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8.3 +5

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COMP.3040 Foundations of Computer Science
Fall 2019 Quiz 1 [5%] 10/3/2019

1. *[30 points]* Define

- Set, Sequence
  - Set: group of elements follow a regulation
  - Sequence: series of states Q in relation σ
- String, Language
  - String: √set of characters which are alphabets
  - Language: finite set of strings and symbols
- Domain, Range
  - Set: of possible inputs of a sequence / function
  - Range: set of possible outcomes / outputs of a function
- Empty set, Empty string
  - Empty set: set with no element / member, $\emptyset$, NULL
  - Empty string: string with length zero, ε
- Function, Relation
  - Function: a relation between inputs and outputs
  - Relation: link between two or more elements

Factorial

2. *[15 points]* Write a formal description for the following sets

$1 \times 2 = 2$ $\quad 24 \times 5 = 120$
$2 \times 3 = 6$
$6 \times 4 = 24$

- set containing 1, 2, 6, 24, 120, ...

$A = \{ w \mid w_k = k! \}$

- set containing 0-9, a-f

$A = \{ w \mid w \text{ is hexadecimal}, 0 \leq w \leq f \}$

- set containing 0, 1, 1, 2, 3, 5, 8, 13 ... Fibbonaci?

$A = \{ w_k \mid w_k = w_{k-1} + w_{k-2}, k \geq 0, k_0 = 0, k_1 = 1 \}$

3. *[20 points]* Give the formal definition for

$2 = 1 \times 2$
$6 = 1 \times 2 \times 3$
$24 = 1 \times 2 \times 3 \times 4$
$120 = 1 \times 2 \times 3 \times 4 \times 5$

Q: set of states (finite)
Σ: set of symbols
δ: $Q \times \Sigma \to Q$
q_0: start state
F: accept states

- DFA $\{Q, \Sigma, \delta, q_0, F\}$
- NFA $\{Q, \Sigma, \delta, q_0, F\}$

Finite
Q: set of states
Σ: $Q \times \Sigma \to Q$, $Q * \varepsilon \to Q$
δ: set of symbols
q_0: start state
F: accept states

- Regular Language consist of all strings that a finite information recognizes $A = L(M)$. That means M recognize A.
- Regular Expression used to build up expressions which describing language.

4. *[5 points]* A NFA is not more powerful than a DFA.
   - (•) True
   - ( ) False

5. *[5 points]* Every NFA cannot be converted to a DFA.
   - ( ) True
   - (•) False

6. *[5 points]* A language is Regular if a DFA or NFA exists which can recognize it.
   - (•) True
   - ( ) False

7. *[5 points]* Some regular languages are infinite–contain infinite number of strings
   - (•) True
   - ( ) False

8. *[5 points]* All DFAs and NFAs have at least one Accept/Final state
   - (•) True
   - ( ) False

9. *[10 points]* The class of regular languages is closed under the following operations:

Union $A \cup B = \{x \mid x \in A \text{ OR } x \in B \text{ for some } x\}$

Concatenation $A \circ B = \{x, y \mid x \in A, y \in B\}$

Star A^*