

Question 1 of 9

1.0 Points

A context-free grammar has (check all that apply)

- ☐ A. at least a non-terminal symbol in the left hand side of any production
- ☐ B. just only one non-terminal symbol in the left hand side of any production
- ☐ C. unlimited number of terminal and non-terminal symbols in the right hand side of any production
- ☐ D. at most one non-terminal symbol in the right hand side of any production

Question 2 of 9

1.0 Points

Given the following grammar

$S \Rightarrow aSbS \mid c$

which of the following derivation processes are valid? Check all that apply

- ☐ A. $S \Rightarrow aSbS \Rightarrow acbc$
- ☐ B. $S \Rightarrow aSbS \Rightarrow aaSbSbS \Rightarrow aacbSbS \Rightarrow aacbcbsS \Rightarrow aacbcbbc$
- ☐ C. $S \Rightarrow aSbS \Rightarrow acbS \Rightarrow aacbS \Rightarrow aacbc$
- ☐ D. $S \Rightarrow aSbS \Rightarrow acbS \Rightarrow acbc$

Question 3 of 9

1.0 Points

Given the following grammar

$S \rightarrow AB$

$A \rightarrow aAa \mid \epsilon$

$B \rightarrow bB \mid b$

which of the following derivation processes are valid? Check all that apply

- ☐ A. $S \Rightarrow AB \Rightarrow B \Rightarrow b$
- ☐ B. $S \Rightarrow AB \Rightarrow AbB \Rightarrow Abb \Rightarrow aAabb \Rightarrow aaAaabb \Rightarrow aaaabb$
- ☐ C. $S \Rightarrow AB \Rightarrow AbB \Rightarrow aAabB \Rightarrow aabb$
- ☐ D. $S \Rightarrow AB \Rightarrow aAaB \Rightarrow aaAaaB \Rightarrow aaAaab \Rightarrow aaaab$

1.0 Points

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Which of the following grammars are **ambiguous**? Check all that apply

- ☐ A. $S \rightarrow SS \mid a \mid b$
- ☐ B. $A \rightarrow AcA \mid b$
- ☐ C. $S \rightarrow aS \mid bS \mid a \mid b$
- ☐ D. $A \rightarrow AcB \mid B$

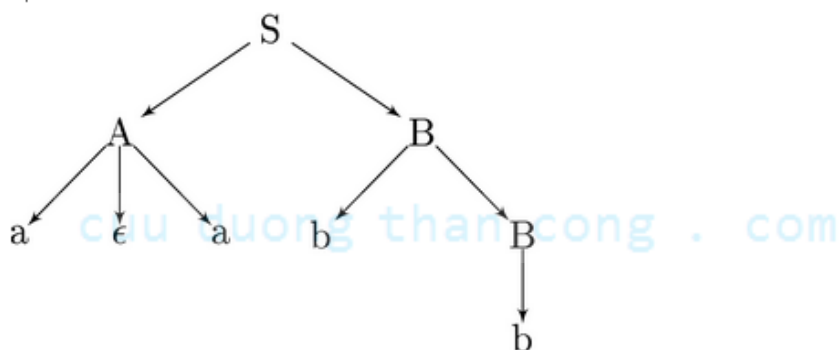
$B \rightarrow yBz \mid t \mid xB$

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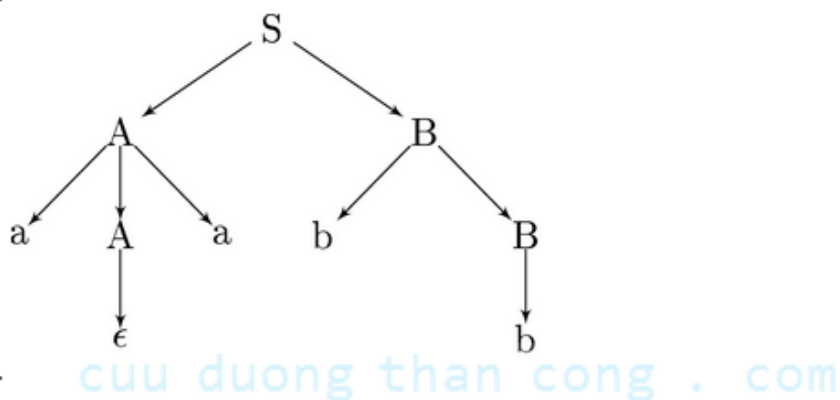
1.0 Points

