Let the sequence length = N bits. Assume that X bits are equal to 1 (the rest being zeros). These 1's can be distributed in any way throughout the N bit sequence. The disparity at the end of this N bit sequence is:

$$\Delta RD = X - (N - X) = 2X - N$$

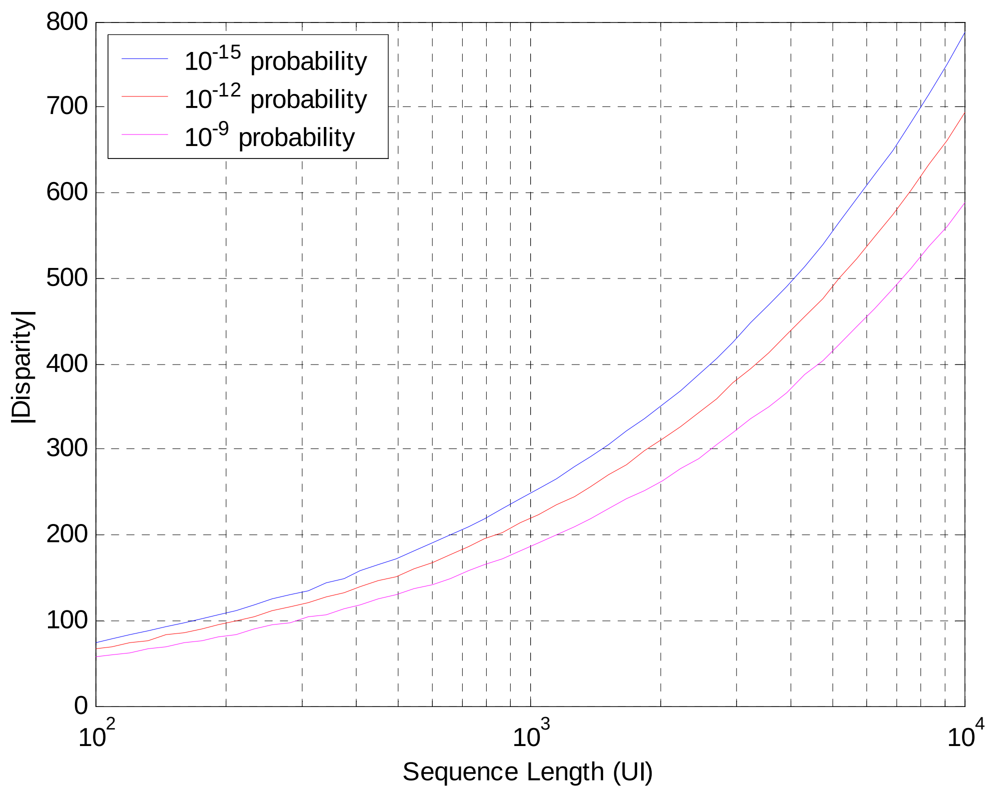
The probability that X 1's are randomly generated in N trials is given by the binomial distribution, (assuming that the probability of a 1 = probability of a 0 = ½)

$$p(X,N) = \binom{N}{X}\left(\frac{1}{2}\right)^{N} \quad \text{where} \quad \binom{N}{X} = \frac{N!}{X!(N-X)!}$$

The probability that the disparity is less than a certain value, RD_0, in a sequence of length N is given by the cumulative distribution:

$$P\{\Delta RD < RD_0 \;\; | \; N\} = \sum_{i=1}^{X} p(i,N) \quad \sum_{i=1}^{(RD_0+N)/2} p(i,N)$$

This probability is doubled if only the magnitude of the disparity, and not the sign, is considered.



The figure illustrates the magnitude of the disparity as a function of the sequence length for a given probability of occurrence. For example, with a sequence length of 2000 bits, a running disparity of >350 will occur with probability 10^{-15}, and a disparity of >300 will occur with probability 10^{-12}. For a sequence of 4000 bits, a disparity of > 500 occurs with probability 10^{-15}.