Homework #5

Name ______________________ Sec _____

Questions:	Answers:
1. Consider the following grammar with start symbol X. 1. $X \rightarrow (P)$ 2. $P \rightarrow ZP$ 3. $P \rightarrow Z$ 4. $Z \rightarrow 0$ 5. $Z \rightarrow 1$ 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. b) Which terminal symbols are in $FIRST(ZP) \cap FIRST(Z)$? (Your table should tell you.) c) Why is the grammar not LL(1)?	
2. Using the technique of creating tails with ε: a) convert the grammar in Problem 1 to an LL(1) grammar with ε. b) Give a table for table-driven parsing for your new grammar.	

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<tr><td>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, →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 →and |, the only terminal symbols are x, y, and z.

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 →can be a terminal since it is not a meta-symbol in the BNF syntax. Further, you can use a non-terminal such as <bar> to denote the meta-symbol |. Add the rule” <bar> ::= |”, which cannot be ambiguous, to give <bar> 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.</td><td></td></tr>
<tr><td>4. Using the statements R and H respectively for “Mark is rich” and “Mark is happy,” write the following statements in symbolic form.

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.</td><td>a) $\neg R$
b) $R \wedge H$
c) $R \vee H$
d) $R \to H$</td></tr>
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5. Identify the atomic propositions of the following sentences and replace them by propositional symbols. Then translate the sentences into propositional calculus. a) If you do not leave, I will call the police. b) I am sad if and only if I am not happy. c) It is a nice day if it is sunny and it is not hot. d) if $i > j$, then $i - 1 > j$, else (if i is not > j) j = 3	a) L (you leave) P(I call the police) $\neg L \to P$ b) S(I am sad) H(I am happy) $S \Leftrightarrow \neg H$ c) S(It is sunny) H(It is hot) N(It is a nice day) $(S \wedge \neg H) \to N$
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.	
7. Given that P and Q are true and R and S are false, find the truth values of the following expressions. a) $(\neg(P \wedge Q) \vee \neg R) \vee ((Q \Leftrightarrow \neg P) \Rightarrow (R \vee \neg S))$ b) $(P \Leftrightarrow R) \wedge (\neg Q \Rightarrow S)$ c) $(P \vee (Q \Rightarrow (R \wedge \neg P))) \Leftrightarrow (Q \vee \neg S)$	a) True b) False c) True