a) end with 101

$RE = (0/1)^* 101$

Trans. Diagram:

Trans. Table

	0	1
→A	$\{A\}$	$\{A,B\}$
B	$\{C\}$	$\emptyset$
C	$\emptyset$	$\{D\}$
*D	$\emptyset$	$\emptyset$
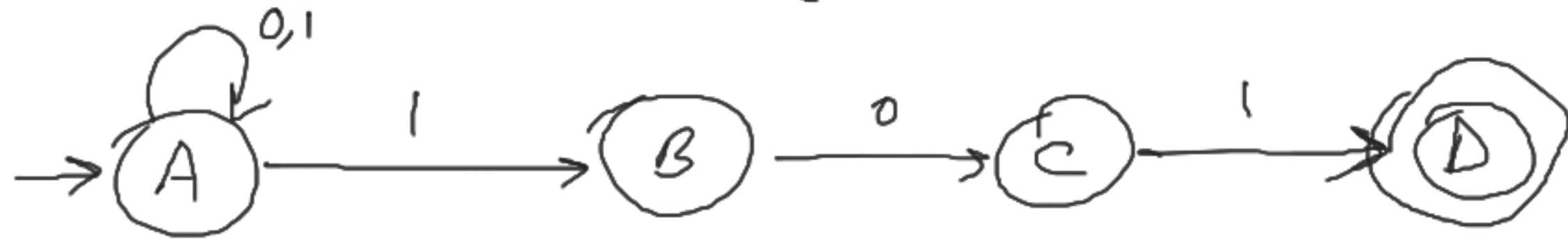
Checking 0100:

$\delta(A,0) = \{A\}$

$\delta(A,1) = \{A,B\}$

$\delta(\{A,B\},0) = \delta(A,0) \cup \delta(B,0)$
$\qquad\qquad = \{A,C\}$

$\delta(\{A,C\},0) = \delta(A,0) \cup \delta(C,0) = \{A\}$
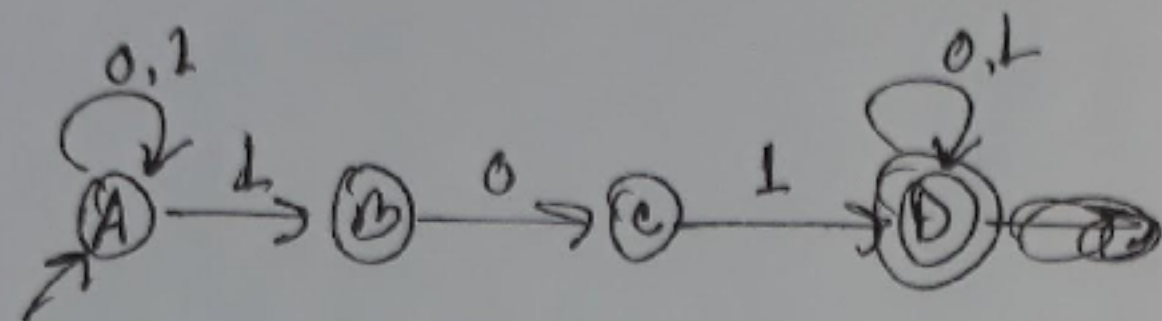
since A is not final, 0100 is rejected.

