① $P(X_0=1)$

$$P(X_1=1) = P(X_1=1 | X_0=1) \cdot P(X_0=1) + P(X_1=1 | X_0=2) \cdot P(X_0=2) =$$

$$= 2/3 \cdot 1 + 1/2 \cdot 0 = 2/3$$

$$P(X_1=2) = P(X_1=2 | X_0=1) \cdot P(X_0=1) + P(X_1=2 | X_0=2) \cdot P(X_0=2) =$$

$$= 1/3 \cdot 1 + 1/2 \cdot 0 = 1/3$$

$$P(X_2=1) = P(X_2=1 | X_1=1) \cdot P(X_1=1) + P(X_2=1 | X_1=2) \cdot P(X_1=2) =$$

$$= 2/3 \cdot 2/3 + 1/2 \cdot 1/3 = 4/9 + 1/6 = 11/18$$

$$P(X_2=2) = P(X_2=2 | X_1=1) \cdot P(X_1=1) + P(X_2=2 | X_1=2) \cdot P(X_1=2) =$$

$$= 1/3 \cdot 2/3 + 1/2 \cdot 1/3 = 2/9 + 1/6 = 7/18$$

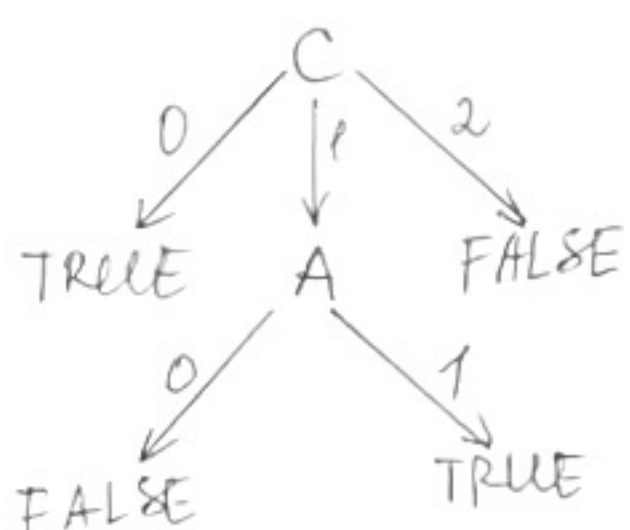
② $\begin{cases} P(X_0=1) = P(1|1)P_0(1) + P(1|2)P_0(2) \\ P(X_0=2) = P(2|1)P_0(1) + P(2|2)P_0(2) \end{cases} \Rightarrow$

$$\Rightarrow \begin{cases} P(X_0=1) = 2/3 P_0(1) + 1/2 P_0(2) \\ P(X_0=2) = 1/3 P_0(1) + 1/2 P_0(2) \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} P_0(1) = 1.5 P_0(2) \\ P_0(2) = 2/3 P_0(1) \end{cases} \Rightarrow \begin{cases} P_0(1) = 3/5 \\ P_0(2) = 2/5 \end{cases}$$

Q.2. (a) The information gain would choose C as the root of the tree because it is split into (almost ideally) "all positive" and "all negative". That is, ~~all~~ all 0's are True, all 2's are False.

(b)



(c) $[A=0, B=0, C=2]$ FALSE
 $[A=1, B=1, C=1]$ TRUE