Example 1: This is a TeXfile.

$$(f * g) = \int_{-\infty}^{\infty} f\tau g(t - \tau)\, d\tau$$

Example 2: *As NFA defined on Page 54 of ITC* textbook.

$Q = \{q_1, q_2, q_3, q_4\}$
$\sum = \{0, 1\}$
$F = \{q_4\}$
$q_0 = q_1$
$\delta = \{((q_1, 0), \{q_1\}), ((q_1, 1), \{q_1, q_2\}), ((q_1, \epsilon), \phi),$
$((q_2, 0), \{q_3\}), ((q_2, 1), \phi), ((q_2, \epsilon), \{q_3\}),$
$((q_3, 0), \phi), ((q_3, 1), \{q_4\}), ((q_3, \epsilon), \phi),$
$((q_4, 0), \{q_4\}), ((q_4, 1), \{q_4\}), ((q_4, \epsilon), \phi)\}$

Transition Function in Table form:

	0	1	ϵ
q_1	$\{q_1\}$	$\{q_1, q_2\}$	ϕ
q_2	$\{q_3\}$	ϕ	$\{q_3\}$
q_3	ϕ	$\{q_4\}$	ϕ
q_4	$\{q_4\}$	$\{q_4\}$	ϕ

NFA in pictorial form:
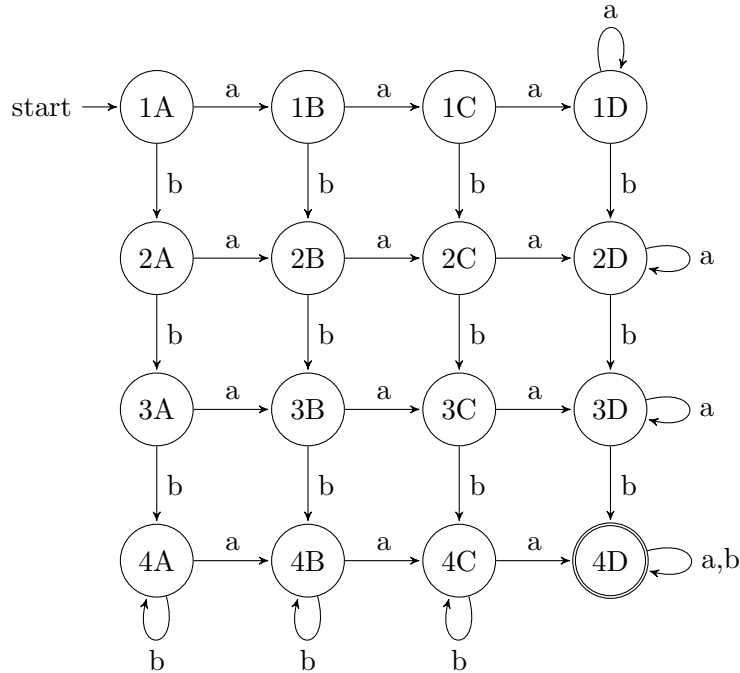

Example 3: **DFA, state diagram of machine M**

Example 4: **Machine DFA has 02 languages and it combine:**
{w| w has at least three a's}

{w| has at least three b's}

Combining them using the intersection construction for DFA machine:

Regular expression and it diagram DFA: $\mathbf{1\sum^{*}0}$
{w|w begin with a 1 and end with a 0}

{w | w = w^{R},. that is, w is a palindrome}

$$S \rightarrow 0S0 \mid 1S1 \mid 0 \mid 1 \mid \epsilon$$

Informal description: We begin by pushing the symbols read onto the stack. At each point we will nondeterministically guess if the middle of the string has been reached or if the next symbol read is the middle of the string and will not be put on the stack. Then we pop off the symbols from the stack if they match the input symbol read. If the symbol popped are exactly the same symbols that were pushed on earlier and the stack empties as the input is finished, ten accept. Otherwise, reject.

$$0, \epsilon \to \epsilon$$
$$1, \epsilon \to \epsilon$$
$$\epsilon, \epsilon \to \epsilon$$

start $\to$ q_1 $\quad \epsilon, \epsilon \to \$ \quad$ q_2 $\qquad$ q_3 $\quad \epsilon, \$ \to \epsilon \quad$ q_4

$$0, \epsilon \to 0 \qquad\qquad 0, 0 \to \epsilon$$
$$1, \epsilon \to 1 \qquad\qquad 1, 1 \to \epsilon$$