True/False Questions

- 1. True or False. T = true, F = false, and O = open, meaning that the answer is not known science at this time. In the questions below, \mathcal{P} and \mathcal{NP} denote \mathcal{P} -TIME and \mathcal{NP} -TIME, respectively.
 - (i) _____ Every finite language is regular.
 - (ii) _____ A language is regular if and only if it is accepted by some DFA.
 - (iii) _____ A language is regular if and only if it is accepted by some NFA.
 - (iv) _____ A language is regular if and only if it is generated by some regular grammar.
 - (v) _____ The programming language C++ is regular.
 - (vi) _____ The union of any two regular languages is regular.
 - (vii) _____ The intersection of any two regular languages is regular.
 - (viii) _____ The concatenation of any two regular languages is regular.
 - (ix) _____ The Kleene closure of any regular language is regular.
 - (x) _____ The intersection of any two regular languages is regular.
 - (xi) _____ There exists a polynomial time algorithm which finds the factors of any positive integer, where the input is given as a binary numeral.
 - (xii) _____ Every problem that can be mathematically defined has an algorithmic solution.
 - (xiii) _____ The intersection of two \mathcal{NP} languages must be \mathcal{NP} .
 - (xiv) $\square \mathcal{P} = \mathcal{NP}.$
 - (xv) $\mathcal{NP} = \mathcal{P}$ -SPACE
 - (xvi) _____ Every language is countable.
 - (xvii) _____ There exists a mathematical proposition which is true but cannot be proven.
 - (xviii) _____ There exists a machine that runs forever and outputs the string of decimal digits of π (the well-known ratio of the circumference of a circle to its diameter).
 - (xix) _____ There is a polynomial time algorithm which determines whether any two regular expressions are equivalent.
 - (xx) _____ Every subset of a regular language is regular.
 - (xxi) _____ Every subset of any countable set is countable.
 - (xxii) _____ The complement of any \mathcal{P} -TIME language is \mathcal{P} -TIME.
 - (xxiii) _____ For any infinite countable sets A and B, there is a 1-1 correspondence between A and B.

- (xxiv) ------ If L_1 is a language, L_2 is an \mathcal{NP} langage, and there is a \mathcal{P} -TIME reduction of L_1 to L_2 , then L_1 must be \mathcal{NP} .
- (xxv) _____ Every function $\mathcal{N} \to \mathcal{N}$ can be computed by some machine.

We say that two finite automata M_1 and M_2 are *isomorphic* if M_1 can be changed into M_2 by just renaming the states.

- (xxvi) _____ Given any regular langauge L, any two minimal DFA which accept L are isomorphic.
- (xxvii) _____ Given any regular langauge L, any two minimal NFA which accept L are isomorphic.
- (xxviii) $___$ Given any NFA M with n states, there is a DFA equivalent to M with 2^n states.
- (xxix) $____$ Given any two positive integers n and m, the set of all binary numerals for positive integers which are equivalent to n modulo m is a regular language.