b) Start with 101

$$RE = 101 \left(0/1 \right)^*$$

A —1→ B —0→ C —1→ D, with self-loop 0,1 on D
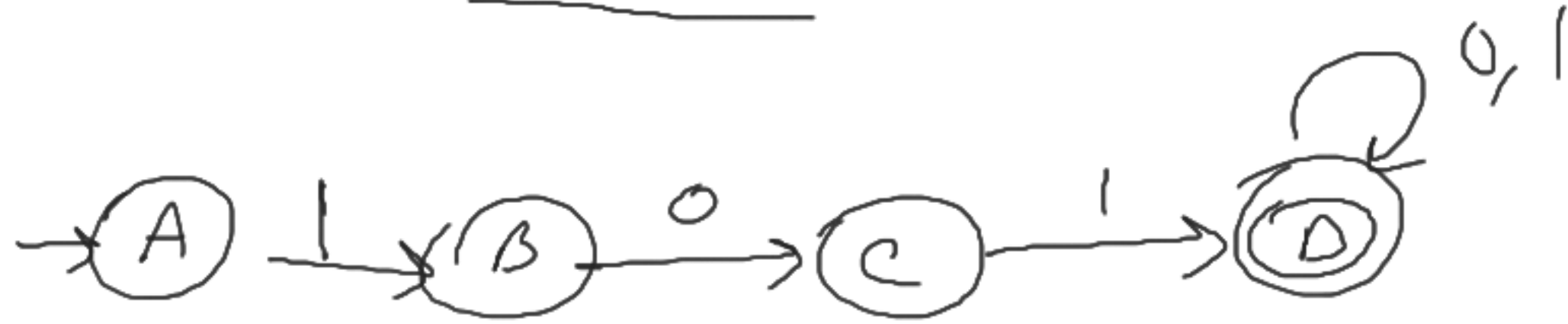
© 101 substring. RE = $(0/1)^*$ 101 $(0/1)^*$

0,1 (self-loop on A)

A $\xrightarrow{1}$ B $\xrightarrow{0}$ C $\xrightarrow{1}$ D

0,1 (self-loop on D)

	0	1
→ A	$\{A\}$	$\{A,B\}$
B	$\{C\}$	ϕ
C	ϕ	$\{D\}$
↓ D	$\{D\}$	$\{D\}$

check: 0 1 0 1 0

$\delta(A,0) = \{A\}$

$\delta(A,1) = \{A,B\}$

$\delta(\{A,B\},0) = \delta(A,0) \cup \delta(B,0)$
$= \{A,C\}$

$\delta(\{A,C\},1) = \delta(A,1) \cup \delta(C,1)$
$= \{A,B,D\}$

$\delta(\{A,B,D\},0) = \delta(A,0) \cup \delta(B,0) \cup \delta(D,0)$
$= \{A,C,D\}$ Accepted

f) Contain no 0s: RE = 1*
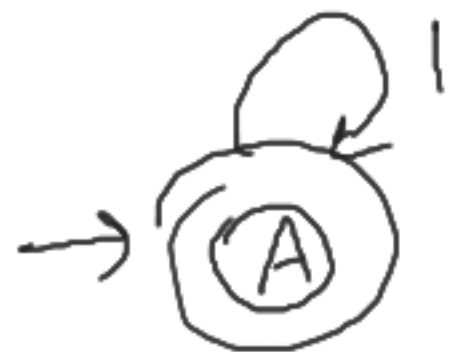
g) exactly one 0: RE = 1*01*

	0	1
→ A	{B}	{A}
* B	∅	{B}

checking 110101:

