NFA TO DFA

EX. NO. 3
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AIM: To write a program for converting NFA to DFA.

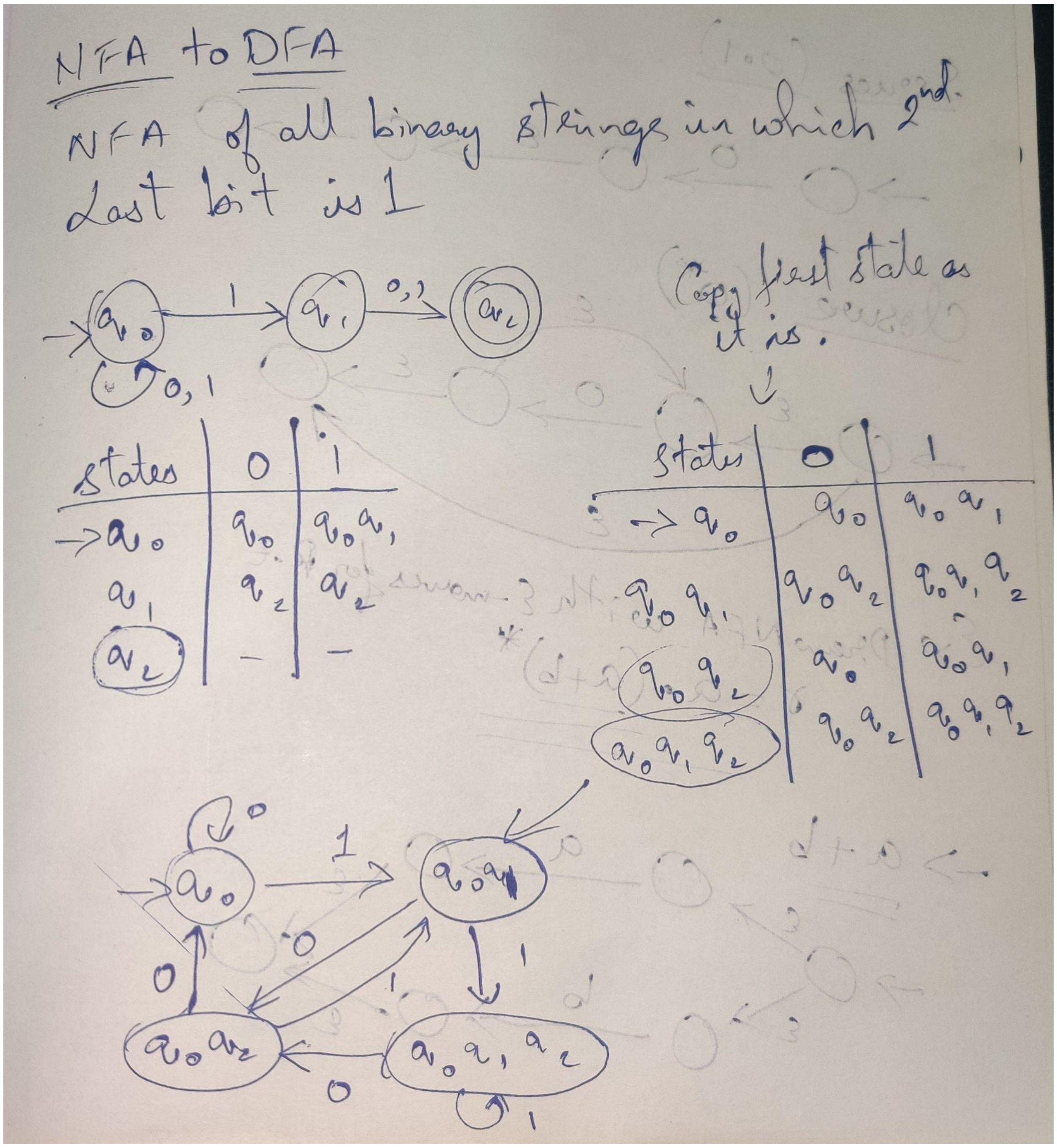
ALGORITHM:

```
1. Start
2. Get the input from the user
3. Set the only state in SDFA to “unmarked”.
4. while SDFA contains an unmarked state do:
        a. Let T be that unmarked state
        b. for each a in % do S = e-Closure(MoveNFA(T,a))
        c. if S is not in SDFA already then, add S to SDFA (as an “unmarked” state)
        d. Set MoveDFA(T,a) to S
5. For each S in SDFA if any s & S is a final state in the NFA then, mark S an a final state in the DFA
6. Print the result.
7. Stop the program.
```

