ECE 495S/573 Fall 2007, First Exam

version 1

DO NOT START WORKING ON THIS UNTIL TOLD TO DO SO. LEAVE IT ON THE DESK.

You have until 8:20 to take this exam.

Your exam should have 8 pages total (including this cover sheet). *Please let Prof. Midkiff know immediately if it does not.*

This exam is open book and open notes. If you have a question, please ask for clarification. If the question is still not clear, state whatever assumptions you need to make to answer the question, and answer it under those assumptions. *Check the front board occasionally for corrections.*

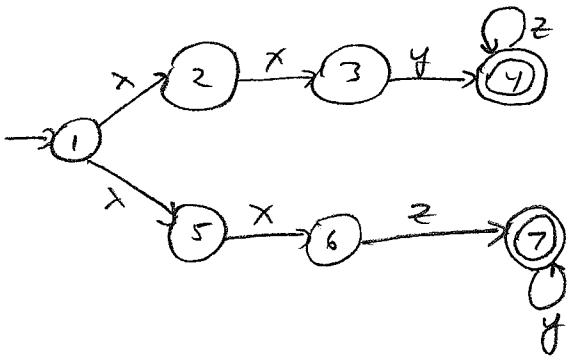
Points for each question part is shown as "**(X/Y)**", where "X" is the number of points the question is worth to a 495S student, and "Y" is the number of points the question is worth to a 573 student. The total should be 100 points.

Questions are not numbered, but are identified by the symbols $\spadesuit, \clubsuit, \heartsuit, \diamondsuit, \triangle and \nabla$. There are 5 questions (most with multiple parts) for 495S students, and 6 questions for 573 students.

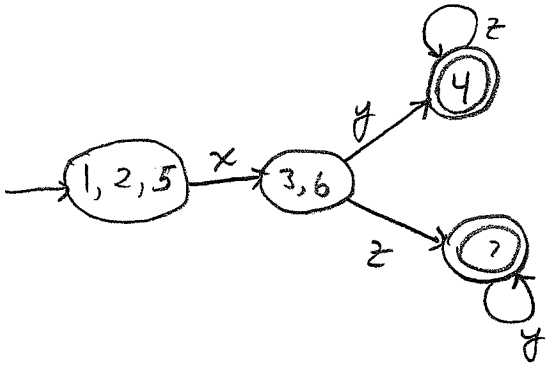
Name:

Student ID:

Question ♣a (8/6): Given the regular expression $(xyz^*)|(xzy^*)$ give a non-deterministic finite automata (NDFA) that accepts the languages defined by the regular expression. The automata you give must be non-deterministic, i.e. it cannot be a deterministic finite automata.



Question ♣b: **(8/6)** Give a deterministic finite automata (DFA) that is equivalent to the NDFA of question ♣a.



Let G_1 be:

$$\begin{aligned} S &\Rightarrow A\ \$ \\ A &\Rightarrow (\ b\ ) \\ A &\Rightarrow (\ A\ b\ A\ ) \end{aligned}$$

The notation $S \stackrel{n}{\Rightarrow} \beta$ means that the string β, consisting of terminals and non-terminals, can be derived from S in n steps, where each step replaces one non-terminal in the string with a right hand side of a production for that non-terminal.

Question ♠a: (8/6) Given the derivation $S \stackrel{2}{\Rightarrow} (\ A\ b\ A\ )\ \$$, what are the possible strings β in $S \stackrel{3}{\Rightarrow} \beta$?

((b) b A)

((A b A) b A)

(A b (b))

(A b (A b A))

Question ♠b: (8/6) Circle the strings above that would be possible for $S \stackrel{3}{\Rightarrow} \beta$ in a leftmost derivation.

Given the following grammars, provide the requested information.

Question ♡a: (6/4)

1. $S \Rightarrow A\ \$$
2. $A \Rightarrow (\ b\ A\ )$
3. $A \Rightarrow (\ A\ b\ A\ )$
4. $A \Rightarrow x$

First($A\ \$$)	{(, x}
First($(\ b\ A\ )$)	{(}
First($(\ A\ b\ A\ )$)	{(}
First(x)	{x}
Follow(A)	{$,), b}

Question ♡b: (6/4) Fill in the predict sets.

production	predict set
$S \Rightarrow A\ \$$	{(, x}
$A \Rightarrow (\ b\ A\ )$	{(}
$A \Rightarrow (\ A\ b\ A\ )$	{(}
$A \Rightarrow x$	{x}

