CSE431 Midterm Examination

Name: KEY

ID Number: _____

- Show your work to receive maximum credit. Partial credit will be given, but only if work is shown.
- Circle or otherwise indicate your answer to each question.
- Please keep your written answers brief and to the point. Incorrect or rambling statements can hurt your score on a question.
- If a question requires you to provide code, please use Java syntax. Minor syntax errors will not be counted against you, but extremely sloppy code will result in deductions.
- This exam is worth 20% of your final grade.
- The exam is broken up into 5 parts and is worth 100 points. It is your responsibility to make sure you have all of the pages.
- You must sign the pledge below for your exam to count. Any cheating will cause the students involved to receive an F for this course. Other action may be taken.

Section	Possible Points	Score
I	18	
II	15	
III	8	
IV	24	
V	35	
Total	100	

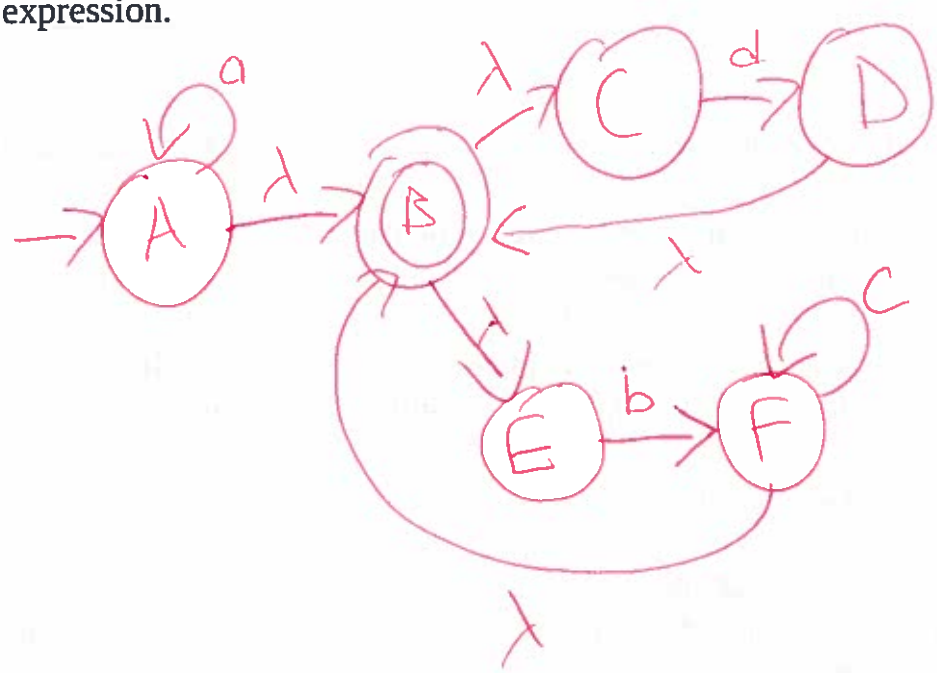
Pledge: On my honor, I have neither given nor received any unauthorized aid on this exam.

Signed: _____

1. (18 points) You are given the following regular expression:

a*(bc* | d)*

(8 points) Create a finite automata that can recognize the same language as this regular expression.



(3 points) Is your finite automata deterministic or non-deterministic? Explain how you know.

It is non-deterministic because of the λ transitions.

(7 points) Create a Right Linear Grammar that has the same language as the given regular expression.

$A \rightarrow aA$

$\quad | \; B$

$B \rightarrow C$

$\quad | \; E$

$C \rightarrow dD$

$D \rightarrow B$

$E \rightarrow bF$

$F \rightarrow cf$

$\quad | \; B$

2. (15 points) For the following questions, you must explain your answers. If the answer is false, give a counter example showing why. If the answer is true, write a couple of sentences explaining your answer, giving as much detail as possible.

(5 points) True or false: Overlapping predict sets are always caused by ambiguity.

False

Predict

S → aB a
| aC a) — overlap

B → b b

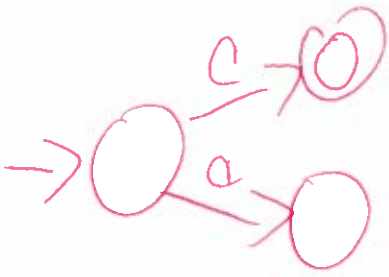
C → c c

(5 points) True or false: No parsing technique that we have discussed is able to parse an ambiguous grammar.

True. All of the parsing processes we have seen are deterministic and cannot handle ambiguity.

(5 points) True or False: Removing the non-determinism from an NFA will result in a DFA that has more states than necessary, and must be minimized.

False



becomes



which cannot be minimized

3. (8 points) Prove that the following grammar is ambiguous.

