Problem Set # 1: Due Friday, Feb. 6.
Note Rescheduled Date

This is a hint for Problem Set 1, exercise 5.

5. Counting.

Consider two sequences, $\mathbf{a} = a_1 ... a_n$ and $\mathbf{b} = b_1 ... b_m$, where $1 \leq n \leq m$.

(a) How many alignments are there of length m?

(b) How many alignments are there of length $m + 2$?

(c) How many alignments *in general* are there between $\mathbf{a}$ and $\mathbf{b}$?

[For a hint on the general case, see p. 19 of Durbin. It is important to note here that for purposes of sequence alignment, one does not allow aligning a gap against a gap. We will, however, distinguish between cases such as

$$\begin{array}{cccc} \dots & a_i & \_ & \dots \\ \dots & \_ & b_j & \dots \end{array}$$

and

$$\begin{array}{cccc} \dots & \_ & a_i & \dots \\ \dots & b_j & \_ & \dots \end{array} \Bigg]$$

Since I don't require the text by DE, here are the problems on p. 19 of DE:

2.5: Show that the number of ways of *intercallating* two sequences of length m and n respectively, to give a single sequence of length $m+n$, while preserving the orsder of each of the two sequences is $\binom{m+n}{n}$.

2.6 By taking alternatiing symbols from the the upper and lower sequences in an alignment, then discarding the gaps, show that there is a one-to-one correspondence between gapped alignments of two sequences (with gap-to-gap alignment disallowed as above) and intercallat6ed sequences of the type described in problem 2.5 above.

2.7 Use Stirling's formula ($x! \approx \sqrt{2\pi} x^{x+\frac{1}{2}} e^{-x}$) to prove that

$$\binom{2n}{n} \approx \frac{2^{2n}}{\sqrt{2\pi n}}.$$