9/10/2020 CSI1003 Formal Language & Automata Theory

Digital Assignment

Prashanth.S
19MID0020

Group-II

(2) Divisible by number with concept explanation for DFA

Deterministic Finite Automata (DFA)

A DFA (Deterministic Finite Automata) is defined by 5 tuples

$M \Rightarrow (Q, \Sigma, \delta, q_0, F)$. Here,

- $Q \Rightarrow$ Number of states
- $\Sigma \Rightarrow$ Set of input symbols
- $\delta \Rightarrow$ Transition function
- $q_0 \Rightarrow$ Start state / intial state
- $F \Rightarrow$ Final state

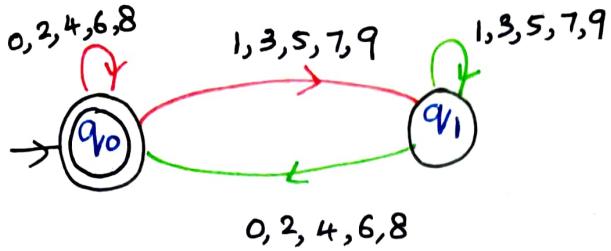
*) In words, the first condition says that the machine starts in q_0.

*) The second condition says that the given each character of string w, The machine will transition from state to state according to the function δ.

*) The last condition says that the machine accepts w if the last input of w causes the machine to halt in one of the accepting states

*) A deterministic Finite Automata (DFA) without accepting states and without a starting state is known as a transition system

① Divisible by decimal number 2



A DFA is defined by 5 tuples $M \rightarrow (Q, \Sigma, \delta, q_0, F)$

Here,

$Q \Rightarrow$ 2 states

$\Sigma \Rightarrow \{0, 2, 3, 4, 5, 6, 7, 8, 9\}$

$q_0 \Rightarrow$ Intial state

$q_0 \Rightarrow$ Final state

Since the number is divisible by itself and 0 (i.e remainder $\Rightarrow$ 0).
So the start state and final state is same.

Logic:

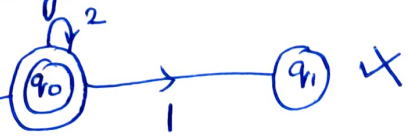
Remainder $\Rightarrow$ 0 [0, 2, 4, 6, 8] $\longrightarrow$ q_0 state

Remainder $\Rightarrow$ 1 [1, 3, 5, 7, 9] $\longrightarrow$ q_1 state

If the remainder is i, then it must end in the q_i state.

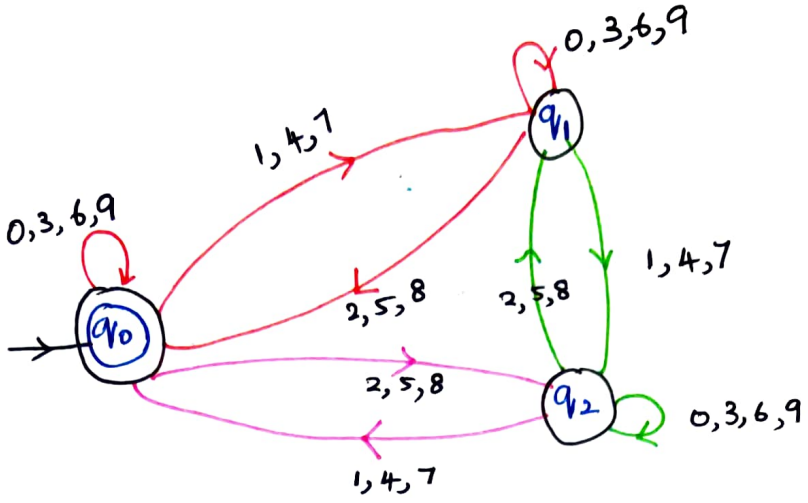
check a valid string

Eg: i) 21



ii) 22

② Divisible by decimal number 3



A DFA is defined by 5 tuples $M \Rightarrow (Q, \Sigma, \delta, q_0, \checkmark$

Here

$Q \Rightarrow$ 3 states

$\Sigma \Rightarrow \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$

$q_0 \Rightarrow$ Initial state

$q_0 \Rightarrow$ Final state

Logic :

