

COMP3710—Compiling Construction

Example Midterm Exam

Instructions: Read carefully through the whole exam first and plan your time. Note the relative weight of each question and part (as a percentage of the score for the whole exam). The total points is 100 (*ie*, your grade will be the percentage of your answers that are correct).

This exam is **open book, open notes**. You may *not* use any electronic device during this exam.

You have **75 minutes** to complete all four (4) questions. Write your answers on this paper (use both sides if necessary).

Name: _____

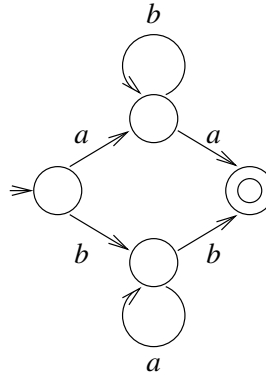
Student Number: _____

Signature: _____

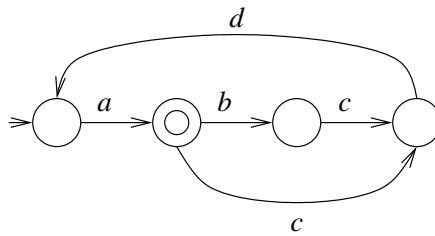
Question	Points	Score
1	15	
2	35	
3	25	
4	25	
Total:	100	

1. (Regular expressions) Write regular expressions that define the strings recognized by the following finite automata:

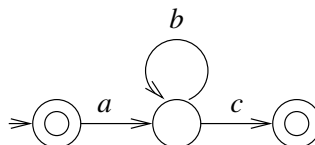
(a) (5 marks)



(b) (5 marks)



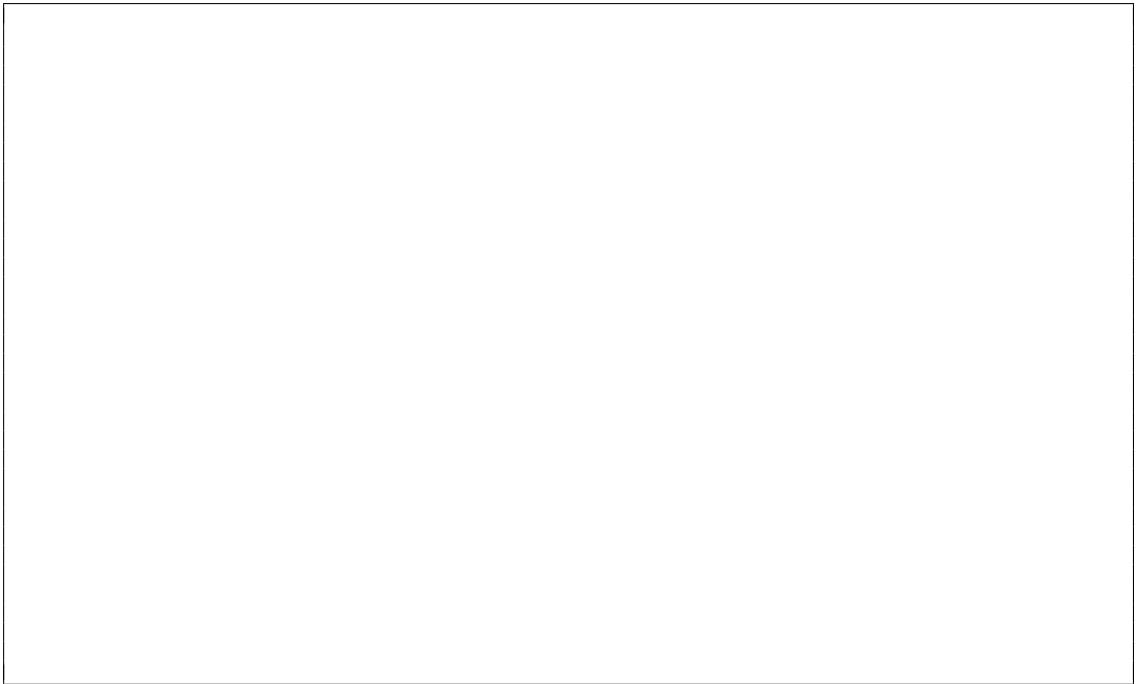
(c) (5 marks)



