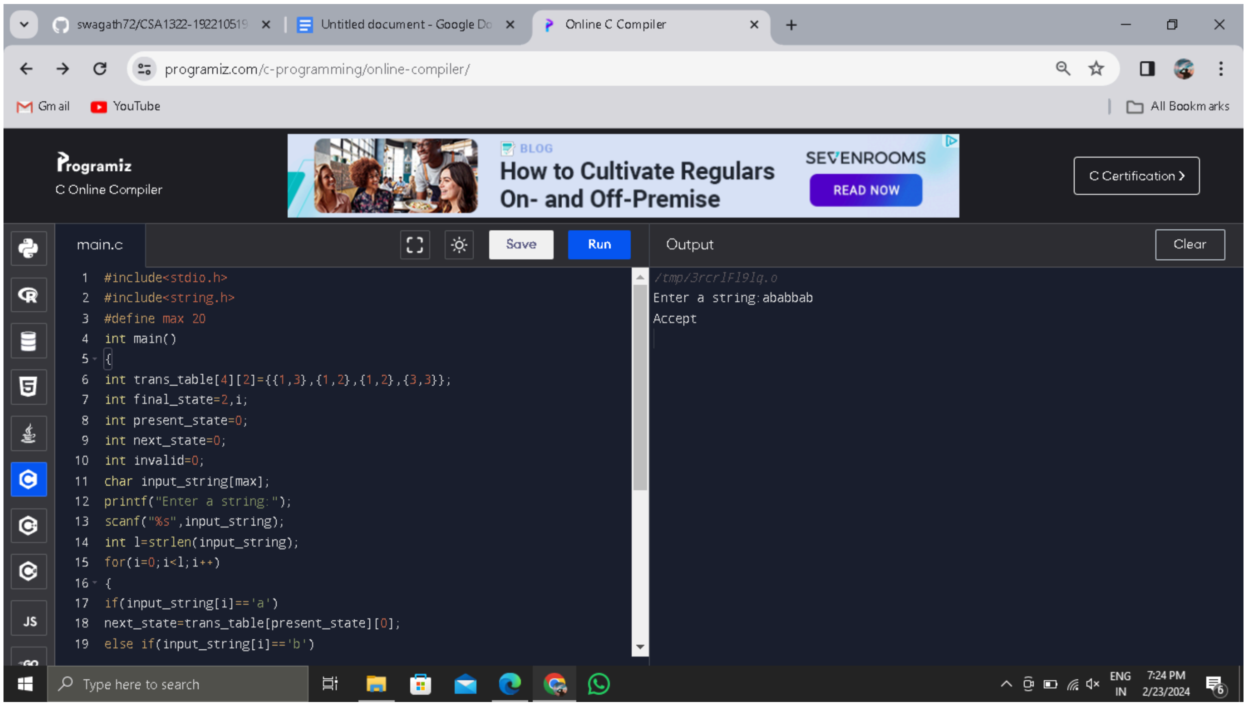
1.DETERMINISTIC FINITE AUTOMATA (DFA)

Code:

```
#include<stdio.h>
#include<string.h>
#define max 20
int main()
{
int trans_table[4][2]={{1,3},{1,2},{1,2},{3,3}};
int final_state=2,i;
int present_state=0;
int next_state=0;
int invalid=0;
char input_string[max];
printf("Enter a string:");
scanf("%s",input_string);
int l=strlen(input_string);
for(i=0;i<l;i++)
{
if(input_string[i]=='a')
next_state=trans_table[present_state][0];
else if(input_string[i]=='b')
next_state=trans_table[present_state][1];
else
invalid=l;
present_state=next_state;
}
if(invalid==l)
{
printf("Invalid input");
}
else if(present_state==final_state)
printf("Accept\n");
else
printf("Don't Accept\n");
}
```

