

Name _____

Directions: This is the CSCI-250 Final Examination. There are 5 questions worth 150 points. Answer each question in the space provided or on separate scratch paper. Turn in all scratch paper with your exam and place a large X through any of your work that should not be graded. The exam is open-book and open-notes and you have one hour and fifty minutes to complete the exam. When you are finished, check your work. Turn your exam in at the front of the classroom and then quietly leave the room. Good luck with your exam and with CSCI-250.

1. (20 Points) Given the following grammar:

$$\begin{aligned} A &\rightarrow BcD \mid a \mid AD \\ B &\rightarrow acB \mid c \\ C &\rightarrow c \\ D &\rightarrow Cab \end{aligned}$$

Where $\{A, B, C, D\}$ are non-terminals, $\{a, b, c\}$ are terminals, and A is the goal symbol.

Convert this grammar to Chomsky-Normal-Form. Minimize the number of productions.

2. Given the grammar:

$$\begin{aligned} D &\rightarrow D T L ; \mid \varepsilon \\ T &\rightarrow \text{int} \mid \text{float} \\ L &\rightarrow L , \text{id} \mid \text{id} \end{aligned}$$

Where $\{D T L\}$ are non-terminals, $\{; \text{int float} , \text{id}\}$ are terminals, D is the goal symbol and ε is the empty symbol.

a. (20 Points) Convert the grammar to a push-down automata.

- b. (10 Points) List the push-down automata moves to recognize the following input string:

int a,b; float c;

3. Given the following grammar:

$A \rightarrow BcD \mid a \mid AD \mid \epsilon$

$B \rightarrow acB \mid c$

$C \rightarrow c$

$D \rightarrow Cab$

Where $\{A, B, C, D\}$ are non-terminals, $\{a, b, c, d\}$ are terminals, and A is the goal symbol.

- a. (10 Points) Find the first and follow sets for the grammar:

	First	Follow
A		
B		
C		
D		

- b. (20 Points) List the canonical LR(0) states and items for the grammar.

4. Given the following grammar:

ACC $E' \rightarrow E$
 (1) $E \rightarrow E^*$
 (2) $E \rightarrow T$
 (3) $T \rightarrow -F$
 (4) $T \rightarrow F$
 (5) $F \rightarrow (E)$
 (6) $F \rightarrow id$

Where $\{E' E T F\}$ are non-terminals, $\{^* - () id\}$ are terminals, E' is the goal symbol and the following are the canonical LR(0) states and items:

l_0	$E' \rightarrow .E$	l_5	$F \rightarrow (.E)$
	$E \rightarrow .E^*$		$E \rightarrow .E^*$
	$E \rightarrow .T$		$E \rightarrow .T$
	$T \rightarrow .-F$		$T \rightarrow .-F$
	$T \rightarrow .F$		$T \rightarrow .F$
	$F \rightarrow .(E)$		$F \rightarrow .(E)$
	$F \rightarrow .id$		$F \rightarrow .id$
l_1	$E' \rightarrow E.$	l_6	$F \rightarrow id.$
	$E \rightarrow E.^*$	l_7	$E \rightarrow E^*.$
l_2	$E \rightarrow T.$	l_8	$T \rightarrow -F.$
l_3	$T \rightarrow -.F$	l_9	$F \rightarrow (E.)$
	$F \rightarrow .(E)$		$E \rightarrow E.^*$
	$F \rightarrow .id$	l_{10}	$F \rightarrow (E).$
l_4	$T \rightarrow F.$		

- (10 Points) Circle the kernel items in the canonical states and items above.
- (10 Points) Assuming LALR(1) parsing, show how hasher (#) propagates for kernel items that can move across a terminal or non-terminal symbol.

