Week 5 Monday Review Quiz

Q1 CFG definition

2 Points

Consider the CFG defined as $(\{A, B\}, \{0, 1\}, R, A)$ with rules $A \to 0A0 \mid 0A1 \mid 1A0 \mid 1A1 \mid 1$.

Q1.1 (a)

1 Point

Select all and only the examples below that are a variable for this CFG?

- [ ] A
- [ ] 0
- [ ] ε

Save Answer

Q1.2 (b)

1 Point

Select all and only the examples below that are a terminal for this CFG?

- [ ] A
- [ ] 0
- [ ] ε

Save Answer

Q2 CFG derivations

3 Points

Consider the CFG defined as $(\{A, B\}, \{0, 1\}, R, A)$ with rules $A \rightarrow 0A0 \mid 0A1 \mid 1A0 \mid 1A1 \mid 1$.

Q2.1 (a)

1 Point

Select all and only the examples below that might appear in the start of a derivation of this grammar as a one step application of a production rule.

- [ ] $A \implies A$
- [ ] $A \implies 0$
- [ ] $A \implies 0A0$
- [ ] $A \implies 0A1$

Save Answer

Q2.2 (b)

2 Points

Select all and only the examples below that are in the language generated by this context free grammar.

- ☐ ε
- ☐ 0
- ☐ 1
- ☐ A
- ☐ 111
- ☐ 10101

Save Answer

Q3 Designing a CFG

2 Points

Is there a CFG G with $L(G) = \emptyset$?

- ○ No, because every grammar has at least one variable.
- ○ No, because every alphabet (and hence the set of terminals) is nonempty.
- ○ No, because $\emptyset$ is a regular language.
- ○ Yes, for example the grammar $(\{S\}, \{0, 1\}\{S \to S\}, S)$

Save Answer

Q4 Analyzing a CFG

3 Points

Consider the alphabet $\{a, b\}$. Select all and only the grammars below that generate the language $\{abba\}$

- [ ] $(\{S, T, V, W\}, \{a, b\}, \{S \to aT, T \to bV, V \to bW, W \to a\}, S)$
- [ ] $(\{Q\}, \{a, b\}, \{Q \to abba\}, Q)$
- [ ] $(\{X, Y\}, \{a, b\}, \{X \to aYa, Y \to bb\}, X)$
- [ ] None of the above

Save Answer

Q5 Feedback

0 Points

Any feedback about today's material or comments you'd like to share? (Optional; not for credit)

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Week 5 Wednesday Review Quiz

Q1 CFL example

2 Points

Consider the language $\{a^i b^j \mid j \geq i \geq 0\}$ over the alphabet $\{a, b\}$.

Q1.1 CFG

1 Point

Which is true?

- ◯ There is exactly one CFG that generates this language.
- ◯ There are many different CFGs that each generate this language.
- ◯ There are no CFGs that generate this language.
- ◯ None of the above.

Save Answer

Q1.2 PDA

1 Point

Which is true? (select all and only correct choices)

- ☐ There is a PDA that recognizes this language.
- ☐ There is a NFA that recognizes this language.
- ☐ There is a DFA that recognizes this language.
- ☐ None of the above.

Save Answer

Q2 Closure for CFL

6 Points

Q2.1 Union: strategy

2 Points

To prove that the set of all context-free languages is closed under the union operation ... (select all and only the correct ways to finish this sentence)

- [ ] we define a general procedure which takes two context-free grammars and produces a new grammar that generates the union of the languages of the input CFGs.
- [ ] we define a general procedure which takes two PDA and produces a new PDA that recognizes the union of the languages of the input PDAs.
- [ ] None of the above.

Save Answer

Q2.2 Union: construction for CFGs

1 Point

Given $G_1 = (V_1, \Sigma, R_1, S_1)$ and $G_2 = (V_2, \Sigma, R_2, S_2)$ that are CFGs with $L(G_1) = L_1$ and $L(G_2) = L_2$ and $V_1 \cap V_2 = \emptyset$ and $S_{new} \notin V_1 \cup V_2$. Which of the following sets of rules complete the CFG $G = (V_1 \cup V_2 \cup \{S_{new}\}, \Sigma, R, S_{new})$ so that $L(G) = L(G_1) \cup L(G_2)$?