Based on the following grammar, which of the following parse trees are valid for input aabb? Check all that apply

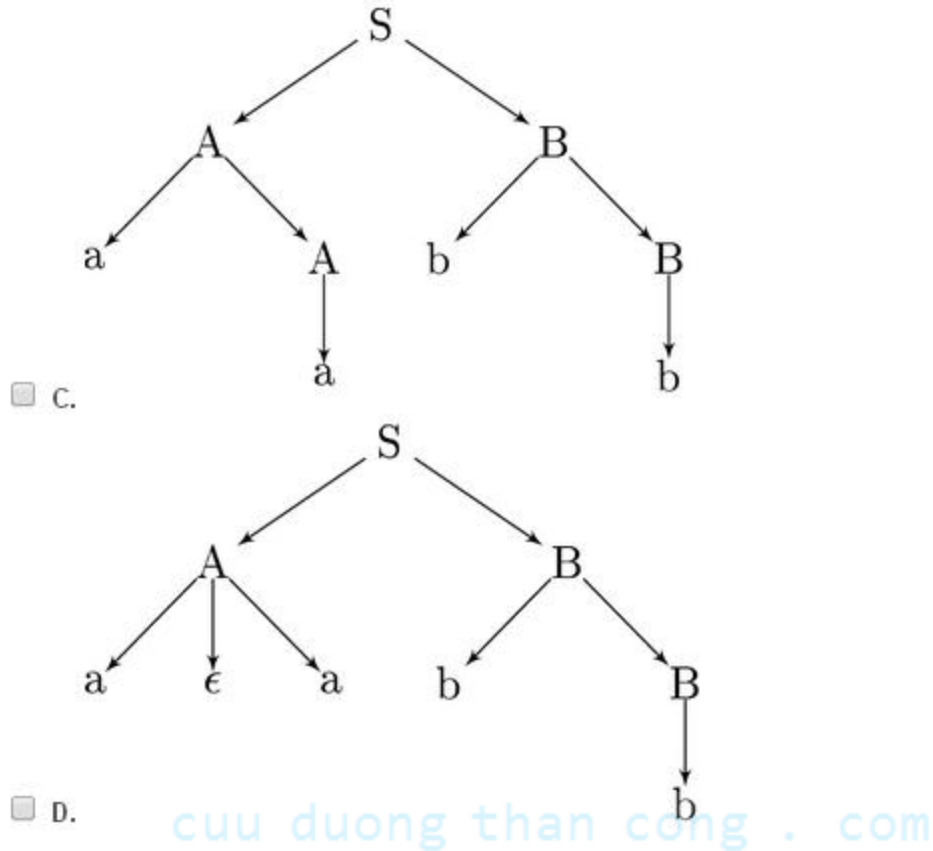
$S \rightarrow AB$
 $A \rightarrow aAa \mid \epsilon$
 $B \rightarrow bB \mid b$



☐ A.



☐ B.



B

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1.5 Points

Assume that an expression in a language is defined as follows

$\langle \text{exp} \rangle \rightarrow \langle \text{term} \rangle \text{ ASSIGN } \langle \text{exp} \rangle$

| $\langle \text{term} \rangle$

$\langle \text{term} \rangle \rightarrow \langle \text{term} \rangle \text{ EXPONENT } \langle \text{fact} \rangle$

| $\langle \text{term} \rangle \text{ ADDOP } \langle \text{fact} \rangle$

| $\langle \text{fact} \rangle$

$\langle \text{fact} \rangle \rightarrow \langle \text{operand} \rangle \text{ RELOP } \langle \text{operand} \rangle$

| $\langle \text{operand} \rangle$

$\langle \text{operand} \rangle \rightarrow \text{LB } \langle \text{exp} \rangle \text{ RB}$

| ID

Which of the following sentences are **correct**? Check all that apply

- ☐ A. ASSIGN is left-associated
- ☐ B. ASSIGN is non-associated
- ☐ C. ASSIGN is right-associated
- ☐ D. EXPONENT is left-associated
- ☐ E. EXPONENT is non-associated
- ☐ F. EXPONENT is right-associated
- ☐ G. ADDOP is left-associated
- ☐ H. ADDOP is non-associated
- ☐ I. ADDOP is right-associated
- ☐ J. RELOP is left-associated
- ☐ K. RELOP is non-associated
- ☐ L. RELOP is right-associated

