Theory of Awomata Assignment # 03

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Q1:- - Prime number is a regular language
- there exists a FA having m number of states
- Selet w from prime number that is |w|. Taking prime no. 13

$w = \underbrace{1}_{x}\underbrace{10}_{y}\underbrace{1}_{z}$

$xyz = 1101 \rightarrow 13$

$xyyz = 110101 \rightarrow 53$

$xyyyz = 11010101 \rightarrow 213$ -> this is not a prime number. heme not a regular language.

Q2:- - $a^n b^n ab^{n+1}$ is a regular language
- Then there exist a FA having no. of states m.
- Selet w from $a^n b^n ab^{n+1}$ or $|w| \geq m$ $|w| > a^n b^n ab^{n+1}$

$xyz = a^m b^m ab^{m+1}$

$xyyz = a^m b^m b^m ab^{m+1}$

then it is not a regular language.

Q3:-

$S \rightarrow AB$

$A \rightarrow abbA \mid bA \mid \lambda$

$B \rightarrow abB \mid \lambda$

- $S \rightarrow ABCA$

$A \rightarrow aaA \mid bbA \mid \lambda$

$C \rightarrow ADADC \mid \lambda$

$D \rightarrow abD \mid baD \mid \lambda$

- $S \rightarrow AbbbA$

$A \rightarrow aA \mid bA \mid \lambda$

- $S \rightarrow ABA$

$A \rightarrow aA$

$B \rightarrow bB$

- $S \rightarrow A \mid BC$

$A \rightarrow OA \mid \lambda$

$B \rightarrow 1B \mid \lambda$

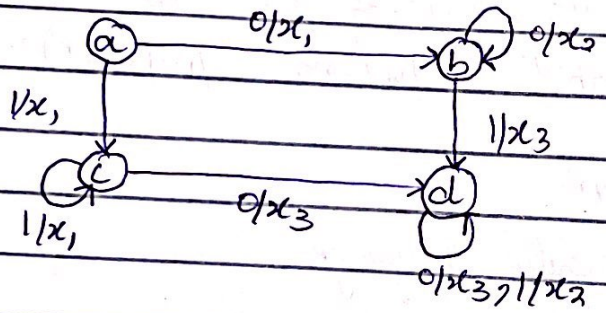
$C \rightarrow OC \mid \lambda$

Q4:- A → aA | bA | B | C
B → aB | a | λ
C → bD | λ
D → aC

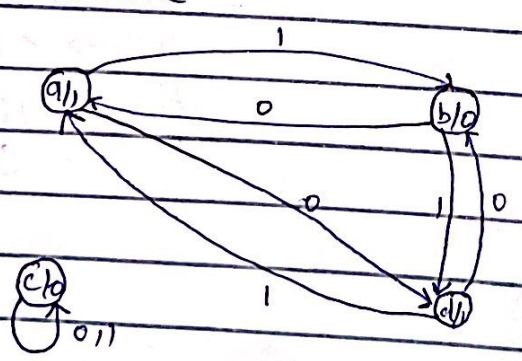
- S → 1A | B
A → 11A | λ | B
B → 00B | A | λ

- z_1 → az_2 | bz_3
z_2 → az_2 | bz_2
z_3 → az_3 | bz_4
z_4 → az_3 | bz_4 | λ

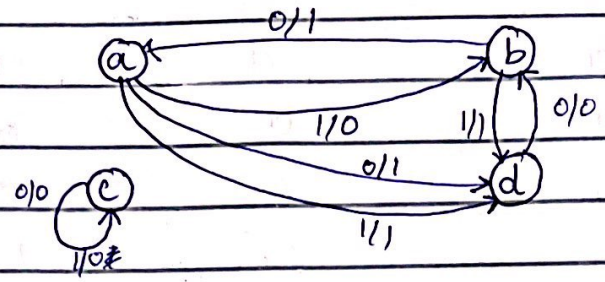
Q5:-



Q6:- Moore Machine

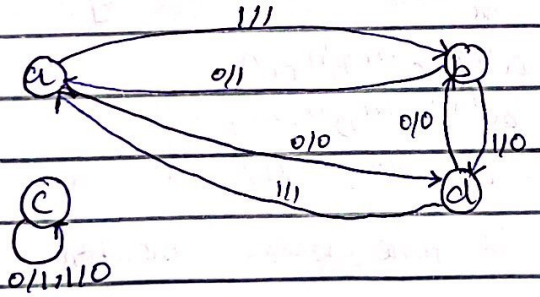


Moore - Mealy Machine:

