

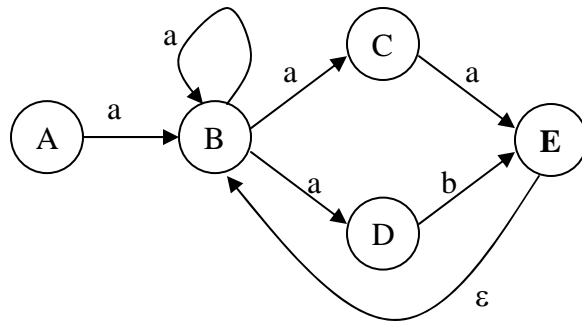
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Name _____

Directions: The following is the CSCI-250 midterm. Answer the questions in the space provided or on separate scratch paper. The exam is open-book/open-notes and is worth 100 points. You have 50 minutes to complete the exam. Good Luck!

1. Given the non-deterministic finite state automata $a^+(aa|ab)^+$ that is described by the following state table (where A is the start state, { A, B, C, D, E } are the non-final states, **F** is the final state, { **a**, **b** } is the set of input tokens, and ϵ is the empty move). Note that final states are boldface and non-final states are not boldface.

	a	b	ϵ
A	B		
B	B,C,D		
C	E		
D		E	
E			B



(30 Points) Use either the ϵ -closure method described in the book or the state table method described in class to determine the state table and state diagram for a minimum state Deterministic Finite State Automata (DFSA) that is equivalent to the above NDFSA. **SHOW ALL STEPS!** Guesses will receive 0 points.

This page is intentionally blank. It should be used as workspace for Question 1.

2. Given the following grammar:

$$\begin{aligned}
 E &\rightarrow T E \mid T \\
 T &\rightarrow T P F \mid F \mid \varepsilon \\
 F &\rightarrow (E) \mid * \\
 P &\rightarrow id \mid +
 \end{aligned}$$

where { E, T, F, P } are non-terminals, { id, +, * } are terminals, E is the start symbol, and ε is the empty symbol.

a. (15 Points) Derive first and follow sets for the above grammar.

	First	Follow
E		
T		
F		
P		

b. (20 Points) Given the following grammar:

$$\begin{aligned}
 E &\rightarrow T E' \\
 E' &\rightarrow \wedge T \mid \varepsilon \\
 T &\rightarrow F T' \\
 T' &\rightarrow * F T' \mid \varepsilon \\
 F &\rightarrow id \mid (E)
 \end{aligned}$$

where { E, E', T, T', F } are non-terminals, { id, \wedge , *, (,) } are terminals, E is start symbol, ε is the empty symbol, and the following are the first and follow sets:

	First	Follow
E	id, (\$,)
E'	\wedge , ε	\$,)
T	id, (\wedge , \$,)
T'	*, ε	\wedge , \$,)
F	id, (*, \wedge , \$,)

fill in the following LL(1) parse table:

	id	\wedge	*	()	\$
E						
E'						
T						
T'						
F						

c. (5 Points) Is the grammar LL(1)? Why?

3. (30 Points) Given the following grammar:

$$A \rightarrow \wedge B \mid A C \mid B$$
$$B \rightarrow B * \mid B \% \mid \text{id } C$$
$$C \rightarrow (A)$$

where non-terminals are $\{A, B, C\}$, terminals are $\{\text{id}, \wedge, \&, *, \%, (,)\}$. Apply transformations wherever necessary to convert these productions to new productions that are suitable for top-down parsing. Note that you do NOT need to compute first/follow sets or fill in an LL(1) parse table. Simply list the transformed productions.