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1.5 Points

Assume that an expression in a language is defined as follows

$\langle \text{exp} \rangle \rightarrow \langle \text{term} \rangle \text{ ASSIGN } \langle \text{exp} \rangle$

$\begin{array}{l} | \langle \text{term} \rangle \\ \langle \text{term} \rangle \rightarrow \langle \text{term} \rangle \text{ EXPONENT } \langle \text{fact} \rangle \end{array}$

$| \langle \text{term} \rangle \text{ ADDOP } \langle \text{fact} \rangle$

$| \langle \text{fact} \rangle$

$\langle \text{fact} \rangle \rightarrow \langle \text{opeand} \rangle \text{ RELOP } \langle \text{operand} \rangle$

$\begin{array}{l} | \langle \text{operand} \rangle \\ \langle \text{operand} \rangle \rightarrow \text{LB } \langle \text{exp} \rangle \text{ RB} \end{array}$

$| \text{ID}$

Which of the following sentences are **correct**? Check all that apply

- ☐ A. ASSIGN has the highest precedence among operators ASSIGN, EXPONENT, ADDOP, RELOP
- ☒ B. ASSIGN has the lowest precedence among operators ASSIGN, EXPONENT, ADDOP, RELOP
- ☐ C. ASSIGN has equal precedence to another operator

- ☐ D. EXPONENT has the highest precedence among operators ASSIGN, EXPONENT, ADDOP, RELOP
- ☐ E. EXPONENT has the lowest precedence among operators ASSIGN, EXPONENT, ADDOP, RELOP
- ☐ F. EXPONENT has equal precedence to another operator
- ☐ G. ADDOP has the highest precedence among operators ASSIGN, EXPONENT, ADDOP, RELOP
- ☐ H. ADDOP has the lowest precedence among operators ASSIGN, EXPONENT, ADDOP, RELOP
- ☐ I. ADDOP has equal precedence to another operator
- ☐ J. RELOP has the highest precedence among operators ASSIGN, EXPONENT, ADDOP, RELOP
- ☐ K. RELOP has the lowest precedence among operators ASSIGN, EXPONENT, ADDOP, RELOP
- ☐ L. RELOP has equal precedence to another operator

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1.0 F

Assume that an expression in a language is defined as follows

$\langle \text{exp} \rangle \rightarrow \langle \text{term} \rangle \text{ ASSIGN } \langle \text{exp} \rangle \mid \langle \text{term} \rangle$

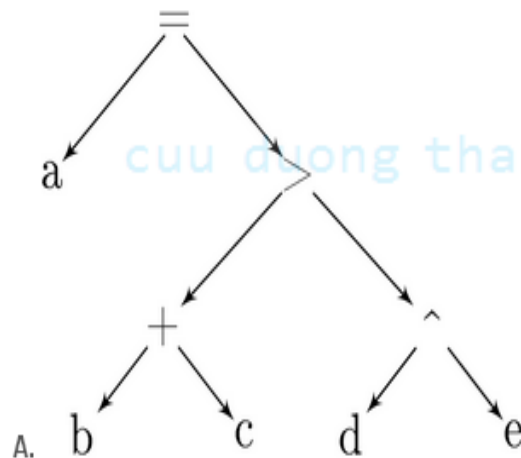
$\langle \text{term} \rangle \rightarrow \langle \text{term} \rangle \text{ EXPONENT } \langle \text{fact} \rangle \mid \langle \text{term} \rangle \text{ ADDOP } \langle \text{fact} \rangle \mid \langle \text{fact} \rangle$

