Homework #2

Nathan Petersen (Name) 001 (Sec)

Questions:	Answers:
1. If V denotes the set of symbols {a, b, c, 0, 1}, then a) V^0 = b) V^2 = c) $\|V^3\|$ =	
2. Give the language (each possible string) described by the following grammar. S is the start symbol. (Recall that a language is a subset of V*, where V is the alphabet.) S →a | aTb | aTbTc T →x | xy | xyz	a axb axyb axyzb axbxc axbxyc axbxyzc axybxc axybxyc axybxyzc axyzbxc axyzbxyc axyzbxyzc
3. Describe the language (in words) generated by each of the following grammars? a) S →0 S 1 | ε b) S →S S | 1 | 0	
4. Given the following grammar, generate four grammatically correct sentences. The start symbol is Sentence. Sentence →SubjectPart VerbPart SubjectPart → Article Noun Article →a | the | an Noun →monkey | banana | tree | gorilla VerbPart →Verb Object Verb →ate | climbed | licked | laughed Object →NounPart NounPart →Article Noun	

5. Give a grammar for the language Time of Day, which accepts strings such as: 12:36 pm 1:59 am 4:00 pm 2:45 am . In general the language has strings with hour times from 1 to 12, followed by a colon, followed by minute times from 00 to 59, and then either am or pm. (Use BNF notation and give good mnemonic names for concepts such as <Time of Day>, which is to be the start symbol, and <Single Hour Digit> for digits that are hour digits, i.e., 1 through 9 but not 0.)	<Time of Day> ::= <hour> : <minute> <SPACE> <meridiem> <hour> ::= <single hour digit> | <double hour digit> <minute> ::= <first minute digit> <second minute digit> <meridiem> ::= am | pm <single hour digit> ::= 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 <double hour digit> :: = <first double hour digit> <second double hour digit> <first double hour digit> :: = 1 <second double hour digit> :: = 0 | 1 | 2 <first minute digit> ::= 0 | 1 | 2 | 3 | 4 | 5 | 6 <second minute digit> ::= 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9

6. Letting <S> be the start symbol, convert the following grammar into a 4-tuple as defined below:
 	
`<S> ::= wc<S>`
`<S> ::= {<L>}`
`<S> ::= s;`
`<L> ::= <L><S>`
`<L> ::= ε`
 	
A *context-free grammar with epsilon* G is a 4-tuple:
 	
G = (V_N, V_T, S, Φ), where:
– V_N is a set of non-terminal symbols
– V_T is a set of terminal symbols
– S ∈ V_N is a start symbol
 	
– Φ is a finite set of relations from V_N to $(V_T \cup V_N)^+ \cup \{\varepsilon\}$.
 	
Consider the terminal symbols to be individual characters—not character sequences. The symbol ε is a meta-symbol denoting the empty sequence; it is not a terminal symbol.	