



Department of Computer Engineering

# Artificial Intelligence

## Assignment 4 part 1

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## 1

## 1.1

Bayesian network for each step of the problem is shown in figure 1.

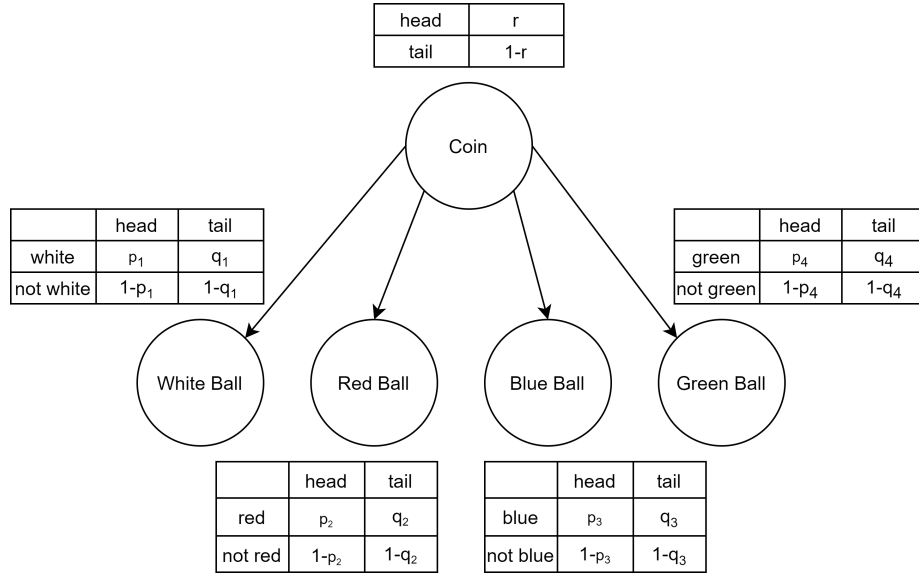


Figure 1: Bayes' network for each coin toss

## 1.2

$$\begin{aligned}
 P(\text{Isochromatic} | \text{TTH}) &= A \\
 \text{Isochromatic} : \text{balls} &\in \{(w, w, w), (r, r, r), (b, b, b), (g, g, g)\} \\
 \text{TTH} : \text{coins} &= \{T, T, H\} \\
 \Rightarrow A &= \frac{P(\text{Isochromatic}, \text{TTH})}{P(\text{TTH})} \\
 &= \frac{(1-r)^2 \times r \times (q_1 q_1 p_1 + q_2 q_2 p_2 + q_3 q_3 p_3 + q_4 q_4 p_4)}{(1-r)^2 \times r} \\
 &= q_1 q_1 p_1 + q_2 q_2 p_2 + q_3 q_3 p_3 + q_4 q_4 p_4 \\
 &= q_1^2 p_1 + q_2^2 p_2 + q_3^2 p_3 + q_4^2 p_4 \\
 &= \sum_{i=1}^4 q_i^2 p_i
 \end{aligned}$$

**1.3**

$$\begin{aligned}P(H|\text{Red}) &= A \\ H : \text{coins} &= \{H\} \\ \text{Red} : \text{balls} &\in \{(r)\} \\ \Rightarrow A &= \frac{P(H, \text{Red})}{P(\text{Red})} \\ &= \frac{rp_2}{rp_2 + (1-r)q_2}\end{aligned}$$