Question ♡c: (6/4) Fill in the LL(1) parse table based on your answers to **♡b.**

	b	x	(	)	$
S		1	1		
A		4	2, 3		

Given the following grammar, provide the requested information.
Question ♡d: (6/4)

1. $S \Rightarrow A$
2. $A \Rightarrow (\; b \; A \;)$
3. $A \Rightarrow (\; A \; b \; A \;)$
4. $A \Rightarrow \lambda$

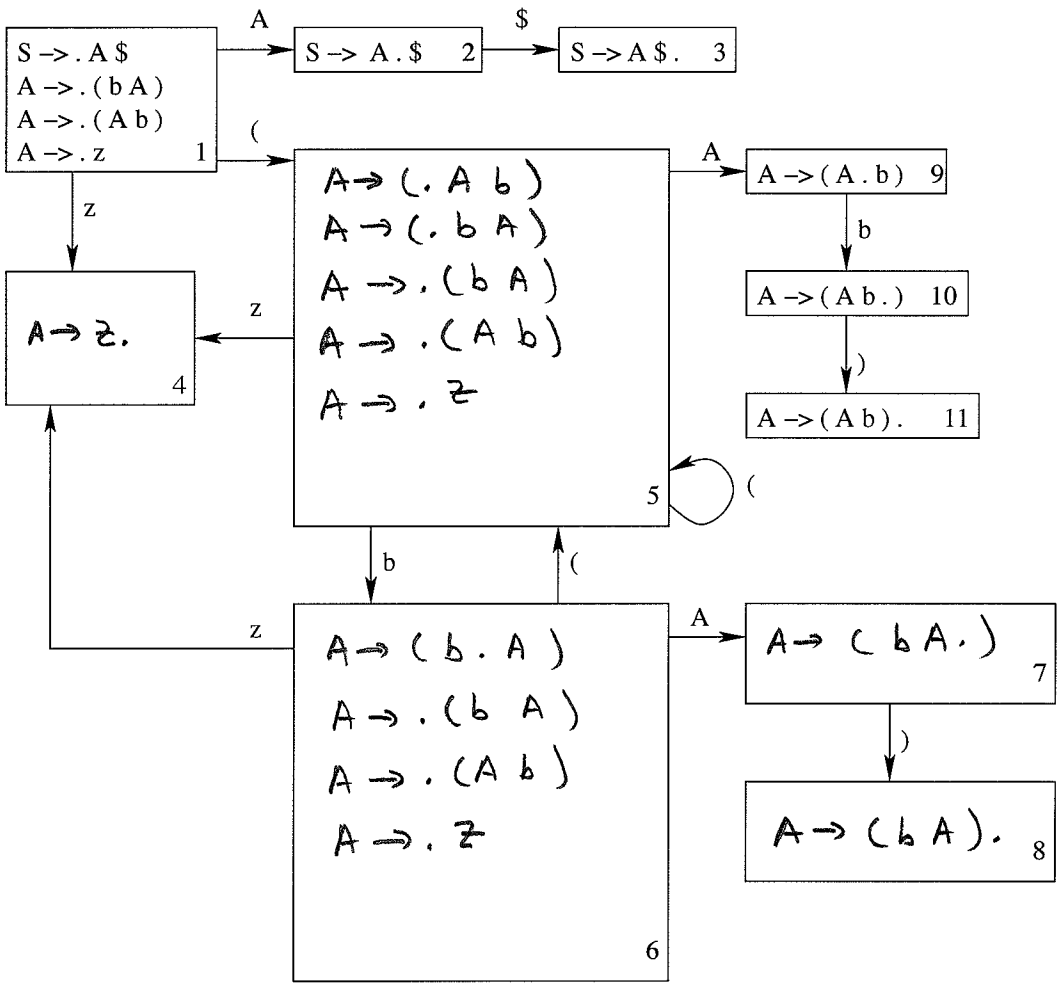
First(A)	{ (, λ }
First((b A))	{ (}
First((A b A))	{ (}
First(λ)	{ λ }
Follow(A)	{ b,), λ }

Given the grammar G_2, answer the following questions.