Remainder 0 $\Rightarrow [0, 3, 6, 9] \Longrightarrow q_0$

Remainder 1 $\Rightarrow [1, 4, 7] \Longrightarrow q_1$

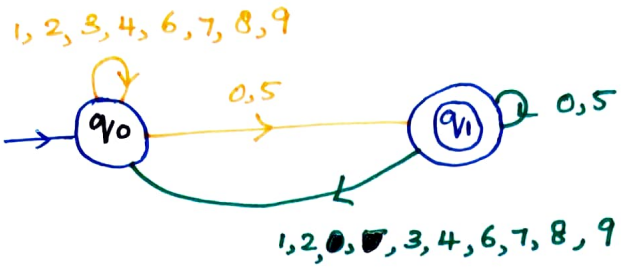
Remainder 2 $\Rightarrow [2, 5, 8] \Longrightarrow q_2$

check a string :

eg i) 33 → q_0 3, q_0 ✓

ii) 24 → q_0 2 q_2 4 q_0 ✓

(3) Divisible by a decimal number 5



A DFA is defined by 5 tuples $M \Rightarrow (Q, \Sigma, \delta, q_0, F)$

Here,

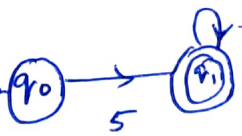
$Q \Rightarrow$ Number of states $\Rightarrow 2$

$\Sigma \Rightarrow \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$

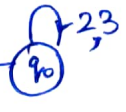
$q_0 \Rightarrow$ Initial state

$q_1 \Rightarrow$ Final state

Check a string,

1) Eg: 55 

✓

2) Eg: 23 

✗

④ Divisible by decimal number 6

A DFA is defined by 5 tuples $M \Rightarrow (Q, \Sigma, \delta, q_0, F)$

$Q \Rightarrow$ 6 states

$\Sigma \Rightarrow \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$

$q_0 \Rightarrow$ Initial state

$q_0 \Rightarrow$ Final state

Logic,

Remainder 0 $\Rightarrow$ [0, 6] $\Longrightarrow q_0$

Remainder 1 $\Rightarrow$ ~~[2, 8]~~ [1, 7] $\Rightarrow q_1$

Remainder 2 $\Rightarrow$ [2, 8] $\Longrightarrow q_2$

Remainder 3 $\Rightarrow$ [3, 9] $\Longrightarrow q_3$

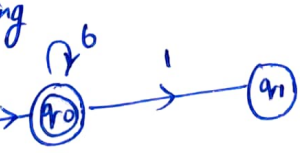
Remainder 4 $\Rightarrow$ [4] $\Longrightarrow q_4$

