1. NFSA to Regular Expression

  a. /ab(ab|aab)*/

  b. /ab(a|ab|aab)*/

2. Bigram Probabilities - By Hand

  a. *<s> a man a man a man a plan a plan a canal panama panama </s>*

Word	Frequency
<s>	1
a	6
man	3
plan	2
canal	1
panama	2
</s>	1

Bigram	Frequency
<s>, a	1
a, man	3
man, a	3
a, plan	2
plan, a	2
a, canal	1
canal, panama	1
panama, panama	1
panama, </s>	1

  b. *<s> plan a panama </s>*

   P(S) = P(<s>) . P(plan | <s>) . P(a | plan) . P(panama | a) . P(</s> | panama)

   i. $P(S) = \frac{1}{16}.0.\frac{2}{2}.0.\frac{1}{2} = 0$

   ii. $P(S) = \frac{1}{16}.\frac{1}{8}.\frac{3}{9}.\frac{1}{13}.\frac{2}{9} = 0.0000445$

   iii. $P(S) = \frac{1}{16}.\frac{5}{15}.\frac{3}{15}.\frac{5}{15}.\frac{0.8}{15} = 0.0000741$