CODE:

```
import pandas as pd

# Taking NFA input from User

nfa = {}
n = int(input("No. of states : "))
t = int(input("No. of transitions : "))

for i in range(n):
    state = input("state name : ")
    nfa[state] = {}
    for j in range(t):
        path = input("path : ")
        print("Enter end state from state {} traveling through path {} : ".format(state,path))
        reaching_state = [x for x in input().split()]
        nfa[state][path] = reaching_state
print("\nNFA :- \n")
print(nfa)
print("\nPrinting NFA table :- ")
nfa_table = pd.DataFrame(nfa)
print(nfa_table.transpose())
print("Enter final state of NFA : ")
nfa_final_state = [x for x in input().split()]

new_states_list = []
dfa = {}
keys_list = list(list(nfa.keys())[0])
path_list = list(nfa[keys_list[0]].keys())

dfa[keys_list[0]] = {}
for y in range(t):
    var = "".join(nfa[keys_list[0]][path_list[y]])
    dfa[keys_list[0]][path_list[y]] = var
    if var not in keys_list:
        new_states_list.append(var)
        keys_list.append(var)


while len(new_states_list) != 0:
    dfa[new_states_list[0]] = {}
    for _ in range(len(new_states_list[0])):
        for i in range(len(path_list)):
            temp = []
            for j in range(len(new_states_list[0])):
                temp += nfa[new_states_list[0][j]][path_list[i]]
            s = ""
            s = s.join(temp)
            if s not in keys_list:
                new_states_list.append(s)
                keys_list.append(s)
            dfa[new_states_list[0]][path_list[i]] = s

    new_states_list.remove(new_states_list[0])
print("\nDFA :- \n")
print(dfa)
print("\nPrinting DFA table :- ")
dfa_table = pd.DataFrame(dfa)
print(dfa_table.transpose())

dfa_states_list = list(dfa.keys())
dfa_final_states = []
for x in dfa_states_list:
    for i in x:
        if i in nfa_final_state:
            dfa_final_states.append(x)
            break

print("\nFinal states of the DFA are : ",dfa_final_states)
```

INPUT AND PROBLEM SOLVING:



NFA to DFA

NFA of all binary strings in which 2nd last bit is 1

$$\begin{tikzcd} \arrow[r] & q_0 \arrow[loop below, "0,1"] \arrow[r, "1"] & q_1 \arrow[r, "0,1"] & q_2 \end{tikzcd}$$

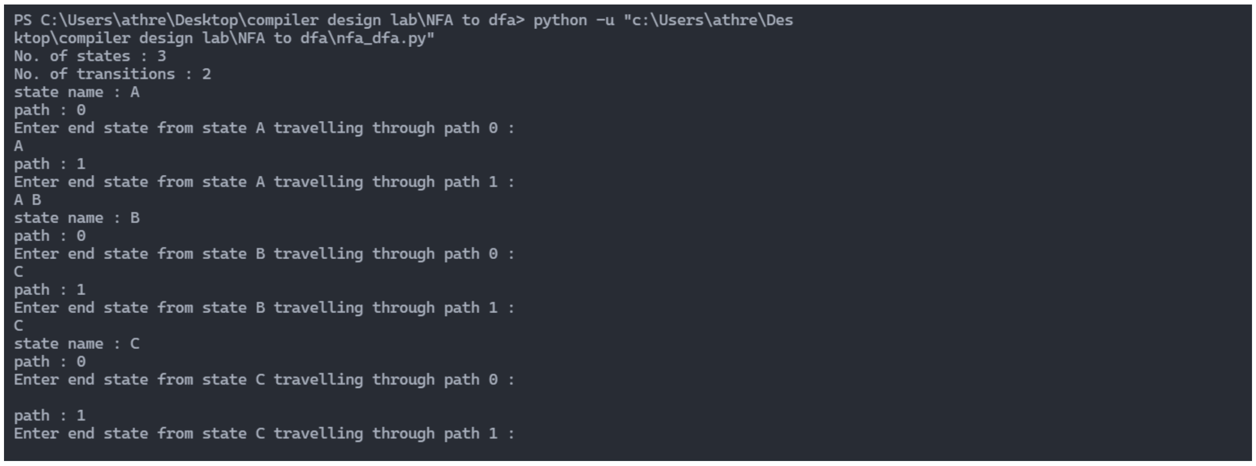
states	0	1
$\rightarrow q_0$	q_0	$q_0 q_1$
q_1	q_2	q_2
q_2	–	–