- ○ $R_1 \cup R_2$
- ○ $R_1 \cup R_2 \cup \{S_{new} \to S_1 \mid S_2\}$
- ○ $R_1 \times R_2$
- ○ $R_1 \times R_2 \times \{S_{new}\}$
- ○ None of the above

Save Answer

Q2.3 Union: construction for PDAs

1 Point

Given $M_1 = (Q_1, \Sigma, \Gamma_1, \delta_1, q_1, F_1)$ and $M_2 = (Q_2, \Sigma, \Gamma_2, \delta_2, q_2, F_2)$ with $L(M_1) = L_1$ and $L(M_2) = L_2$ and $Q_1 \cap Q_2 = \emptyset$ and $q_{new} \notin Q_1 \cup Q_2$. Which of the following part of the definition of the transition function indicates that in a PDA $M = (Q_1 \cup Q_2 \cup \{q_{new}\}, \Sigma, \Gamma_1 \cup \Gamma_2, \delta, q_{new}, F_1 \cup F_2)$ so that $L(M) = L(M_1) \cup L(M_2)$ there is a nondeterministic choice to transition from q_{new} to either one of the start states of M_1 and M_2?

- ○ $\delta(q_{new}, \varepsilon, \varepsilon) = (q_1, q_2, \varepsilon)$
- ○ $\delta(q_{new}, q_1, q_2) = \{(\varepsilon, \varepsilon)\}$
- ○ $\delta(q_{new}, \varepsilon) = \{(q_1, q_2)\}$
- ○ $\delta(q_{new}, \varepsilon, \varepsilon) = \{(q_1, \varepsilon), (q_2, \varepsilon)\}$
- ○ None of the above

Save Answer

Q2.4 Set-wise Concatenation

1 Point

True or false: The following construction can be used to prove that the class of context-free languages is closed under set-wise concatenation.

Given $G_1 = (V_1, \Sigma, R_1, S_1)$ and $G_2 = (V_2, \Sigma, R_2, S_2)$ that are CFGs with $L(G_1) = L_1$ and $L(G_2) = L_2$ and $V_1 \cap V_2 = \emptyset$ and $S_{new} \notin V_1 \cup V_2$. Then we define a new grammar as $(V_1 \cup V_2 \cup \{S_{new}\}, \Sigma, R_1 \cup R_2 \cup \{S_{new} \to S_1 S_2\}, S_{new})$. We can prove that this new grammar generates the set-wise concatenation $L_1 \circ L_2$.

- ○ True
- ○ False

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Q2.5 Kleene Star
1 Point

True or false: The following construction can be used to prove that the class of context-free languages is closed under Kleene star.

Consider a CFG (V, Σ, R, S) and suppose $S_{new} \notin V$, then we define a new grammar as $(V \cup \{S_{new}\}, \Sigma, R \cup \{S_{new} \to \varepsilon, S_{new} \to S_{new}S\}, S_{new})$. We can prove that this new grammar generates the Kleene star of the language of the given CFG.

- ◯ True
- ◯ False

Save Answer

Q3 Closure
2 Points

Fix an alphabet Σ.

Q3.1 Regular languages
1 Point

(Select all and only correct choices.)

- ☐ The class of regular languages over Σ is closed under complementation.
- ☐ The class of regular languages over Σ is closed under union.
- ☐ The class of regular languages over Σ is closed under intersection.
- ☐ The class of regular languages over Σ is closed under set-wise concatenation.
- ☐ The class of regular languages over Σ is closed under Kleene star.

Save Answer

Q3.2 Context-free languages
1 Point

(Select all and only correct choices.)

- [ ] The class of context-free languages over Σ is closed under complementation.
- [ ] The class of context-free languages over Σ is closed under union.
- [ ] The class of context-free languages over Σ is closed under intersection.
- [ ] The class of context-free languages over Σ is closed under set-wise concatenation.
- [ ] The class of context-free languages over Σ is closed under Kleene star.

Save Answer

Q4 Feedback
0 Points

Any feedback about this week's material or comments you'd like to share? (Optional; not for credit)

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