

# AI1110: Assignment 4

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# Outline

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# Question

**a)** In the coin experiment, the space  $S$  consists of the outcomes  $h$  and  $t$ :

$$S = \{h, t\}$$

and it's events are the four sets  $\{\emptyset\}$ ,  $\{t\}$ ,  $\{h\}$ ,  $S$ .

$P\{h\} = p$  and  $P\{t\} = q$ . Show that  $p + q = 1$

**b)** We consider now the experiment of the toss of a coin three times. What is the probability of getting two heads in the first two tosses?

## Solution (a)

The given coin is fair.

We get either heads or tails for one toss.

Number of possible outcomes = 2

Probability of getting heads is  $P\{h\} = p$

Probability of getting tails is  $P\{t\} = q$

Both events are exhaustive, mutually exclusive and equally probable.

$$\implies P\{h\} = P\{t\} = \frac{1}{2} \quad (1)$$

$$\implies p = q = \frac{1}{2} \quad (2)$$

$$\therefore p + q = \frac{1}{2} + \frac{1}{2} \quad (3)$$

$$= 1 \quad (4)$$

## Solution (b)

Let  $P(E)$  be the required probability

The possible outcomes/events of this experiment(tossing the coin thrice) are:

$$hhh, hht, hth, htt, thh, tht, tth, ttt$$

In this case, the probability of each elementary event equals  $\frac{1}{8}$ .

Thus the probability  $P\{hhh\}$  that we get three heads equals  $\frac{1}{8}$ . The event

$$\{E\} = \{hhh, hht\} \quad (5)$$

consists of the two outcomes  $hhh$  and  $hht$ .

Hence the required probability is

$$P(E) = P\{hhh\} + P\{hht\} \quad (6)$$

$$= \frac{1}{8} + \frac{1}{8} \quad (7)$$

$$= \frac{2}{8} \quad (8)$$