Execution:



```
#include<stdio.h>
#include<string.h>
#define max 20
int main()
{
int trans_table[4][2]={{1,3},{1,2},{1,2},{3,3}};
int final_state=2,i;
int present_state=0;
int next_state=0;
int invalid=0;
char input_string[max];
printf("Enter a string:");
scanf("%s",input_string);
int l=strlen(input_string);
for(i=0;i<l;i++)
{
if(input_string[i]=='a')
next_state=trans_table[present_state][0];
else if(input_string[i]=='b')
```

```
/tmp/3rcrlFI9Iq.o
Enter a string:ababbab
Accept
```

2.NON-DETERMINISTIC FINITE AUTOMATA (NFA)

Code:

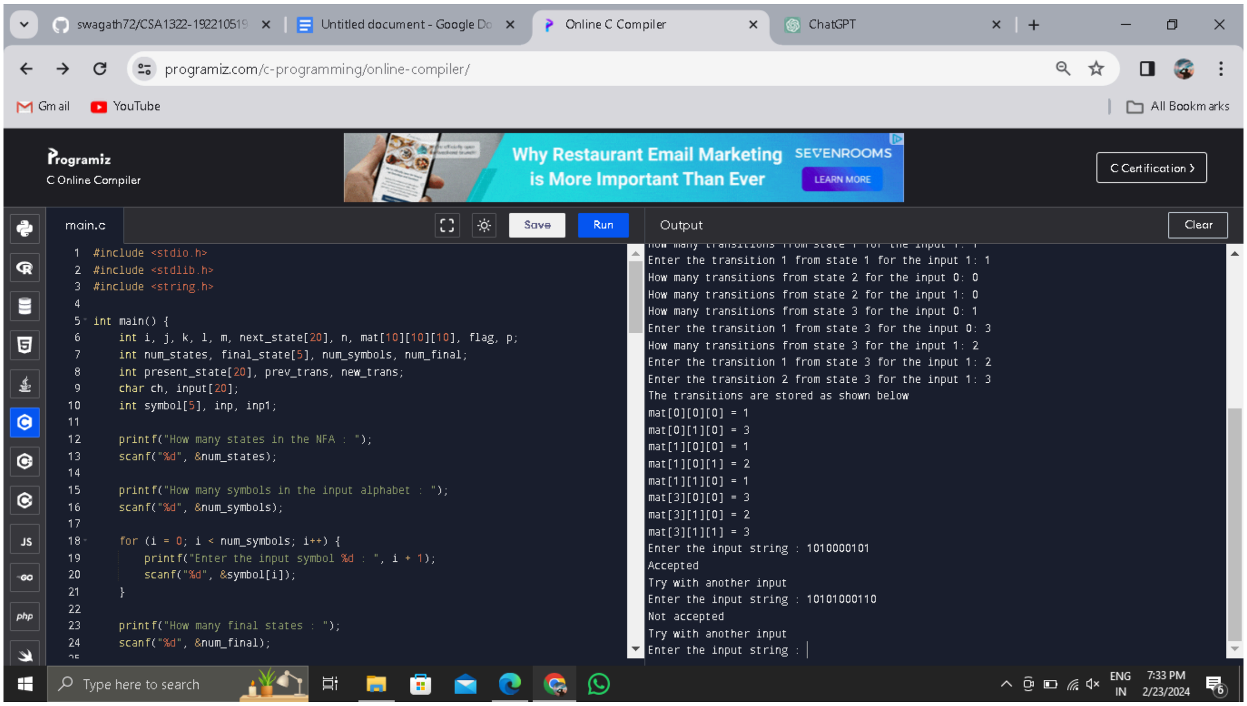
```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>

int main() {
    int i, j, k, l, m, next_state[20], n, mat[10][10][10], flag, p;
    int num_states, final_state[5], num_symbols, num_final;
    int present_state[20], prev_trans, new_trans;
    char ch, input[20];
    int symbol[5], inp, inp1;

    printf("How many states in the NFA : ");
    scanf("%d", &num_states);

    printf("How many symbols in the input alphabet : ");
    scanf("%d", &num_symbols);

    for (i = 0; i < num_symbols; i++) {
        printf("Enter the input symbol %d : ", i + 1);
        scanf("%d", &symbol[i]);
```

```
}

printf("How many final states : ");
scanf("%d", &num_final);

for (i = 0; i < num_final; i++) {
    printf("Enter the final state %d : ", i + 1);
    scanf("%d", &final_state[i]);
}

// Initialize all entries with -1 in Transition table
for (i = 0; i < 10; i++) {
    for (j = 0; j < 10; j++) {
        for (k = 0; k < 10; k++) {
            mat[i][j][k] = -1;
        }
    }
}

// Get input from the user and fill the 3D transition table
for (i = 0; i < num_states; i++) {
    for (j = 0; j < num_symbols; j++) {
        printf("How many transitions from state %d for the input %d: ", i, symbol[j]);
        scanf("%d", &n);
        for (k = 0; k < n; k++) {
            printf("Enter the transition %d from state %d for the input %d: ", k + 1, i, symbol[j]);
            scanf("%d", &mat[i][j][k]);
        }
    }
}

printf("The transitions are stored as shown below\n");

for (i = 0; i < 10; i++) {
    for (j = 0; j < 10; j++) {
        for (k = 0; k < 10; k++) {
            if (mat[i][j][k] != -1)
                printf("mat[%d][%d][%d] = %d\n", i, j, k, mat[i][j][k]);
        }
    }
}

while (1) {
    printf("Enter the input string : ");
```

```
scanf("%s", input);

present_state[0] = 0;
prev_trans = 1;
l = strlen(input);

for (i = 0; i < l; i++) {
    if (input[i] == '0')
        inp1 = 0;
    else if (input[i] == '1')
        inp1 = 1;
    else {
        printf("Invalid input\n");
        exit(0);
    }

    for (m = 0; m < num_symbols; m++) {
        if (inp1 == symbol[m]) {
            inp = m;
            break;
        }
    }

    new_trans = 0;

    for (j = 0; j < prev_trans; j++) {
        k = 0;
        p = present_state[j];
        while (mat[p][inp][k] != -1) {
            next_state[new_trans++] = mat[p][inp][k];
            k++;
        }
    }

    for (j = 0; j < new_trans; j++) {
        present_state[j] = next_state[j];
    }

    prev_trans = new_trans;
}

flag = 0;

for (i = 0; i < prev_trans; i++) {
```

```
            for (j = 0; j < num_final; j++) {
                if (present_state[i] == final_state[j]) {
                    flag = 1;
                    break;
                }
            }
        }

        if (flag == 1)
            printf("Accepted\n");
        else
            printf("Not accepted\n");

        printf("Try with another input\n");
    }

    return 0;
}
```

