

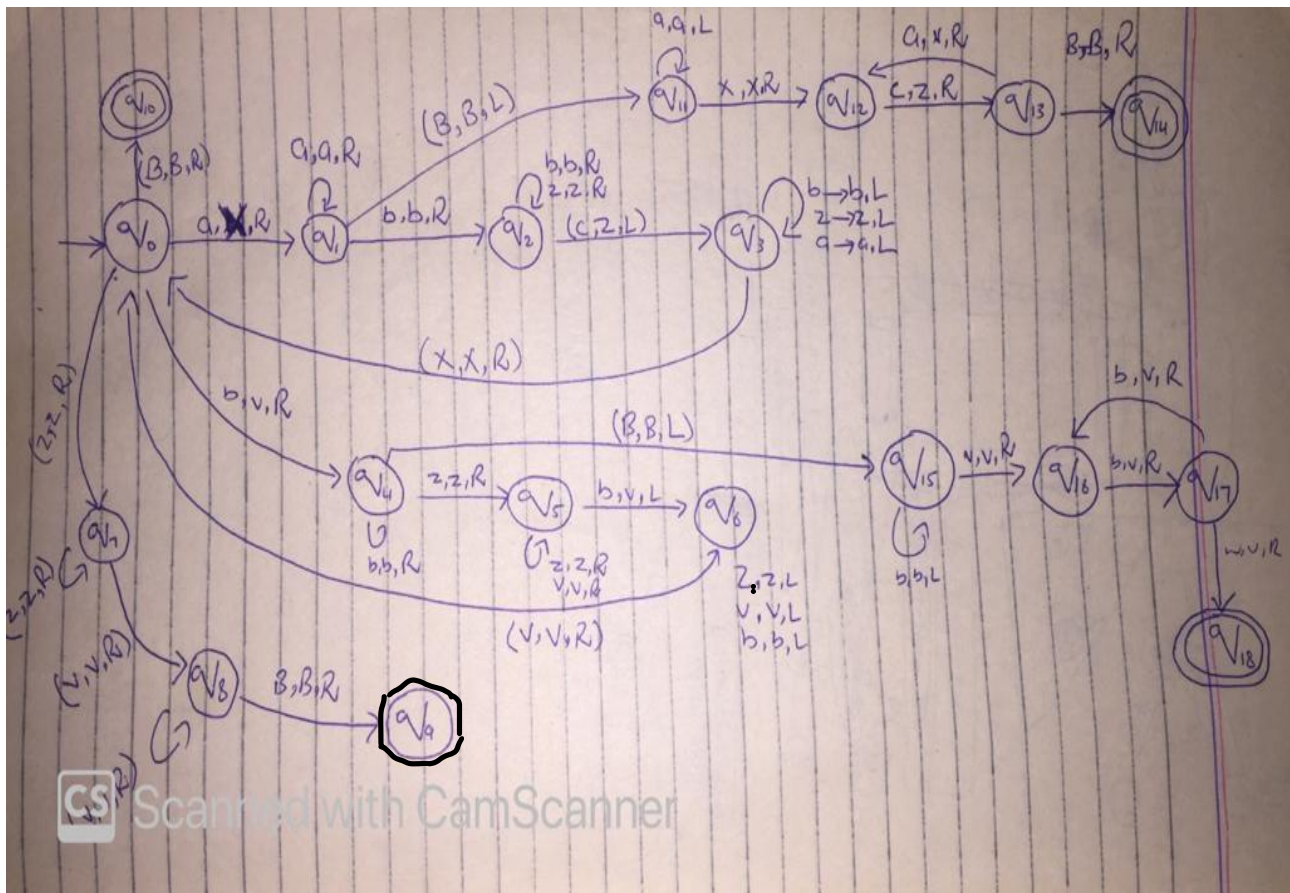
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Theory of Automata
Section (B)

Language: $\{a^n b^m a^n b^m \mid m, n > 0\}$

Descriptive Definition:

'n' number of A's and 'm' number of B's are followed by same 'n' number of A's and same 'm' number of B's. Where $n, m \geq 0$;

- ❖ If the number of a's and c's are equal then the string will be accepted otherwise it will be rejected.
- ❖ If the number of b's and d's are equal then the string will be accepted otherwise it will be rejected.