S -> aB
  | C
B -> c
  | dS
  | λ
C -> BS
  | d





Two parse trees for "d"

4. (24 points) Answer the following:

(20 points) Construct the Derives-λ, FIRST, FOLLOW, and PREDICT sets for the following grammar:

```
S       -> E semi $
E       -> Term Tail
Tail    -> plus Term Tail
        |  λ
Term    -> Factors Op
Op      -> times Factor Op
        |  λ
Factors -> plus Factor
        |  Factor
Factor  -> num
        | ( E )
```

Non-Terminal	Derives - λ	First	Follow
S	F	+ num (	—
E	F	+ num (	;)
Tail	T	+	;)
Term	F	+ num (	+ ;)
Op	T	*	+ ;)
Factors	F	+ num (	* + ;)
Factor	F	num (	* + ;)

Production	Predict
S -> E semi $	+ num (
E -> Term Tail	+ num (
Tail -> plus Term Tail	+
Tail -> λ	;)
Term -> Factors Op	+ num (
Op -> times Factor Op	*
Op -> λ	+ ;)
Factors -> plus Factor	+
Factors -> Factor	num (
Factor -> num	num
Factor -> (E)	(

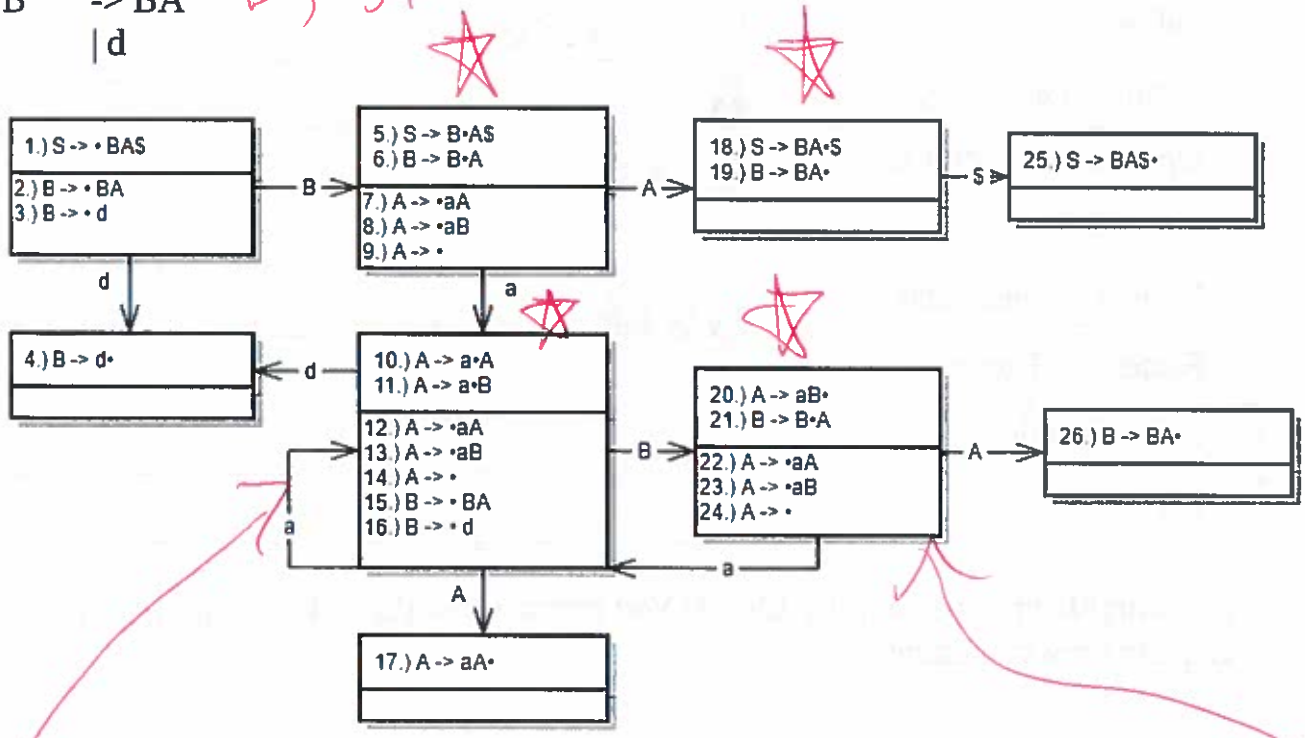
(4 points) Is this grammar LALR(1)? You may assume that it is not ambiguous. Explain how you know.

This grammar contains no overlapping predict sets, no left recursion, no common prefix, and no ambiguity. This grammar is LL(1) and therefore it is also LALR(1).

5. (35 points) You are given the following grammar and CFSM:

Follow

S -> BA$ S —
A -> aA A $, a
| aB
| λ
B -> BA B, a, $
| d



(6 points) Mark any states that contain conflicts, and state what kinds of conflicts there are.

They are all shift-reduce except this one which is shif-reduce and reduce - reduce.

(5 points) Is this grammar SLR(1)? Explain how you know.

It is not SLR(1) because in this State it says to reduce on "a" but also to shift on "a"

(20 points) Complete the item follow sets for this grammar by filling in the table. Use the item numbers as labelled on the CFSM.

Item	Initial Item Follow	Propagate From	Item Follow
1	$		$
2	a $		a $
3	a $	2	a $
4		3, 16	a $
5		1	$
6		2	a $
7	$	6	a $
8	$	6	a $
9	$	6	a $
10		7, 12, 22	a $
11		8, 13, 23	a $
12		10	a $
13		10	a $
14		10	a $
15	a	11	a $
16	a	11, 15	a $
17		10	a $
18		5	a $
19		6	a $
20		11	a $
21		15	a $
22		21	a $
23		21	a $
24		21	a $
25		18	$
26		21	a $

(4 points) Is this grammar LALR(1)? Explain how you know.

This grammar is not LALR(1). If you examine the shift-reduce conflict with items 18 and 19, LALR says we should reduce item 19 on $ but shift item 18 on $ also.