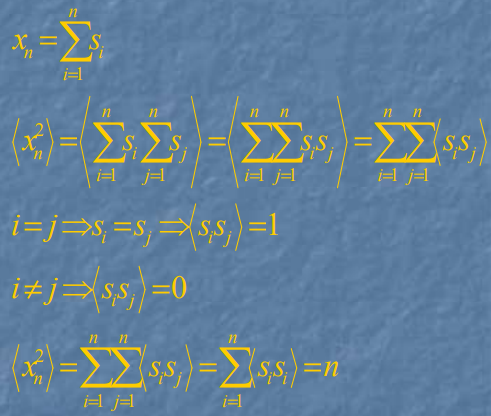
**Project Research**

Random Walks

* A random process consisting of a sequence of discrete steps of fixed length
  + Length varies depending on no. of dimensions and whether it is confined to a lattice
* Random walks applied to collisions of molecules in a gas = diffusion
* Random walks applied to random thermal perturbations in a liquid = Brownian motion
  + Motion of small particles suspended in a fluid due to bombardment of molecules obeying a Maxwellian velocity distribution
* In 1D: can only move in the positive or negative direction with equal probability
  + On a number line, most probable distance from the starting point after steps is 0
  + Gaussian distribution around the mean with standard deviation
  + standard deviation property applies in all numbers of dimensions, is characteristic of random walks and diffusion processes



Diffusion

* Consider the probability that a walker is at position after steps
* To get to position , the walker must be at position or to the previous step, where the probability the walker moves to position is 0.5
* Letting the time and spatial steps become infinitesimally small leads to the diffusion eqn:

Monte Carlo Methods

* Any method that solves a problem by generating suitable random numbers and observing the fraction of numbers obeying a property
* Useful for obtaining numerical solutions to problems with complex analytical solutions

RNG in Computers

* A uniform distribution of **pseudo-**random numbers can be generated by a linear congruential generator (LCG), defined by a recurrence relation:
  + a, b, m are chosen fixed integers: multiplier, increment and modulus respectively
  + starting value is the seed
  + A random number in the interval [0,1] is given by
  + M random uniformly distributed numbers will be produced
* PRNGs generate a sequence of numbers whose properties **approximate** the properties of sequences of random numbers, so are not truly random since they are entirely determined by an initial *(seed )*value. Are very speedy and reproducible.