

When does Bernoulli apply:

- ① there is an exact no. of trials (n).
- ② only 2 outcomes - "Success" or "fail"
- ③ $P(\text{success}) = p$
 $P(\text{fail}) = q$
 p and q are constant throughout the experiment.
- ④ all events are independent.

Example 1

An unbiased die is thrown 5 times. Find the probability of obtaining

- (i) 1 six (ii) 3 sixes (iii) at least 1 six.

$$P(r \text{ successes}) = \binom{n}{r} p^r q^{n-r}$$

$$p = P(6) = \frac{1}{6}$$

$$q = P(\text{not } 6) = \frac{5}{6}$$

$$r = \text{no. } 6\text{s} = 3 \leftarrow \text{successes}$$

$$n = \text{no. trials} = 5$$



$$p = P(6) = \frac{1}{6}$$

$$q = P(\text{not } 6) = \frac{5}{6}$$

$$r = 0$$

$$n = 5$$

$P(3 \text{ sixes}) = ?$

$$= \binom{5}{3} \left(\frac{1}{6}\right)^3 \left(\frac{5}{6}\right)^2$$

$$= \frac{125}{388}$$

\swarrow successes
 \searrow fails

$P(\text{at least 1 six}) = 1 - P(\text{no six})$

$$= 1 - \binom{5}{0} \left(\frac{1}{6}\right)^0 \left(\frac{5}{6}\right)^5$$

$$= 1 - (1)(1) \left(\frac{3125}{7776}\right)$$

$$= \frac{4651}{7776}$$

Combinations

$$\binom{n}{r} \text{ or } nCr$$

Calculator

$$\binom{5}{0} = 5C0$$
$$= 1$$