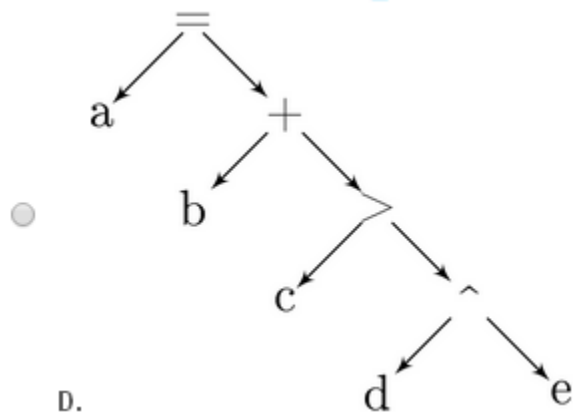
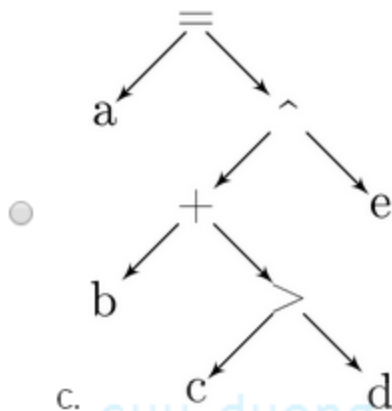
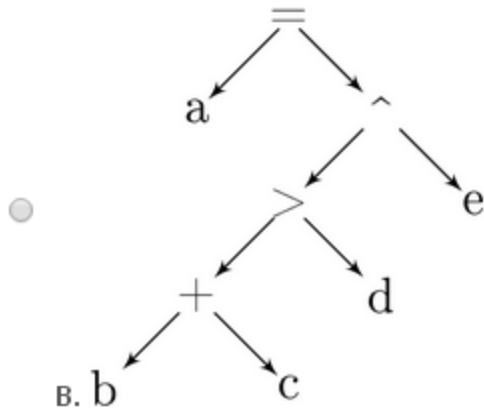
$\langle \text{fact} \rangle \rightarrow \langle \text{operand} \rangle \text{ RELOP } \langle \text{operand} \rangle \mid \langle \text{operand} \rangle$

$\langle \text{operand} \rangle \rightarrow \text{LB } \langle \text{exp} \rangle \text{ RB } \mid \text{ID}$

Let ID be token of identifiers, ASSIGN of '=', EXPONENT of '^', ADDOP of '+', RELOP of '>', LB of '(' and RB of ')'

Which of the following trees is the abstract syntax tree of expression $a = b + c > d \wedge e$?





C

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1.0 Points

Assume that an expression in a language is defined as follows

$\langle \text{exp} \rangle \rightarrow \langle \text{term} \rangle \text{ ASSIGN } \langle \text{exp} \rangle \mid \langle \text{term} \rangle$

$\langle \text{term} \rangle \rightarrow \langle \text{term} \rangle \text{ EXPONENT } \langle \text{fact} \rangle \mid \langle \text{term} \rangle \text{ ADDOP } \langle \text{fact} \rangle \mid \langle \text{fact} \rangle$

$\langle \text{fact} \rangle \rightarrow \langle \text{opeand} \rangle \text{ RELOP } \langle \text{operand} \rangle \mid \langle \text{operand} \rangle$

$\langle \text{operand} \rangle \rightarrow \text{LB } \langle \text{exp} \rangle \text{ RB} \mid \text{ID}$

Let ID be token of identifiers, ASSIGN of '=', EXPONENT of '^', ADDOP of '+', RELOP of '>', LB of '(' and RB of ')'.
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Association and precedence help to reduce the brackets in an expression. For example, if operator - is left-associated, $((a - b) - c)$ can be rewritten as $a - b - c$ with the same meaning. With the above grammar, which of the following expressions are equivalence to expression $(a = ((b + c) > ((c = (a + b)) ^ d)))$? Check all that apply

- ☐ A. $a = b + c > c = a + b ^ d$
- ☐ B. $a = b + c > (c = a + b) ^ d$
- ☐ C. $a = b + c > ((c = a + b) ^ d)$
- ☐ D. $a = (b + c) > (c = a + b ^ d)$
- ☐ E. $(a = b + c) > (c = a + b ^ d)$
- ☐ F. $a = (b + c) > ((c = a + b) ^ d)$
- ☐ G. $a = ((b + c) > ((c = a + b) ^ d))$
- ☐ H. $a = ((b + c) > (c = (a + b) ^ d))$

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