(FIRST CASE)

- ❖ Here the states {q0,q10} deals with the first case.

(2ND CASE)

- ❖ {q0, q1, q11, q12, q13, q14} deals with the second case.

(3RD CASE)

- ❖ {q0, q4, q15, q16, q17, q18} deals with the third case.

(4TH CASE)

- ❖ {q0, q1, q2, q3, q4, q5, q6, q7, q8, q9} deals with the final case.

(CODE)

```
#-----Turing Machine-----#
#----- Language {a^n b^m c^n d^m | n,m>=1} -----#

# Function to perform action in the main body of the code.
def action(input, replicate, move):
    global tapehead
    if tape[tapehead] == input: # give the input
        tape[tapehead] = replicate # replicate elements in the tape
        if move == 'L':
            tapehead -= 1
        else:
            tapehead += 1
        return True
    return False

tape = ['B']*50 # input blank tape is blank
string = input("Enter String: ") # get input from the user
i = 5
tapehead = 5
for s in string: # loop to place string in tape
    tape[i] = s
    i += 1

state = 0
# variable for states
a, b, c, d, X, Z, U, V, R, L, B = 'a', 'b', 'c', 'd', 'X', 'Z', 'U', 'V', 'R', 'L', 'B'
olddtapehead = -1
accept = False
while(olddtapehead != tapehead): # if tapehead not moving that means terminate Turing machine
    oldtapehead = tapehead
    #-----checks to go for the Exact direction-----
    -----#
    if state == 0:
        if action(a, X, R):
```

```
        state = 1
    elif action(B, B, R):
        state = 10
    elif action(Z, Z, R):
        state = 7
    elif action(b, U, R):
        state = 4

elif state == 1:
    if action(a, a, R):
        state = 1
    elif action(b, b, R):
        state = 2
    elif action(B, B, L):
        state = 11

elif state == 2:
    if action(b, b, R) or action(Z, Z, R):
        state = 2
    elif action(c, Z, L):
        state = 3

elif state == 3:
    if action(b, b, L) or action(Z, Z, L) or action(a, a, L):
        state = 3
    elif action(X, X, R):
        state = 0

elif state == 4:
    if action(b, b, R):
        state = 4
    elif action(Z, Z, R):
        state = 5
    elif action(B, B, L):
        state = 15

elif state == 5:
    if action(Z, Z, R) or action(V, V, R):
        state = 5
    elif action(d, V, L):
        state = 6

elif state == 6:
    if action(Z, Z, L) or action(V, V, L) or action(b, b, L):
        state = 6
    elif action(U, U, R):
        state = 0

elif state == 7:
    if action(Z, Z, R):
        state = 7
```

```
        elif action(V, V, R):
            state = 8

    elif state == 8:
        if action(V, V, R):
            state = 8
        elif action(B, B, R):
            state = 9

    elif state == 11:
        if action(a, a, L):
            state = 11
        elif action(X, X, R):
            state = 12

    elif state == 12:
        if action(c, Z, R):
            state = 13

    elif state == 13:
        if action(a, X, R):
            state = 12
        elif action(B, B, R):
            state = 14

    elif state == 15:
        if action(b, b, L):
            state = 15
        elif action(U, U, R):
            state = 16

    elif state == 16:
        if action(d, V, R):
            state = 17

    elif state == 17:
        if action(b, U, R):
            state = 16
        elif action(B, B, R):
            state = 18

    else:
        accept = True

if accept:
    print("String accepted on state = ", state)
else:
    print("String not accepted on state = ", state)
```

(Output)

```
PS E:\5th Semester\Theory of Automata\Project> e::; cd '
ers\.vscode\extensions\ms-python.python-2021.12.15597326
achine.py'
Enter String: aabbbccddd
String accepted on state = 9
```

```
PS E:\5th Semester\Theory of Automata\Project> e::; cd
ers\.vscode\extensions\ms-python.python-2021.12.15597326
achine.py'
Enter String: abbccddd
String not accepted on state = 5
PS E:\5th Semester\Theory of Automata\Project> █
```