# Grade 12 GS

# Probability ex 20

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Let **C** be a given fake coin such that the probability of having a head is three times having a tail.

Let $U_1$ and $U_2$ be two given urns such that:

$U_1$ contains 10 balls: 6 red and 4 yellow.

$U_2$ contains 10 balls: 5 red, 4 black and 1 green.

We throw the coin **C**. If we get a tail, then we pick up, randomly and **simultaneously**, two balls from urn $U_1$; otherwise, if we get a head, we select at random two balls from $U_2$ **one after the other with replacement**.

Consider the following events:
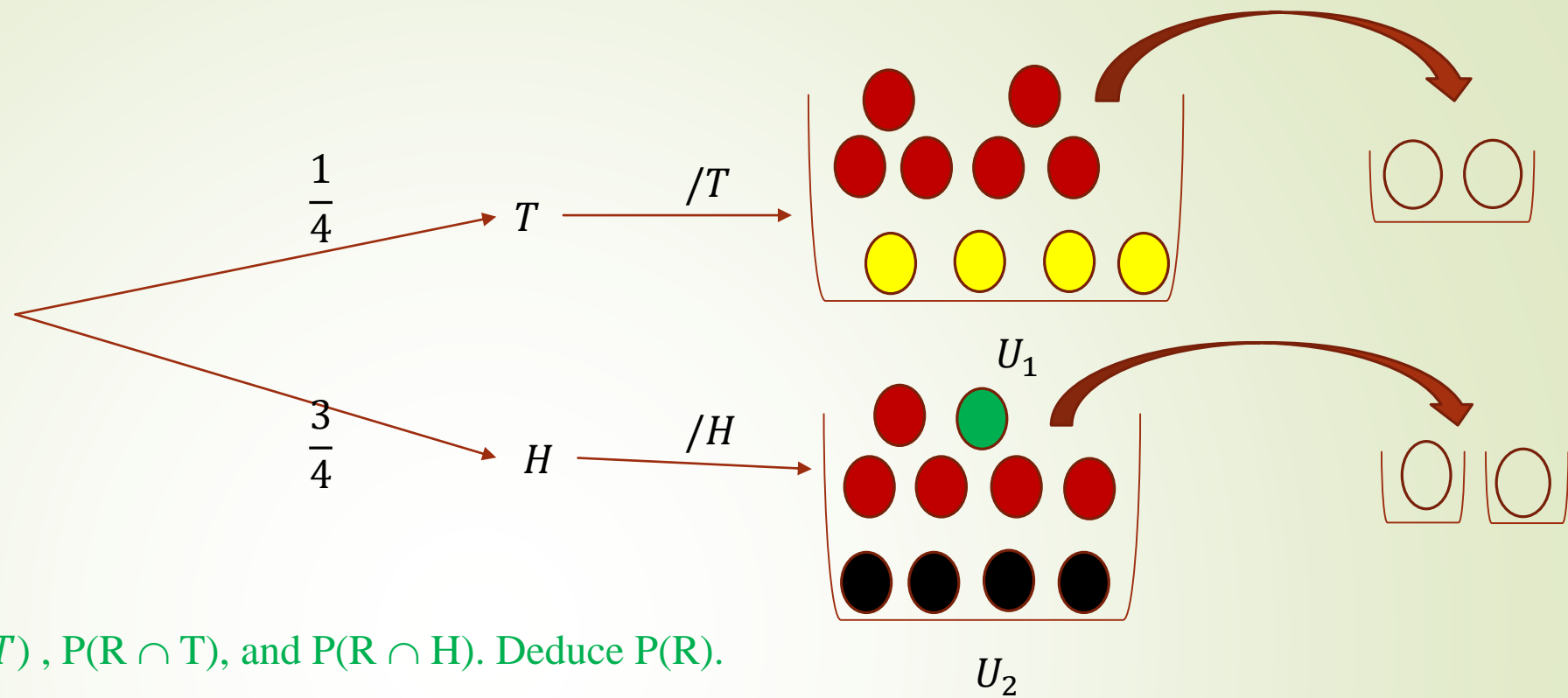
T: "The coin turns on a tail"

H: "The coin turns on a Head"

R: "The chosen balls are all red."

1) Show that P(H) = $\frac{3}{4}$ and P(T) = $\frac{1}{4}$ .

$$P(H) + P(T) = 1$$

$$but \ P(H) = 3P(T)$$

$$Then: \ \ 3P(T) + P(T) = 1 \ \rightarrow 4P(T) = 1$$

$$P(T) = \frac{1}{4} \ \ \ and \ P(H) = 3P(T) = \frac{3}{4}$$

- *Toss the coin C*:

$$\frac{1}{4}$$ → $T$ → /T →  $U_1$

$$\frac{3}{4}$$ → $H$ → /H →  $U_2$

1) Calculate $P(R/T)$ , P(R ∩ T), and P(R ∩ H). Deduce P(R).

- $P(R/T)= \dfrac{C_6^2}{C_{10}^2} = \dfrac{1}{3}$

- $P(R \cap T)=\ P(R/T)\times P(T) = \dfrac{1}{3}\times\dfrac{1}{4}\ = \dfrac{1}{12}$

- $P(R \cap H)=\ P(R/H)\times P(H)= \dfrac{5}{10}\times\dfrac{5}{10}\times\dfrac{3}{4}=\dfrac{3}{16}$

- $P(R)= P(R \cap T) + P(R \cap H) = \dfrac{1}{12}+\dfrac{3}{16}=\dfrac{13}{48}$

2) The two selected balls are red. Calculate the probability that they come from $U_1$.

- $P(T/R) = \dfrac{P(T \cap R)}{P(R)} = \dfrac{\frac{1}{12}}{\frac{13}{48}} = \dfrac{4}{13}$

3) Calculate the probability of getting only one red ball.

- $P(N) = P(N \cap T) + P(N \cap H) = P(N/T) \times P(T) + P(N/H) \times P(H)$

$$= \dfrac{C_6^1 \times C_4^1}{C_{10}^2} \times \dfrac{1}{4} + \left( \dfrac{5}{10} \times \dfrac{5}{10} \times 2! \right) \times \dfrac{3}{4} = \dfrac{61}{120}$$

- *Toss the coin C:*