

TuringNeural-Turing-Machine

February 26, 2024

```
[1]: # implement a Turing machine for the language  $L = \{a^m b^n a^m b^n \mid m, n \geq 0\}$ 

[2]: # It can be easily figured out that the language will be accepted in four cases:
# Blank string.
# List contains only a's and their total number is even.
# List contains only b's and their total number is even.
# The input is a combination of both a and b's and follows the rule of the
↪ language.

[3]: def action(input_char, replace_with, move, new_state):
    global tapehead, state
    if tape[tapehead] == input_char:
        tape[tapehead] = replace_with
        state = new_state
        if move == 'L':
            tapehead -= 1
        else:
            tapehead += 1
    return True
    return False

[6]: string = input("Enter String: ")
length = len(string) + 2
tape = ['B']*length
i = 1
tapehead = 1
for s in string: #loop to place string in tape
    tape[i] = s
    i += 1

state = 0
#assigning characters to variable so that don't have to use characters each time
a, b, X, Z, U, V, R, L, B = 'a', 'b', 'X', 'Z', 'U', 'V', 'R', 'L', 'B'
oldtapehead = -1
accept = False
while(oldtapehead != tapehead): #if tapehead not moving that means terminate
↪ Turing machine
    oldtapehead = tapehead
```

```

print(tape , "with tapehead at index", tapehead, "on state" , state)

if state == 0:
    if action(a, X, R, 1) or action(B, B, R, 10) or action(Z, Z, R, 7) or
↪action(b, U, R, 4):
        pass

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

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

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

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

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

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

elif state == 7:
    if action(Z, Z, R, 7) or action(V, V, R, 8):
        pass

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

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

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

```

```

        pass

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

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

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

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

    else:
        accept = True

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

```

Enter String: (blank string)

['B', '(', 'b', 'l', 'a', 'n', 'k', ' ', 's', 't', 'r', 'i', 'n', 'g', ')', 'B']
 with tapehead at index 1 on state 0
 String not accepted on state = 0

[]: