

# Expectation and Variance

A random variable is a variable whose value is (within limits) determined by chance

The expected value of a discrete random variable  $X$  is

$$E(X) = \sum xP(X = x)$$

As well as being able to find the expected value of  $X$ , in some cases we may need to find  $E(X^2)$ ,  $E(X^3)$  etc

If  $E(X) = \sum xP(X = x)$  then:

$$E(X^2) = \sum x^2P(X = x)$$

$$E(X^3) = \sum x^3P(X = x)$$

The variance of a discrete random variable  $X$  is denoted by

$$\text{Var}(X) = E(X^2) - E(X)^2$$

**N.B.** It is important to remember that  $E(X^2) \neq E(X)^2$  and you may have to calculate this and show they are not equal

## Mode

The mode is the discrete random variable that is most likely to occur

The mode of a discrete random variable is the observation with the largest probability

## Median

The median of a discrete random variable is where the probability of 0.5 would lie if we calculated  $P(X < x)$