# Assignment 3

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# Question

**Papoulli Chapter 2(Ex.2.17)** :
If we toss a coin twice we generate the four outcomes hh, ht, th,and tt.
$H_1 = \{$heads at first toss$\} = \{$hh, ht$\}$
$H_2 = \{$heads at second toss$\} = \{$hh, th$\}$
show that $H_1$ and $H_2$ are independent.

## Solution Page 1

If we assign the probability to elementary events, then we can construct an experiment with these outcomes.

Let a and b be two positive numbers such that $a + b = 1$.

we assume that,

$$P(hh) = a^2 \tag{1}$$
$$P(ht) = P(th) = ab \tag{2}$$
$$P(tt) = b^2 \tag{3}$$

These are consistent with the axioms because

$$a^2 + ab + ab + b^2 = (a + b)^2 = 1 \tag{4}$$

## Solution Page 2

The events
$H_1 = \{$heads at first toss$\} = \{$hh, ht$\}$
$H_2 = \{$heads at second toss$\} = \{$hh, th$\}$
consists of two elements each and their respective probabilities are

$$P(H_1) = P\{hh\} + P\{ht\} = a^2 + ab = a \qquad (5)$$
$$P(H_2) = P\{hh\} + P\{th\} = a^2 + ab = a \qquad (6)$$

The intersection of events $H_1$ and $H_2$ consists of only single element $\{$hh$\}$.

$$P(H_1H_2) = P[hh] = a^2 = P(H_1)P(H_2) \qquad (7)$$

The above equation proves that $H_1$ and $H_2$ are independent