Remainder 5 $\Rightarrow$ [5] $\Longrightarrow q_5$

If the remainder is i, then it must end with q_i state

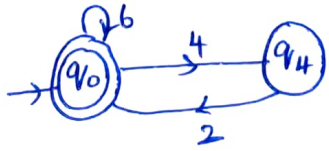
check a string

Eg i) 61

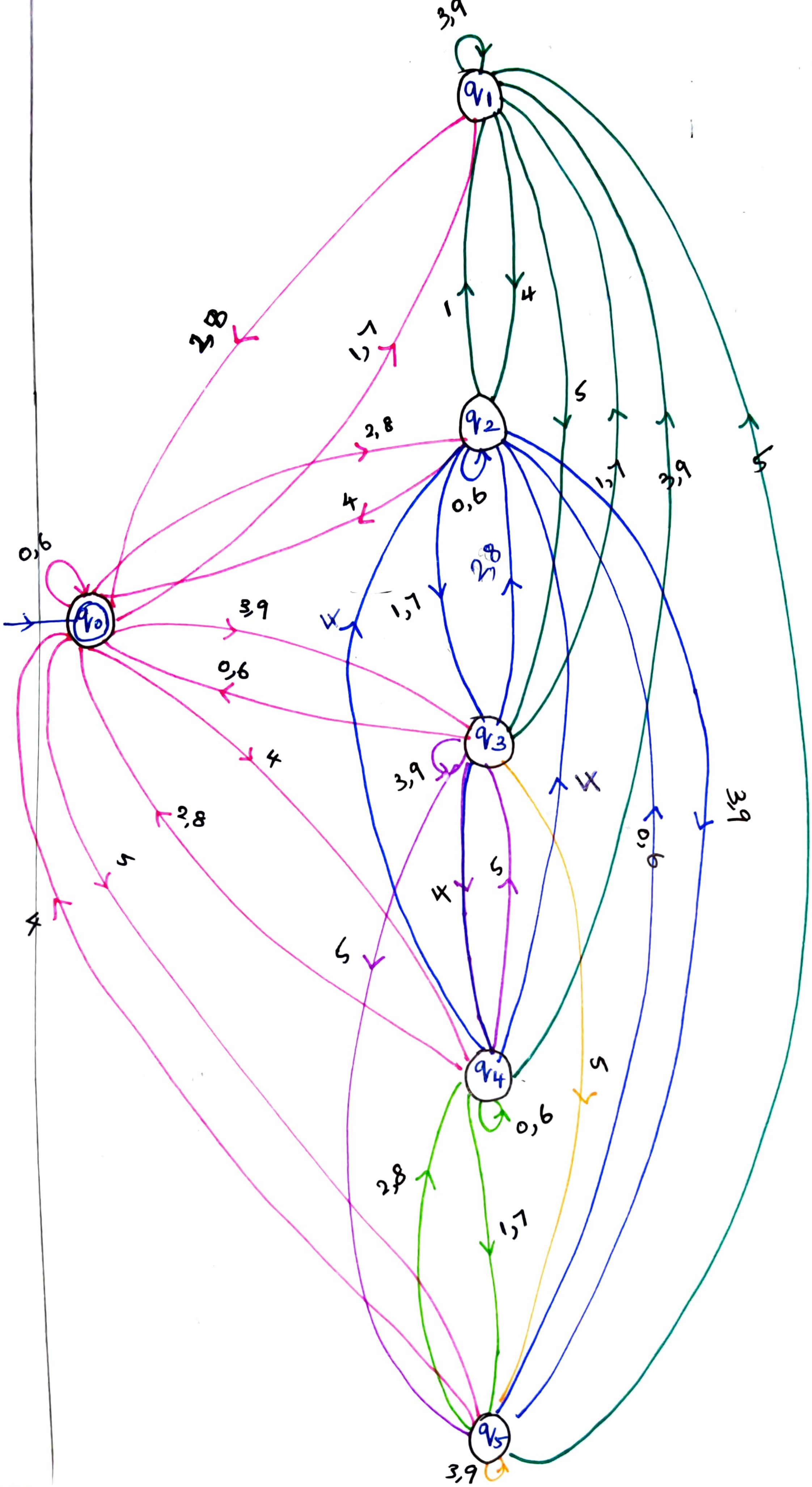


X

ii) 642



✓



q1
q2
q0
q3
q4
q5
3,9
2,8
1,7
1
4
5
2,8
4
0,6
1,7
3,9
0,6
3,9
0,6
4
2,8
5
4
3,9
4
5
5
4
6
3,9
0,6
2,8
1,7
3,9

⑤ Divisible by decimal number 7

A DFA is defined by 5 tuples $M \Rightarrow (Q, \Sigma, \delta, q_0, F)$

$Q \Rightarrow$ 7 states

$\Sigma \Rightarrow \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$

$q_0 \Rightarrow$ Initial state

$q_0 \rightarrow$ Final state

Logic:

Remainder 0 $\Rightarrow [0, 7] \Rightarrow q_0$

Remainder 1 $\Rightarrow [4] \Rightarrow q_1$

Remainder 2 $\Rightarrow [2, 9] \Rightarrow q_2$

Remainder 3 $\Rightarrow [3] \Rightarrow q_3$

Remainder 4 $\Rightarrow [4] \Rightarrow q_4$

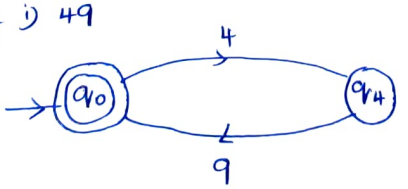
Remainder 5 $\rightarrow [5] \Rightarrow q_5$

Remainder 6 $\Rightarrow [6] \Rightarrow q_6$

If the remainder is i, then must end with q_i state.