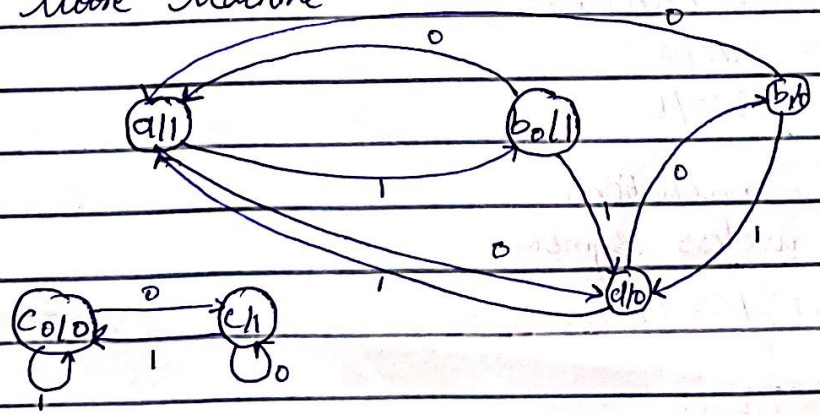


State	input = 0		input = 1	
a	d	output = 1	b	output = 0
b	a	1	d	1
c	c	0	c	0
d	b	0	a	1

Q7:-



Mealy - Moore Machine



States	input = 0	input = 1	output
a	d	b_0	1
b_0	a	d	1
b_1	a	d	0
c_0	c_1	c_0	0
c_1	c_1	c_0	1
d	b	a	0

Q8:- Let $a^n b^n c^m b^n a^n$ as a regular language
then a FA exists of states j.
Select w from $a^n b^n c^m b^n a^n$ such that $|w| \geq j$
So $w = \underbrace{a \ldots n \text{ times}}_{x} \underbrace{b \ldots n \text{ times } c \ldots m \text{ times}}_{y} \underbrace{b \ldots n \text{ times } a \ldots n \text{ times}}_{z}$

$$xyz = a^n b^n c^m b^n a^n$$
$$xyyz = a^n b^n c^m b^n c^m b^n a^n$$
$$= a^n b^{2n} c^{2m} b^n a^n$$

Since b and c are 2 time more, therefore not a regular language

Q9:- $S \rightarrow AS \mid AA \mid AB$
$A \rightarrow aA \mid a$
$B \rightarrow bB \mid b$

- no null
- no unit production
- no useless symbol

- $S \rightarrow AS \mid SS \mid b \mid a \mid BB$
$A \rightarrow Aa \mid \varepsilon$
$B \rightarrow bB \mid \varepsilon$
$C \rightarrow aA \mid c$

$A \rightarrow \varepsilon$
$B \rightarrow \varepsilon$

$S \to AS|SS|b|a|BB$
$A \to Aa|a$
$B \to bB|b$
$C \to aA|c$

no unit production
no useless symbol

- $S \to a|b|AS|BB|AB$
  $A \to AaB|aB|aA|\varepsilon$
  $B \to b$

  kill Null
  $A \to \varepsilon$

  $S \to a|b|AS|BB|AB$
  $A \to AaB|aB|aA|a$
  $B \to b$

* no unit production
* no useless symbol.

- $S \to a|b|AS|BB|AB|\varepsilon$
  $A \to AaB|aB|aA|\varepsilon$
  $B \to bB|\varepsilon$
  $C \to aA|Ca|ab$

* kill null

  $S \to \varepsilon \quad A \to \varepsilon \quad B \to \varepsilon$

  $S \to a|b|AS|A|BB|AB$
  $A \to AaB|aB|aA|a$
  $B \to bB|b$
  $C \to aA|Ca|ab$

* unit production

  $S \to A$
  $S \to a|b|AS|AA|BB|AB$
  $A \to AaB|aB|aA|a$
  $B \to bB|b$
  $C \to aA|Ca|ab$

Useless symbol