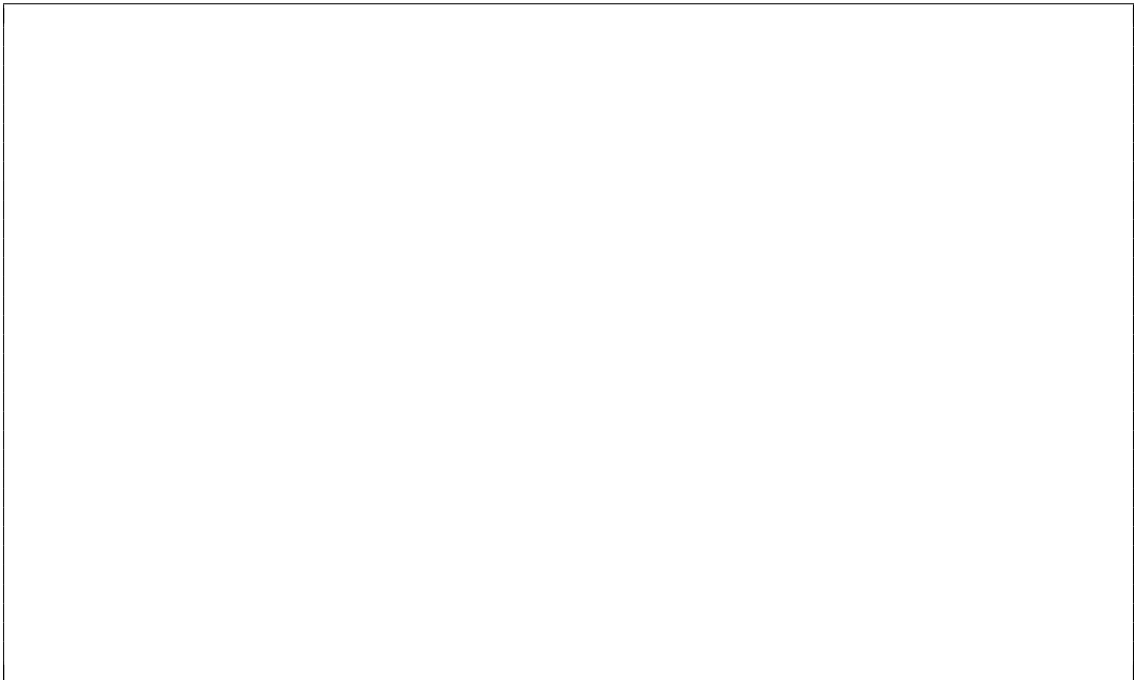
2. (Finite automata)

(a) (10 marks) Draw an NFA for the following regular expression:

$$(a|b)^*abb(a|b)^*$$



(b) (5 marks) Show the sequence of moves made by your NFA in processing the input string *ababbab*.



(c) (15 marks) Convert your NFA into a DFA.

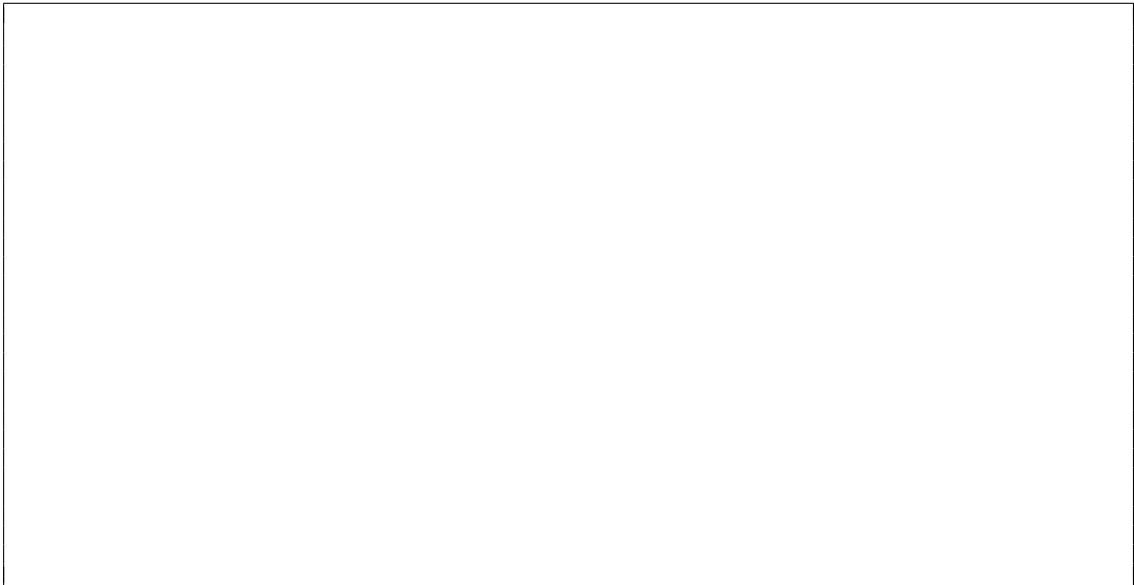
(d) (5 marks) Show the sequence of moves made by your DFA in processing the input string *ababbab*.