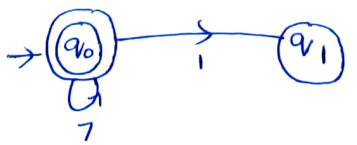
Check for the string,

Eg i) 49

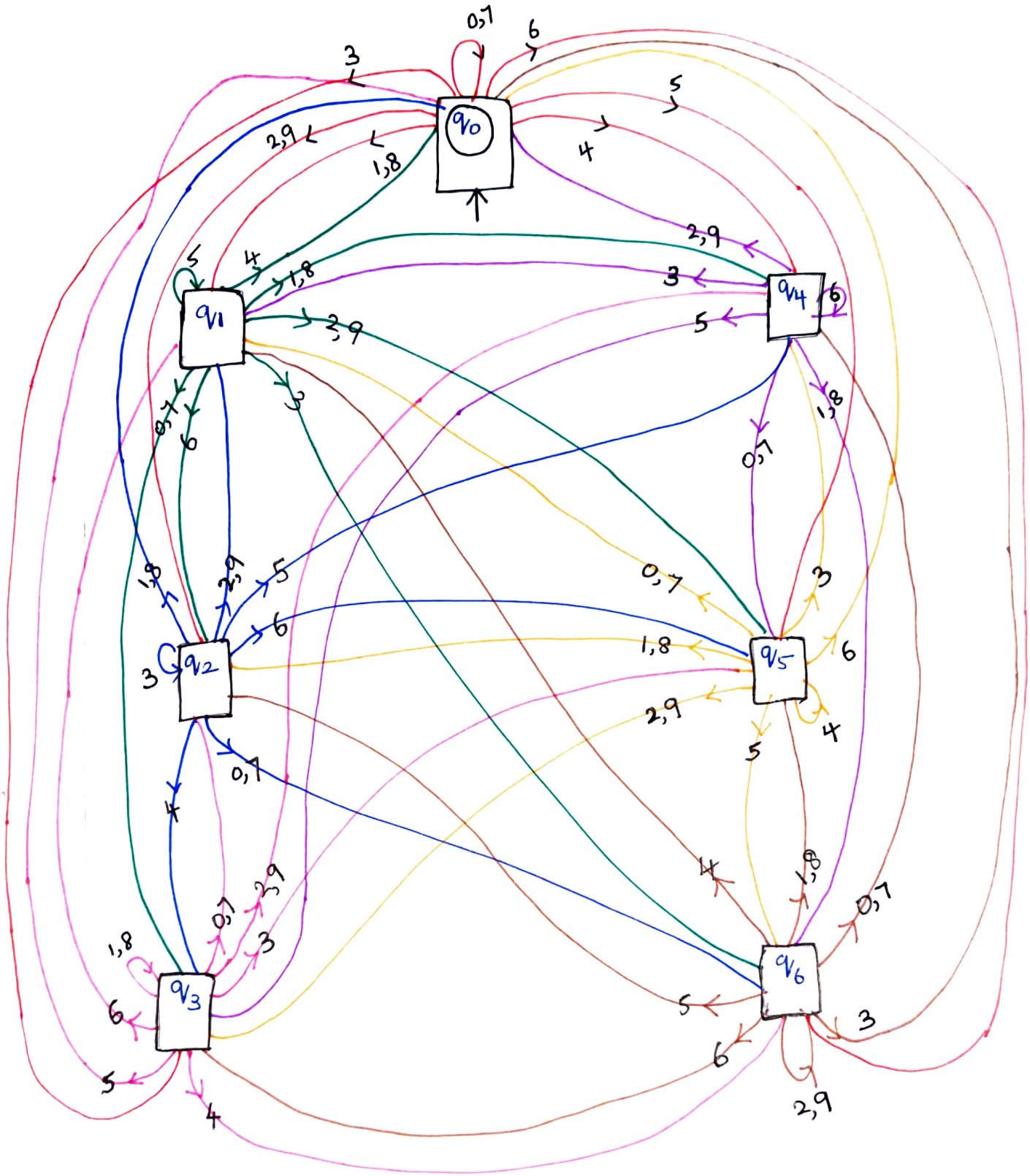


✓

ii) 71



✗


q_0
q_1
q_2
q_3
q_4
q_5
q_6
0,7
1,8
2,9
3
4
5
6

(6) Divisible by a decimal number 8.

A DFA is defined by 5 states $M \Rightarrow (Q, \Sigma, q_0, \delta, F)$

$Q \Rightarrow$ 8 states

$\Sigma \Rightarrow \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$

$q_0 \Rightarrow$ Initial state

q_0 ■ $\Rightarrow$ Final state

Logic:

Remainder 0 $\Rightarrow$ [0, 8] $\Longrightarrow q_0$

Remainder 1 $\Rightarrow$ [1, 9] $\Longrightarrow q_1$

Remainder 2 $\Rightarrow$ [2] $\Longrightarrow q_2$

Remainder 3 $\Rightarrow$ [3] $\Longrightarrow q_3$

Remainder 4 $\Rightarrow$ [4] $\Longrightarrow q_4$

Remainder 5 $\Rightarrow$ [5] $\Longrightarrow q_5$

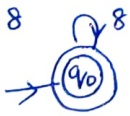
Remainder 6 $\Rightarrow$ [6] $\Longrightarrow q_6$

Remainder 7 $\Rightarrow$ [7] $\Longrightarrow q_7$

If the remainder is i, then it must end with q_i state.

