German University in Cairo
Department of Computer Science
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CSEN1002 Compilers Lab, Spring Term 2021
**Task 1: DFA**

Due: Week starting 03.04.2021

1 Objective

For this task you need to implement a deterministic finite automaton (DFA) abstract data type. Recall that a DFA is a quintuple $(Q, \Sigma, \delta, q_0, F)$: Q is a non-empty, finite set of states; Σ is non-empty, finite set of symbols (an alphabet); $\delta : Q \times \Sigma \longrightarrow Q$ is the transition function; $q_0 \in Q$ is the start state; and $F \subseteq Q$ is the set of accept states. A DFA *accepts* a string $w = w_1 w_2 \cdots w_n \in \Sigma^*$ if there is a sequence $r_0, r_1, \ldots, r_n$ of states such that (i) $r_0 = q_0$, (ii) $r_n \in F$, and (iii) $\delta(r_i, w_{i+1}) = r_{i+1}$, for every $0 \leq i < n$.

2 Requirements

- We make the following assumptions for simplicity.

    a) The alphabet Σ is always the binary alphabet $\{0, 1\}$.

    b) The set of states Q is always of the form $\{0, \ldots, n\}$, for some $n \in \mathbb{N}$.

    c) The start state is always state 0.

- You should implement two functions: `dfa` and `run`.

- `dfa` (which could be a class constructor) takes one parameter which is a string description of a DFA and returns (or constructs) a DFA instance as per the description.

- A string describing a DFA is of the form $P\#S$, where P is a prefix representing the transition function δ and S is a suffix representing the set F of accept state.

- P is a semicolon-separated sequence of triples of states; each triple is a comma-separated sequence of states. A triple i, j, k means that $\delta(i, 0) = j$ and $\delta(i, 1) = k$.

- S is a comma-separated sequence of states.

- For example, the DFA for which the state diagram appears below may have the following string representation.

$$0,0,1;1,2,1;2,0,3;3,3,3\#1,3$$
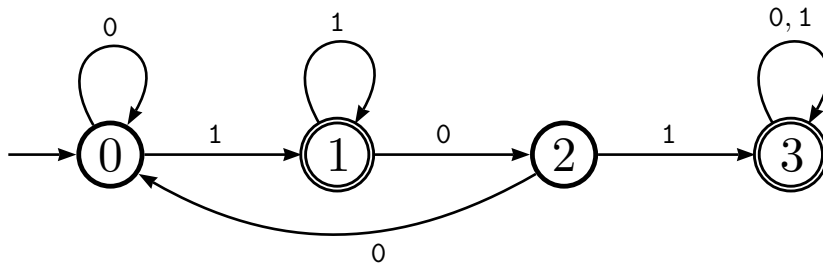
- `run` simulates the operation of the constructed DFA on a given binary string. It returns `true` if the string is accepted by the DFA and `false` otherwise.

3   Evaluation

- Your implementation will be tested by constructing two DFA and running each on five strings.

- You get one point for each correct output of `run`; hence, a maximum of ten points.

- The evaluation will take place during your lab session of the week starting Saturday April 3rd.

4   Online Submission

- You should submit your code at the following link.

  https://forms.gle/JtNz4SC3zze7KgvM9

- Submit one Java file (`.java`) containing executable code.

- The filename should be of form <LabNo_ID_Name>.
  For example, `P13_40_1234_John_Smith.java`

- Online submission is due on Thursday, April 8th, by 23:59.