3. (Context free grammars, top-down LL parsing) Consider the following grammar:

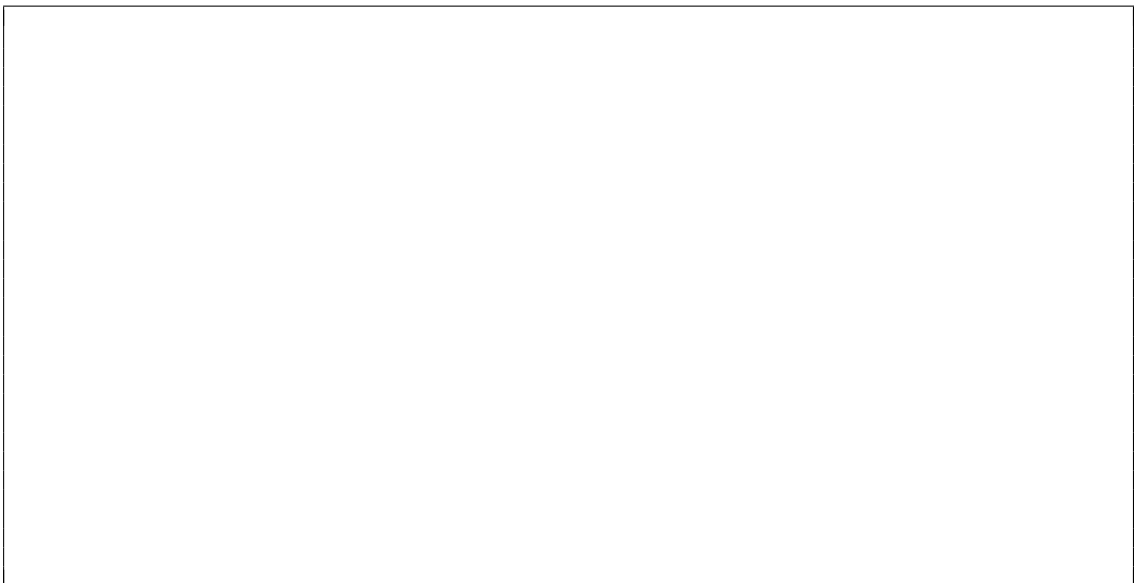
$$\begin{aligned}S &\rightarrow (L) \\S &\rightarrow a \\L &\rightarrow L, S \\L &\rightarrow S\end{aligned}$$

(a) (10 marks) Construct a parse tree and give both leftmost and rightmost derivations for the following sentence of the grammar:

$(a, (a, a))$



(b) (15 marks) Derive an LL(1) parse table for the language generated by this grammar.
[**Hint:** You may have to transform the grammar first in order to do so.]



4. (Context-free grammars, LR parsing) Consider the following grammar:

$$\begin{aligned} S &\rightarrow E\$ \\ E &\rightarrow T \mid E;T \\ T &\rightarrow \varepsilon \mid Ta \end{aligned}$$

(a) (10 marks) Is this grammar LR(0)? *Explain* your answer (a yes/no answer will not suffice).

- (b) (15 marks) Construct the SLR(1) parse table for this grammar. Is the grammar SLR(1)? Again, *explain* your answer.