$\delta(A,1) = A$

$\delta(A,1) = A$
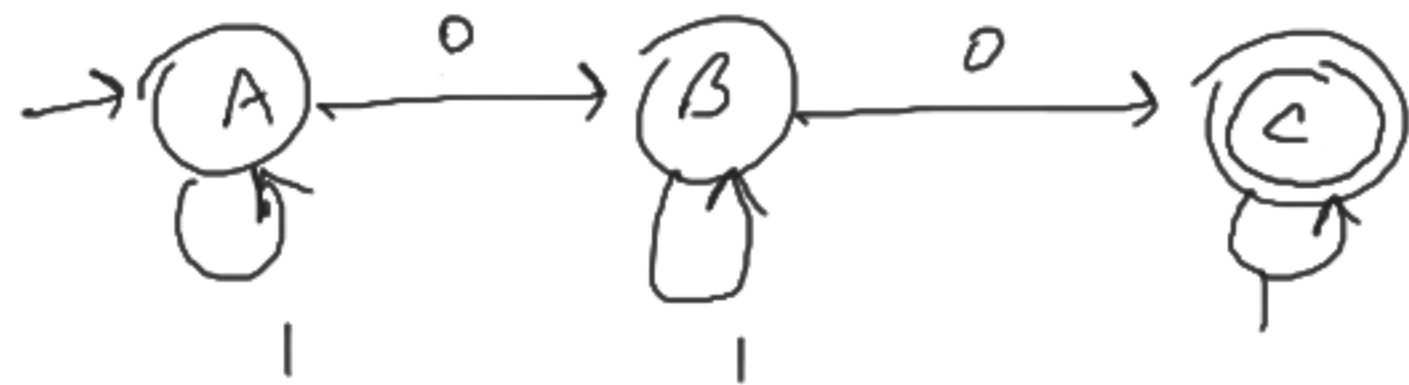
$\delta(A,0) = B$

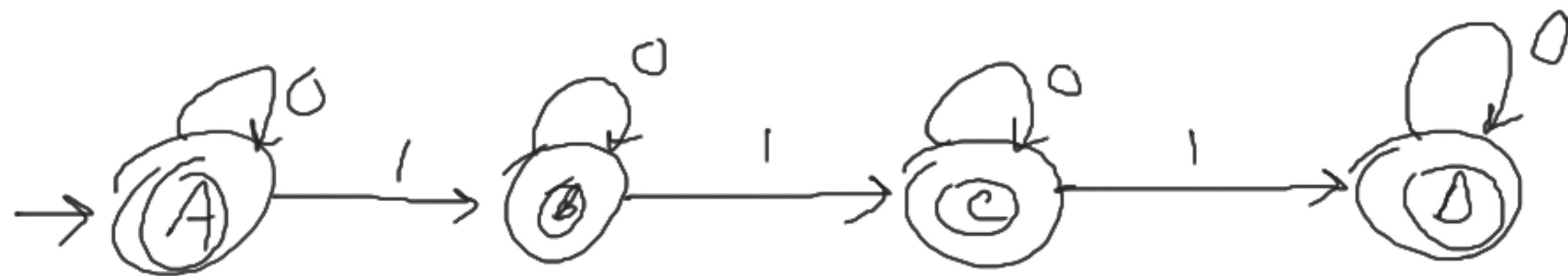$\delta(B,1) = B$

$\delta(B,0) = \emptyset$ (stuck)

rejected

h) exactly two 0s: $RE = 1^*01^*01^*$

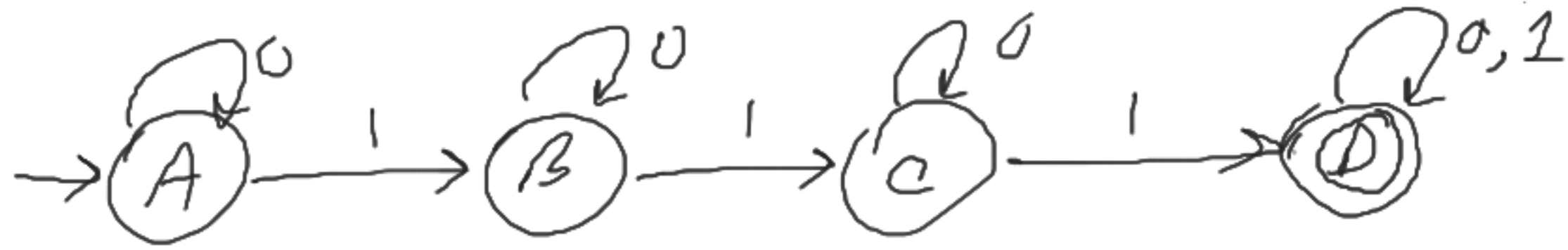(i) and (j) same as DFA

k) $0^*/0^*1\ 0^*/0^*101\ 0^*/0^*10^*10^*10^*$

e) at least three 1s: $RE = 0^q 1 0^q 0^q 1 \quad (0/1)^q$

ALT. $RE = (0/1)^q 1 (0/1)^q 1 (0/1)^q 1 (0/1)^q$