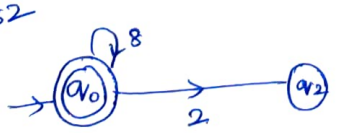
Check for the string.

i) 88

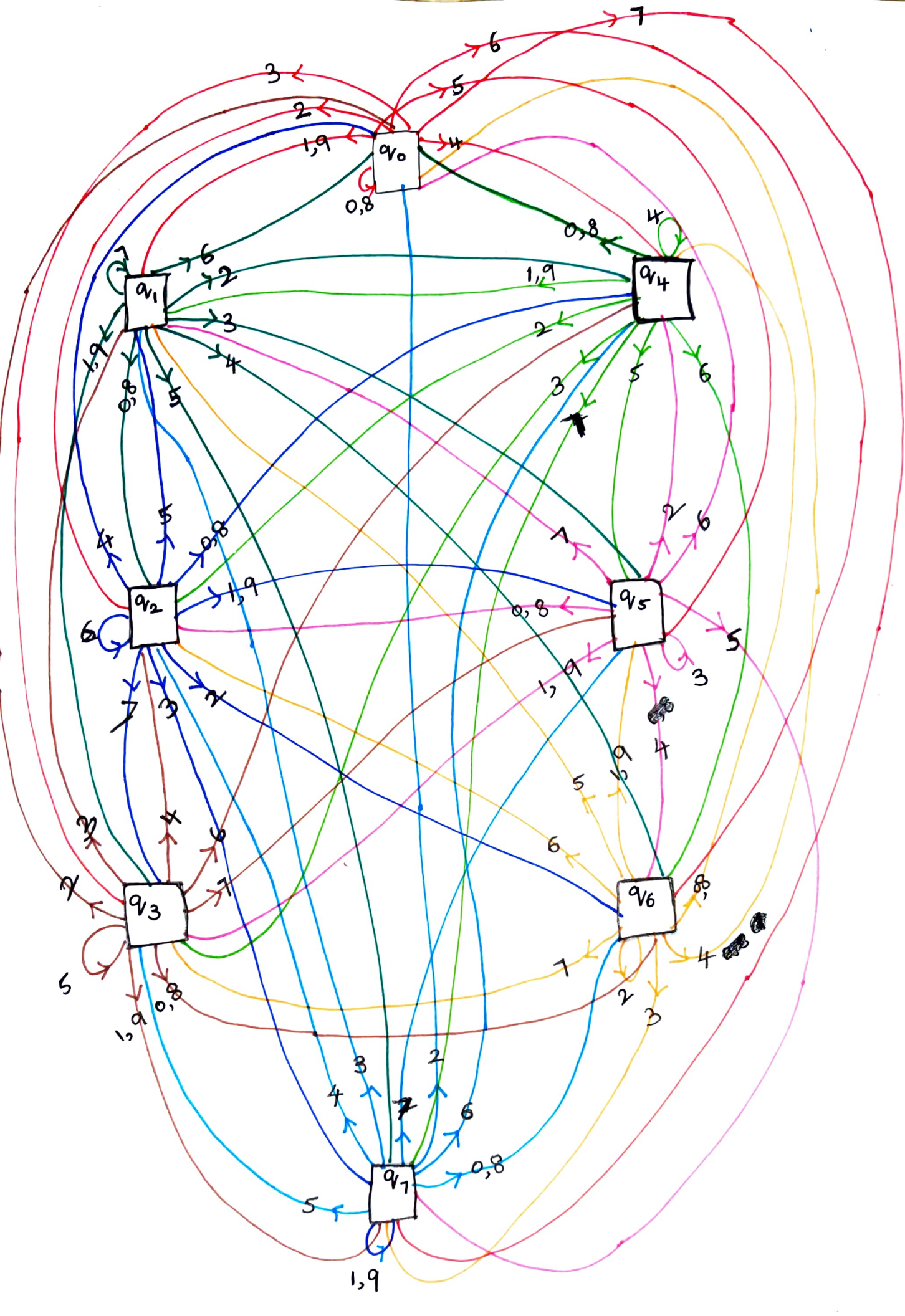


✓

ii) 82



×


q_0
q_1
q_2
q_3
q_4
q_5
q_6
q_7
0,8
1,9