

Mid-Term Examination, Fall 99

This is a take home examination. The purpose of the examination is to give you experience with some of the material we have covered in the class as well as to get an evaluation of you for me. This will help me to give you better advice.

This is an open book examination. You may consult any resources you wish as long as they are non-human. **Do not spend more than four hours.**

Due date: October 22 1999. You may leave the exams in my office in the Moore School or at IRCS.

1. Construct a Finite State Automaton, M with $\Sigma = \{a, b\}$ and $L(M)$ = the set of all strings that do NOT contain aab . If M is nondeterministic then construct M' such that M' is deterministic and $L(M) = L(M')$. **(20 points)**

2. This problem is open ended in a sense. Do the simple versions first and then as much more as you can in the given amount of time. **(80 points)**

It will be more convenient to construct non-deterministic machines. There is no need to convert them to deterministic machines.

Part 1:

Construct a Finite State Machine for the simple noun phrases of English, i.e. phrases with a head noun optional left modifiers with an optional determiner. Thus you will consider adjectives (ADJ), noun (N) modifiers, gerunds (Ving), and past passive participals (Ven). ADJ can have adverbs (ADV) as left modifiers. There can be predeterminers also.

Part 2:

Continue the previous assignment by considering right modifiers such as prepositional phrases (PP).

Part 3:

Construct a Finite State Machine for the verb clusters of English. Verb clusters are verbal sequences such as

eats, ate, has eaten, has been eaten, will have eaten, wants to go, was persuaded to leave, may have been persuaded to leave, ...

Note that

wants John to leave

will not be considered as a verbal sequence. It has two verbal sequences

wants and *to leave*

Part 4:

Provide regular expressions corresponding to the machines in Parts 1, 2, and 3.

Part 5:

Construct a Finite State Transducer (FST) which will mark all simple noun phrases (corresponding to Part 1) in a sentence by enclosing the phrases between [and], for example, given the input

The black cat scratched the very dirty mat.

the output will be

[The black cat] scratched [the very dirty mat].

Part 6:

Construct an FST for marking off the phrases corresponding to Part 2. Assume that phrases in Part 1 have already been marked off by [and].

Part 7:

Construct an FST for marking off the phrases corresponding to Part 3.

Assume that phrases corresponding to Parts 1 and 2 have already been marked off.

I will use the following test sentence for Problem 2 above. You should use it also. Of course, you will test your machines with other sentences. Clearly, your machine should be far more general than a machine needed just for the test sentence below.

All the very dark brown cats in the house had been scratching the carpets.

all: predeterminer

the:determiner

very:adverb

dark:adverb

brown:adjective

cats:noun

in:preposition

house:noun

had:auxiliary verb:VAUX

been: auxiliary verb:VAUX

scratching:gerund: VG

carpets:noun

You need not treat – had, been, scratching–necessarily as I have indicated.