:

1. $S \Rightarrow A\,\$$
2. $A \Rightarrow (\,b\,A\,)$
3. $A \Rightarrow (\,A\,b\,)$
4. $A \Rightarrow z$

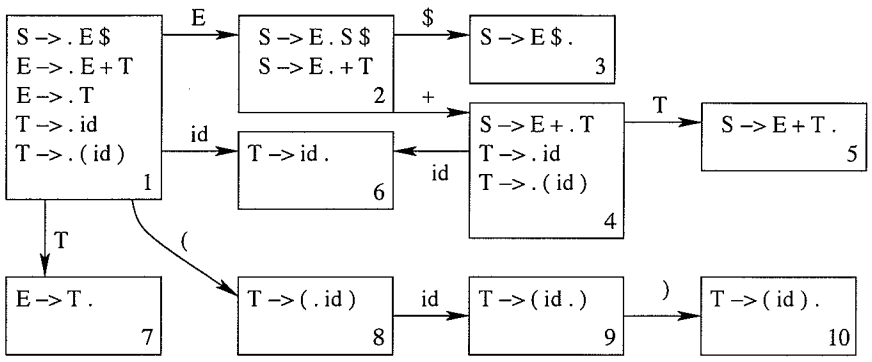
Question ◇a: (16/12) Fill in states 4, 5, 6, 7 and 8 in the CFSM below.



Question ◇b: (4/4)

- List all shift states (if any). 1, 2, 5, 6, 7, 9, 10
- List all reduce states (if any). 4, 8, 11 (Did not count off if 3 included)
- List all states with shift/reduce conflicts (if any). None

Consider the CFSM:



question △a: (8/6) Given the current configuration of an LR(0) parser (where the rightmost item on a stack is the one pushed on last):

symbol stack : (

state stack : 1 8

next token : id

- What is the next action? Shift
- What is the state of the symbol and state stacks after the action is completed finished?

(id 1 8 9

question △b: (8/6) Given the current configuration of an LR(0) parser (where the rightmost item on a stack is the one pushed on last):

symbol stack : (id)

state stack : 1 8 9 10

next token : +

- What is the next action? Reduce
- What is the state of the symbol and state stacks after the action is completed finished?

1 7 T

question △c: (8/6) Given the current configuration of an LR(0) parser (where the rightmost item on a stack is the one pushed on last):

symbol stack : E

state stack : 1 2

next token : $

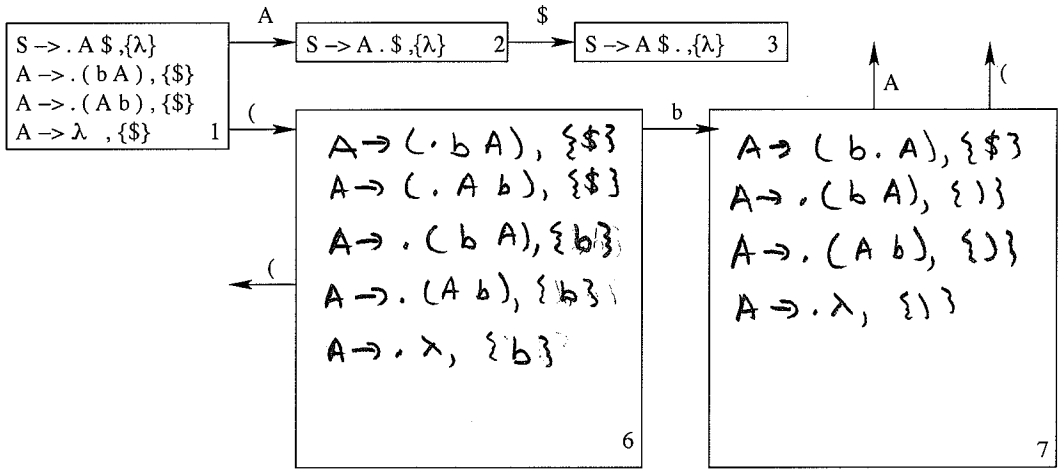
- What is the next action? Shift
- If is the state of the symbol and state stacks after the action is completed finished?

E $ 1 2 3

This page is for 573 students only. 495S students should not work the problems on this page.
Given the grammar G_3:

1. $S \Rightarrow A\ \$$
2. $A \Rightarrow (\ b\ A\ )$
3. $A \Rightarrow (\ A\ b\ )$
4. $A \Rightarrow \lambda$

Question ∇a: (0/9) Fill in states six and seven of the partial LR(1) machine below.



Question ∇b: (0/8) Give the Action and Goto table entries for state 1.

Action table				
State	Lookahead			
	b	$	(	)
1		R	S	

Goto table						
State	Next token					
~~X~~	S	A	b	$	(	)
1		2			6	

Question ∇c: (0/9) Give *Follow*(S) and *Follow*(A). What would state 1 be for an SLR(1) machine?

not needed to receive full credit

Follow(S) = {λ}

Follow(A) = {$,), b}

S -> . A $
A -> . (b A)
A -> . (A b)
A -> . λ , {$,), b}

can have lookahead sets for all and receive full credit.