

CSE 477/Ling 549: Mid-Term Examination, October 24 2000

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 five hours.**

Due date: October 31 2000. You may leave your exam in my office in the Moore School (Room 555) or at IRCS.

Problem 1 (15 points)

Construct a Finite State Automaton, M with $\Sigma = \{a, b\}$ and $L(M)$ = the set of all strings except the strings aa and aaa . If M is nondeterministic then construct M' such that M' is deterministic and $L(M) = L(M')$.

Problem 2 (15 points)

Which ones of the following are true?

1. $baa \in a^*b^*a^*b^*$
2. $b^*a^* \cap a^*b^* = a^* \cup b^*$
3. $a^*b^* \cap c^*d^* = \phi$

Problem 3 (10 points)

State whether each of the following is true or false ($P(X)$ means the power set of X):

1. $\phi \in \phi$
2. $\phi \subseteq \phi$
3. $\phi \in \{\phi\}$
4. $\{a, b\} \in P\{a, b, \{a, b\}\}$
5. $\{a, b\} \subseteq P\{a, b, \{a, b\}\}$

Problem 4 (60 points)

This problem is open ended in a sense. Parts of the problem have been done already in the notes distributed in the class. You may lift those parts from the notes if you wish or do them again in your own way and possibly improve them.

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:

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].

You may find it easier to do this part by scanning the input string from right to left.

Part 5:

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 6:

Construct an FST for marking off the phrases corresponding to Part 3 by enclosing the phrases between { and }. 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 testing the sentence below.

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

all: predeterminer, PDET

the:determiner, DET

very:adverb, ADV

dark:adverb, ADV

brown:adjective, ADJ

cats:noun, N

in:preposition, P

house:noun, N

had:auxiliary verb:VAUX

been: auxiliary verb:VAUX

scratching:gerund: Ving

carpets:noun, N

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