Execution:



```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>

int main() {
    int i, j, k, l, m, next_state[20], n, mat[10][10][10], flag, p;
    int num_states, final_state[5], num_symbols, num_final;
    int present_state[20], prev_trans, new_trans;
    char ch, input[20];
    int symbol[5], inp, inp1;

    printf("How many states in the NFA : ");
    scanf("%d", &num_states);

    printf("How many symbols in the input alphabet : ");
    scanf("%d", &num_symbols);

    for (i = 0; i < num_symbols; i++) {
        printf("Enter the input symbol %d : ", i + 1);
        scanf("%d", &symbol[i]);
    }

    printf("How many final states : ");
    scanf("%d", &num_final);
```

```
How many transitions from state 1 for the input 1: 1
Enter the transition 1 from state 1 for the input 1: 1
How many transitions from state 2 for the input 0: 0
How many transitions from state 2 for the input 1: 0
How many transitions from state 3 for the input 0: 1
Enter the transition 1 from state 3 for the input 0: 3
How many transitions from state 3 for the input 1: 2
Enter the transition 1 from state 3 for the input 1: 2
Enter the transition 2 from state 3 for the input 1: 3
The transitions are stored as shown below
mat[0][0][0] = 1
mat[0][1][0] = 3
mat[1][0][0] = 1
mat[1][0][1] = 2
mat[1][1][0] = 1
mat[3][0][0] = 3
mat[3][1][0] = 2
mat[3][1][1] = 3
Enter the input string : 1010000101
Accepted
Try with another input
Enter the input string : 10101000110
Not accepted
Try with another input
Enter the input string :
```

