

# Probability Assignment 1 (12.13.5.12)

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**Question** Find the probability of throwing at most 2 sixes in 6 throws of a single die.

**Solution** Let  $X$  denote the number of sixes obtained after the 6 trials. Clearly,  $X$  has the binomial distribution with  $n = 6$  and  $p$  being the probability of obtaining a six

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

$$q = 1 - p = \frac{5}{6} \quad (2)$$

Now, since  $X$  has the binomial distribution, the cumulative distribution function is given by

$$F_X(r) = Pr(X \leq r) \quad (3)$$

$$Pr(X = r) = {}^nC_r (p)^r (q)^{n-r} \quad (4)$$

$$\therefore F_X(r) = \sum_{i=0}^r {}^nC_i p^i q^{n-i} \quad (5)$$

The probability of throwing at most 2 sixes in 6 throws is :

$$F_X(2) = {}^6C_0 \left(\frac{1}{6}\right)^0 \left(\frac{5}{6}\right)^{6-0} + {}^6C_1 \left(\frac{1}{6}\right)^1 \left(\frac{5}{6}\right)^{6-1} + {}^6C_2 \left(\frac{1}{6}\right)^2 \left(\frac{5}{6}\right)^{6-2} \quad (6)$$

$$F_X(2) = \frac{21875}{23328} \quad (7)$$