**Probability Distributions**

* Random variable – value is determined by chance
  + E.g. rolling a die:
  + X 1 2 3 4 5 6
  + P(X) 1/6 1/6 1/6 1/6 1/6 1/6
  + X is a discrete variable
* For a probability distribution:
  + **∑ P(X) = 1**
  + **0 ≤ P(X) ≤ 1**
* Mean of a probability distribution
  + **μ = ∑ (X ⋅ P(X))**
* Variance of a probability distribution
  + **σ2 = ∑ (X2 ⋅ P(X)) – μ2**
* Standard deviation
  + **σ = sqrt(σ2)**
* Expectation
  + **E(X) = μ**
  + For a game
    - E(X) > 0 → in favour of the player e.g. win money
    - E(X) < 0 → not in favour of the player e.g. lose money
    - E(X) = 0 → fair game
* **Binomial distribution**
* **Binomial experiment**
  + Each trial has 2 outcomes (success & failure)
  + Each outcome has the same probability for every trial
    - p = P(S); q = 1 – p = P(F); both are constant
  + There are a fixed number of trials (n)
  + All trials are independent
  + X = # of successes in n trials
    - i.e. 0 ≤ X ≤ n
  + **P(X=k) = C(n, k) ⋅ pk ⋅ qn-k**
    - P(0) + … P(n) = qn + npqn-1 + … + npn-1q + pn = (p + q)n = 1 (Binomial expansion)