Copy first state as it is.

states	0	1
$\rightarrow q_0$	q_0	$q_0 q_1$
$q_0 q_1$	$q_0 q_2$	$q_0 q_1 q_2$
$q_0 q_2$	q_0	$q_0 q_1$
$q_0 q_1 q_2$	$q_0 q_2$	$q_0 q_1 q_2$

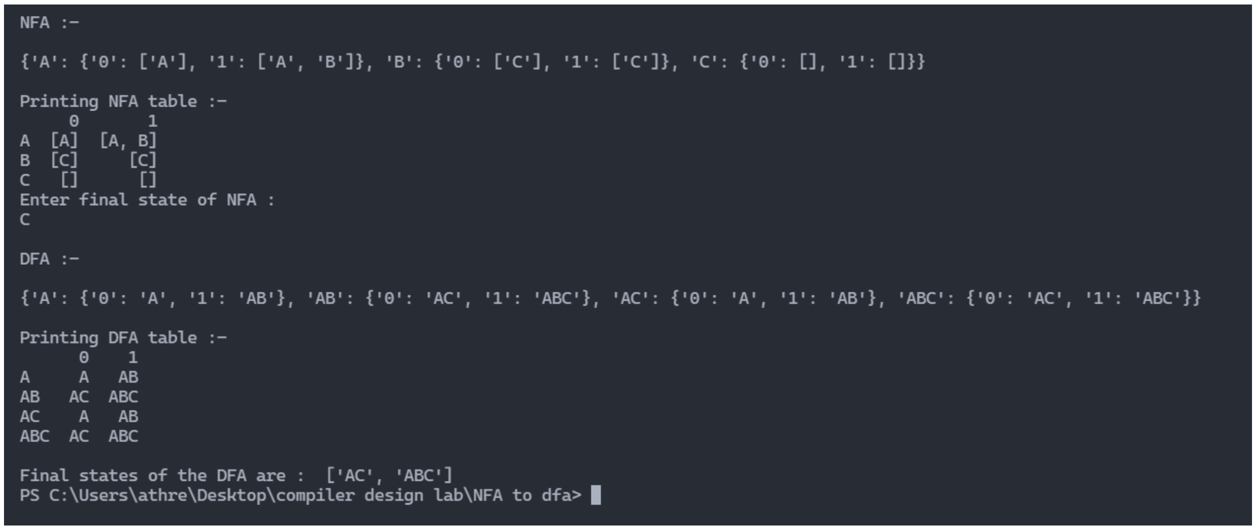
$$\begin{tikzcd} \arrow[r] & q_0 \arrow[loop above, "0"] \arrow[r, "1"] & q_0 q_1 \arrow[dl, "0"] \arrow[d, "1"] \\ & q_0 q_2 \arrow[u, "0"] \arrow[ur, bend right, "1"'] & q_0 q_1 q_2 \arrow[l, "0"] \arrow[loop below, "1"] \end{tikzcd}$$

INPUT :



```
PS C:\Users\athre\Desktop\compiler design lab\NFA to dfa> python -u "c:\Users\athre\Des
ktop\compiler design lab\NFA to dfa\nfa_dfa.py"
No. of states : 3
No. of transitions : 2
state name : A
path : 0
Enter end state from state A travelling through path 0 :
A
path : 1
Enter end state from state A travelling through path 1 :
A B
state name : B
path : 0
Enter end state from state B travelling through path 0 :
C
path : 1
Enter end state from state B travelling through path 1 :
C
state name : C
path : 0
Enter end state from state C travelling through path 0 :

path : 1
Enter end state from state C travelling through path 1 :
```

OUTPUT :



```
NFA :-

{'A': {'0': ['A'], '1': ['A', 'B']}, 'B': {'0': ['C'], '1': ['C']}, 'C': {'0': [], '1': []}}

Printing NFA table :-
     0       1
A  [A]  [A, B]
B  [C]     [C]
C   []      []
Enter final state of NFA :
C

DFA :-

{'A': {'0': 'A', '1': 'AB'}, 'AB': {'0': 'AC', '1': 'ABC'}, 'AC': {'0': 'A', '1': 'AB'}, 'ABC': {'0': 'AC', '1': 'ABC'}}

Printing DFA table :-
      0    1
A     A   AB
AB   AC  ABC
AC    A   AB
ABC  AC  ABC

Final states of the DFA are :  ['AC', 'ABC']
PS C:\Users\athre\Desktop\compiler design lab\NFA to dfa> 
```

RESULT :

The given NFA was converted to a DFA using python successfully.