

May 17, 2024

[7] : *# Mahdi Anvari 610700002
Bioinformatics third homework*

1 Questions

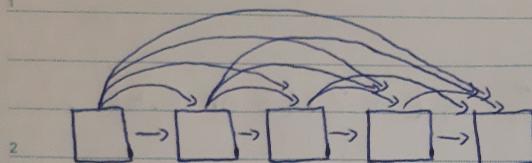
Exercises

- 3.7 Calculate the total number of transitions needed in a forward connected model as the one shown above with a length of L . Calculate the same number for a model with silent states (as above).
- 3.8 Show that the number of paths through an array of n states is indeed $\binom{l-1}{n-1}$ for length l as in (3.24).
- 3.9 What is the probability distribution over lengths for a model with an array of n states with self-loops if using the Viterbi algorithm?

[8] : *# 3.7*

2 Answers

Subject : _____ **Year :** _____ **Month :** _____ **Date :** _____

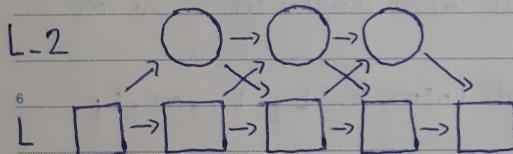


each pair of states has one transition between each other

So the total number of transitions will be $\rightarrow \frac{L(L-1)}{2}$

b-model with silent states

5 Consider we have L real states and $L-2$ silent states:



now our total number of states is $L+L-2=2L-2$ with

number of transitions as:	# States	# transitions
8	1	0
2	2	1
2L-5	2L-5	2

So the total number of transitions will be →

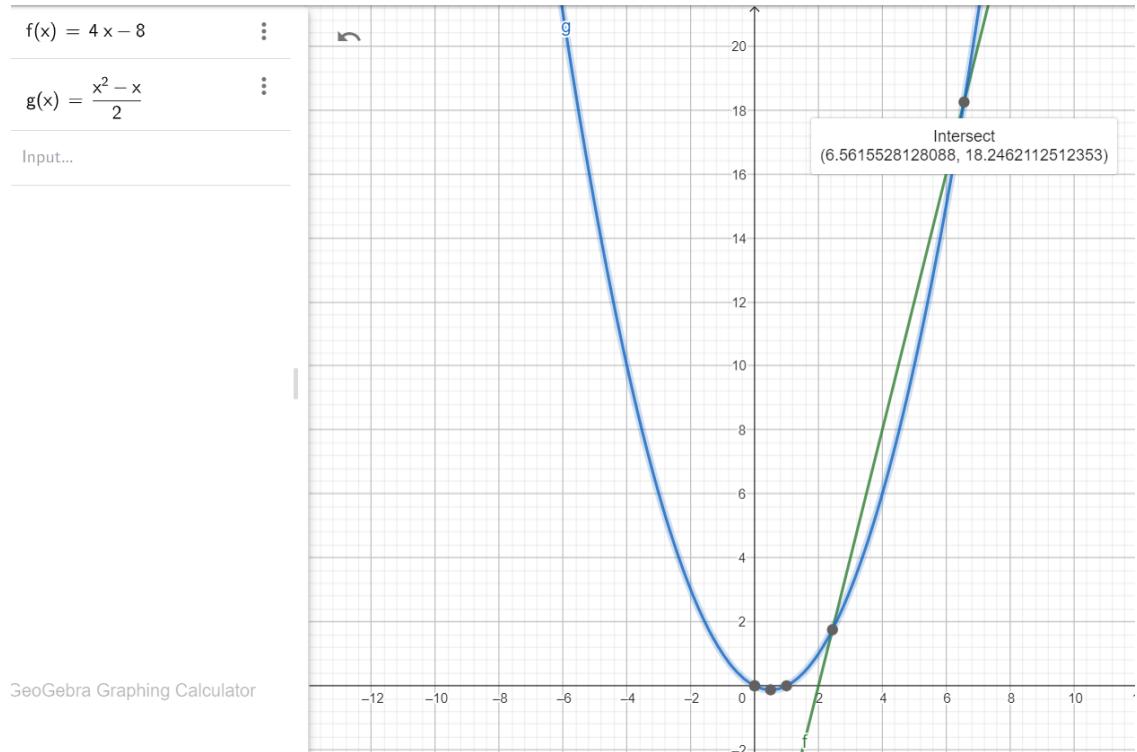
$$2(2L-5) + 1 \times 2 + 0 \times 1 = 4L - 10 + 2 = 4L - 8$$

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$$\frac{L(L-1)}{2} = 4L - 8 \rightarrow L^2 - L = 8L - 16 \rightarrow L^2 - 9L + 16 = 0 \rightarrow$$

$$L = \frac{9 \pm \sqrt{9^2 - 4 \times 16}}{2} = \frac{9 \pm \sqrt{17}}{2} \rightarrow L \approx 2.43 \text{ or } 6.56$$

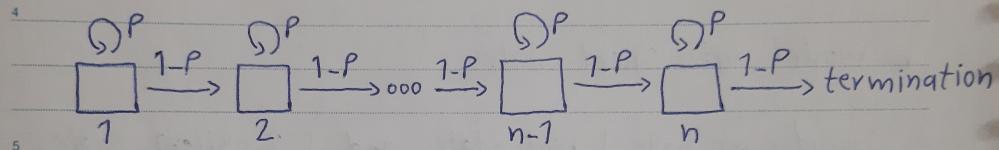
So $L > 7$ is feasible to use hidden states in the model



[9] : # 3.8

3 Answers

3.8) Consider the model below



with n states and an output with length of l . So we

have l emissions. Let's call them as E_1, E_2, \dots, E_l

We have 2 types of transitions. \circlearrowleft for self-transition (t_1)

and \rightarrow for next-transition (t_2)

$E_1 \rightarrow E_2 \rightarrow E_3 \dots \rightarrow E_l$ we have $l-1$ transitions from

E_1 to E_l and for having a successful termination we must

have $\underbrace{n-1}_{\rightarrow}$ type t_2 transitions so the total path will be $\boxed{\binom{l-1}{n-1}}$

States: $1 \rightarrow \dots \rightarrow n$

[]: