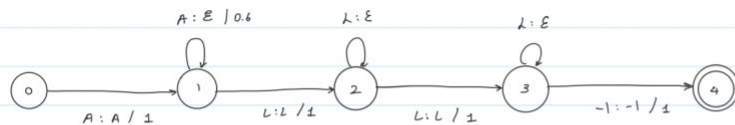
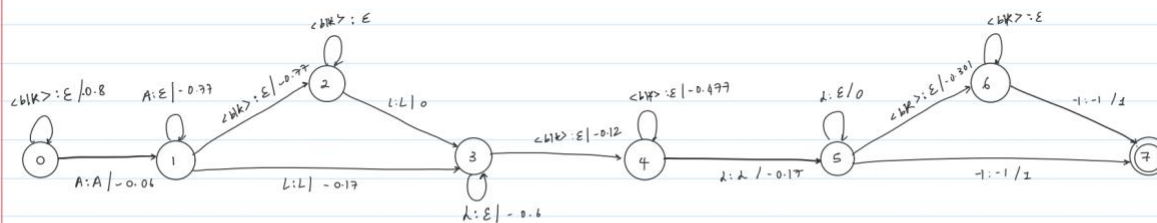


a)



→ this is for HMM

b)



→ it accepts all variations of all

→ it accepts <blank> in starting & in end

c)

a a a l l

a a l l l

a l l l l

d)

a φ l φ l

a l φ φ l

a l l φ l

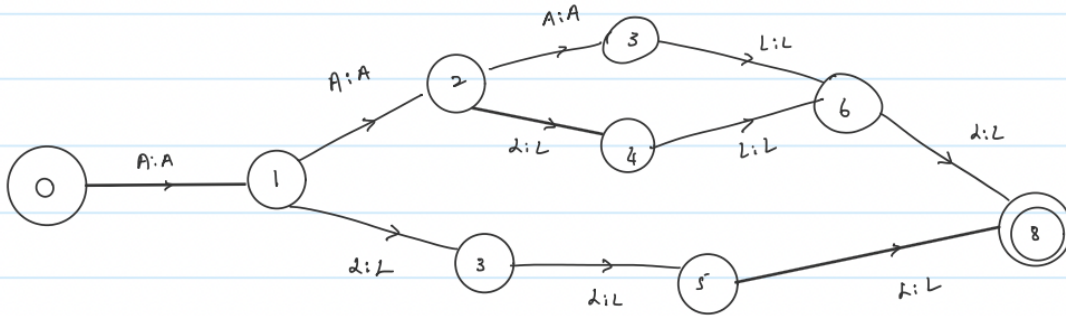
a a l φ l

φ a l φ l

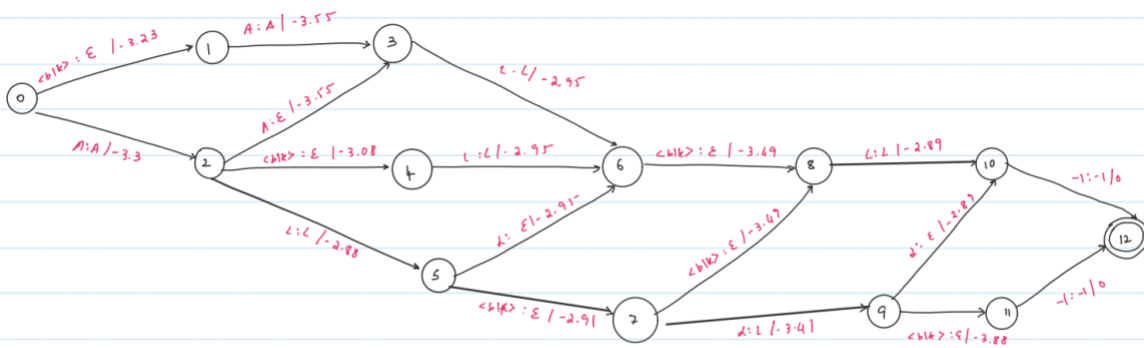
a l φ l φ

a l φ l l

e)



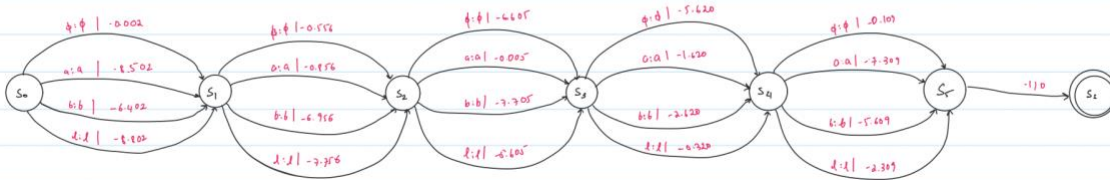
d)



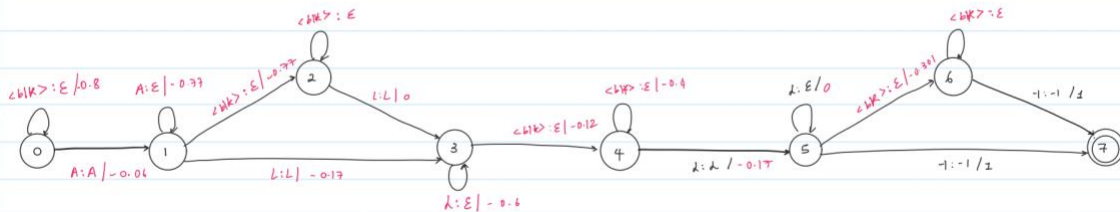
forward algorithm score is -14.018

Question 2:

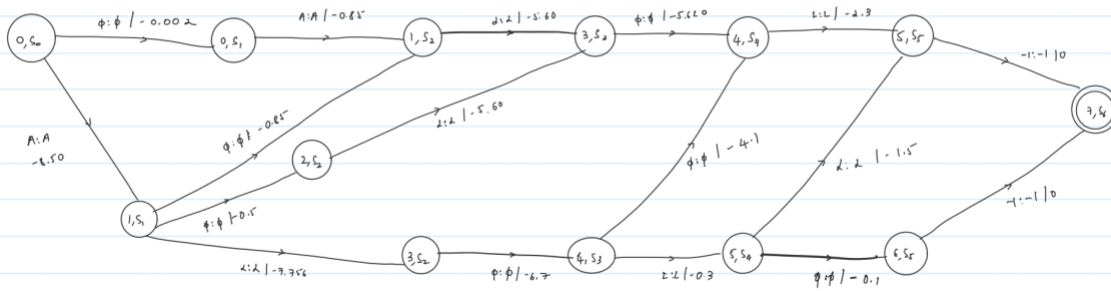
a)



b)



4) combining



4) Comparing the Composed WFST ($\Phi \circ T$) with the CTC Trellis for "ALL"

- Both the composed WFST ($\Phi \circ T$) and the CTC trellis for the string "ALL" represent possible alignments of the sequence with blank insertions and deletions allowed by the CTC model.
- $\Phi \circ T$: A more general WFST structure. It can explicitly show all possible symbol emissions, blank insertions, sequence terminations, and deletions for the input sequence "ALL".

CTC Trellis: A specialized trellis structure designed for efficient decoding in CTC. It focuses on the most likely alignments and might not explicitly represent all deletion paths due to computational cost.

Note: since we have removed states which won't reach final stage. The WFST is also more comparable with CTC Trellis

- $\Phi \circ T$: Uses the log-semiring for weight composition. This allows for combining symbol probabilities from Φ (stored as arc weights) with CTC operations (transitions in T) while considering penalties for deletions (weight of ∞ in the log-semiring).

CTC Trellis: focuses on maximizing the overall score of the alignment.

- $\Phi \circ T$: Offers a overall view of all possible alignments with their weights in the log-semiring. This allows for analyzing alternative alignments and their costs.

CTC Trellis: Primarily focuses on finding the most likely or highest-scoring alignment for the specific input "ALL".

- Trellis** has less state space. **WFST** has more state space.

d) Using the graph from b) and counting the possible alignments

alignments					α	
a	ϕ	l	ϕ	l	-	22.5
a	l	ϕ	ϕ	l	-	31.2
a	l	l	ϕ	l	-	14.0338
a	a	l	ϕ	l	-	22.1519
ϕ	a	l	ϕ	l	-	14.152
a	l	ϕ	l	ϕ	-	26.3122
a	l	ϕ	l	l	-	21.54