

2. When a piece of buttered toast is dropped, the probability that it lands butter side up is p

Two identical pieces of buttered toast are dropped independently in the same way.

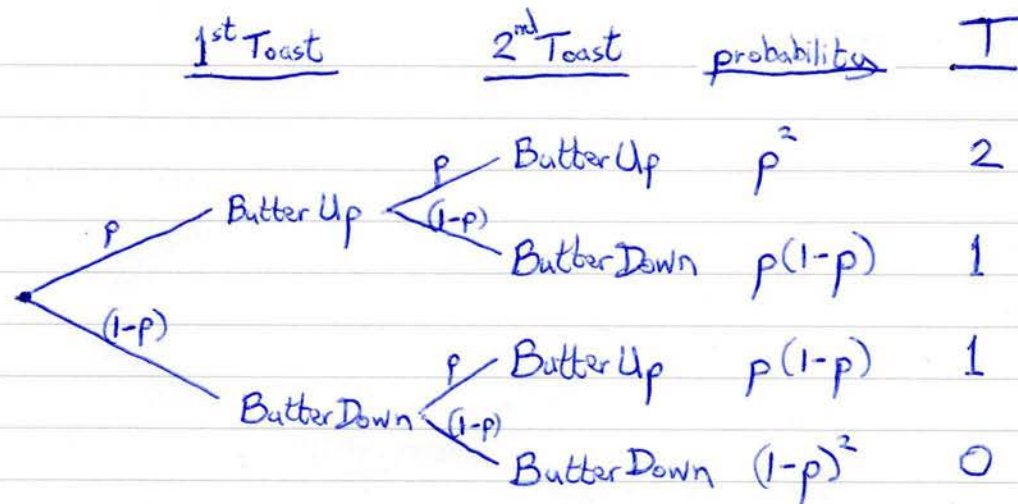
The random variable T represents the number of pieces that land butter side up, so that T can take the value 0, 1 or 2

- (a) Find $P(T=0)$, giving your answer in terms of p

(1)

- (b) Show that the distribution of T is not discrete uniform.

(3)



(a) From Decision Tree, $P(T=0) = (1-p)^2$ (1 mark)

(b) From Decision Tree,

$$\begin{aligned}
 P(T=2) &= p^2 \\
 P(T=1) &= 2p(1-p) = 2p - 2p^2 \\
 P(T=0) &= (1-p)^2 = p^2 - 2p + 1
 \end{aligned}$$

For discrete uniform distribution

$$P(T=2) = P(T=1) = P(T=0)$$

$$p^2 = 2p - 2p^2 = p^2 - 2p + 1$$

$$P(T=2) = P(T=0) \Rightarrow p^2 = p^2 - 2p + 1 \Rightarrow p = \frac{1}{2}$$

but $p = \frac{1}{2} \Rightarrow$

$$P(T=1) = 2\left(\frac{1}{2}\right) - 2\left(\frac{1}{2}\right)^2 = 1 - \frac{1}{2} = \frac{1}{2}$$

$$P(T=2) = \left(\frac{1}{2}\right)^2 = \frac{1}{4}$$

$$P(T=0) = \left(\frac{1}{2}\right)^2 - 2\left(\frac{1}{2}\right) + 1 = \frac{1}{4}$$

so, $P(T=1) \neq P(T=2)$ or $P(T=0)$ (2 marks)

No value of p makes all probabilities equal, so distribution of T is not discrete uniform (1 mark)