

Homework #5

Name

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Questions:	Answers:
<p>1. Consider the following grammar with start symbol X.</p> <ol style="list-style-type: none">1. $X \rightarrow (P)$2. $P \rightarrow ZP$3. $P \rightarrow Z$4. $Z \rightarrow 0$5. $Z \rightarrow 1$ <p>a) Attempt to give a table for table-driven parsing by filling it in with proper entries as much as possible and by placing multiple entries in cells where more than one would be needed.</p> <p>b) Which terminal symbols are in $\text{FIRST}(ZP) \cap \text{FIRST}(Z)$? (Your table should tell you.)</p> <p>c) Why is the grammar not LL(1)?</p>	
<p>2. Using the technique of creating tails with ϵ:</p> <p>a) convert the grammar in Problem 1 to an LL(1) grammar with ϵ.</p> <p>b) Give a table for table-driven parsing for your new grammar.</p>	

<p>3. Create a grammar that describes a grammar rule for a context free grammar (without ϵ). The syntax of the rule for which you are to give a grammar should be like those in Problem 1 (capital letters for non-terminals, non-capitals for terminals, \rightarrow for “produces,” and $$ for “or”). As a simplification, assume that the only non-terminals are A, B, and C, and that, besides the meta-symbols \rightarrow and $$, the only terminal symbols are x, y, and z.</p> <p>Comments: Observe that because you are giving a grammar for a grammar rule, you will have problems with the meta-symbols. (For example, the meta-symbol $$ can’t be both a terminal symbol and a separator for alternative right hand sides.) Resolve this problem as follows. Use BNF syntax for your grammar. Thus, the meta-symbol \rightarrow can be a terminal since it is not a meta-symbol in the BNF syntax. Further, you can use a non-terminal such as $\langle \text{bar} \rangle$ to denote the meta-symbol $$. Add the rule “$\langle \text{bar} \rangle ::=$”, which cannot be ambiguous, to give $\langle \text{bar} \rangle$ its standard terminal symbol. Even though the grammar rule you are describing has no ϵ, the grammar that describes the grammar rule may have ϵ.</p>	
<p>4. Using the statements R and H respectively for “Mark is rich” and “Mark is happy,” write the following statements in symbolic form.</p> <p>a) Mark is not rich. b) Mark is rich and happy. c) Mark is rich or happy. d) If Mark is rich, then he is happy.</p>	<p>!R R ^ H R v H R -> H</p>



<p>5. Identify the atomic propositions of the following sentences and replace them by propositional symbols. Then translate the sentences into propositional calculus.</p> <p>a) If you do not leave, I will call the police.</p> <p>b) I am sad if and only if I am not happy.</p> <p>c) It is a nice day if it is sunny and it is not hot.</p> <p>d) if $i > j$, then $i - 1 > j$, else (if i is not $> j$) $j = 3$</p>	<p>a) $L = \text{You leave}$ $P = \text{I call police}$ $\neg L \rightarrow P$</p> <p>b) $S = \text{I am sad}$ $H = \text{I am happy}$ $S \leftrightarrow \neg H$</p> <p>c) $N = \text{It's a nice day}$ $S = \text{It is Sunny}$ $H = \text{It is Hot}$ $(S \wedge \neg H) \rightarrow N$</p>
<p>6. Give the truth table that defines the exclusive OR operator, xor. Exclusive OR is true when one of the operators is true, but not both; otherwise it is false.</p>	
<p>7. Given that P and Q are true and R and S are false, find the truth values of the following expressions.</p> <p>a) $(\neg(P \wedge Q) \vee \neg R) \vee ((Q \leftrightarrow \neg P) \Rightarrow (R \vee \neg S))$</p> <p>b) $(P \leftrightarrow R) \wedge (\neg Q \Rightarrow S)$</p> <p>c) $(P \vee (Q \Rightarrow (R \wedge \neg P))) \leftrightarrow (Q \vee \neg S)$</p>	<p>a) $(\neg(T \wedge T) \vee T) \vee ((T \leftrightarrow F) \rightarrow (F \vee T))$ $(F \vee T) \vee ((T \leftrightarrow F) \rightarrow (F \vee T))$ $(T) \vee (F \rightarrow T)$ $T \vee T$ T the result is true</p> <p>b) $(T \leftrightarrow F) \wedge (F \rightarrow F)$ $F \wedge T$ F the result is false</p> <p>c) $(P \vee (Q \rightarrow (R \wedge \neg P))) \leftrightarrow (Q \vee \neg S)$ $(T \vee (T \rightarrow (F \wedge F))) \leftrightarrow (T \vee T)$ $(T \vee (T \rightarrow F)) \leftrightarrow T$ $(T \vee F) \leftrightarrow T$ $T \leftrightarrow T$ T the result is true</p>



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