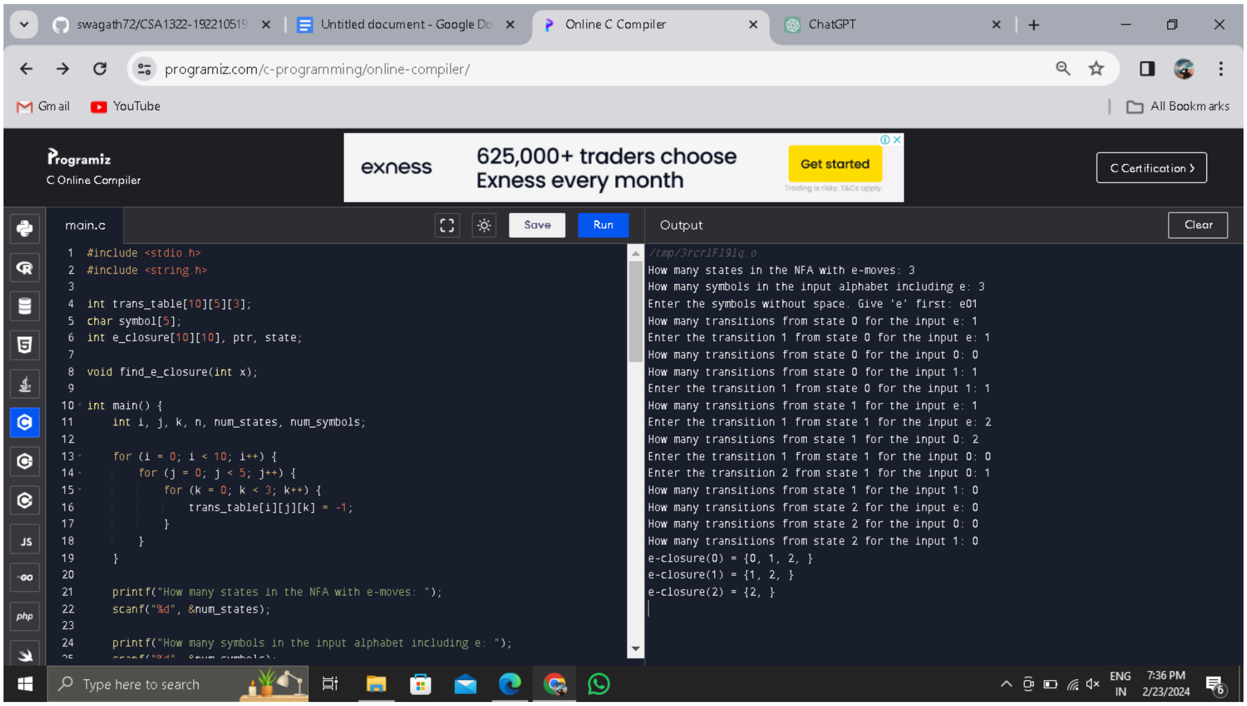
3.FINDING ε-CLOSURE FOR NFA WITH ε-MOVES

Code:

```
#include <stdio.h>
```

```c
#include <string.h>

int trans_table[10][5][3];
char symbol[5];
int e_closure[10][10], ptr, state;

void find_e_closure(int x);

int main() {
    int i, j, k, n, num_states, num_symbols;

    for (i = 0; i < 10; i++) {
        for (j = 0; j < 5; j++) {
            for (k = 0; k < 3; k++) {
                trans_table[i][j][k] = -1;
            }
        }
    }

    printf("How many states in the NFA with e-moves: ");
    scanf("%d", &num_states);

    printf("How many symbols in the input alphabet including e: ");
    scanf("%d", &num_symbols);

    printf("Enter the symbols without space. Give 'e' first: ");
    scanf("%s", symbol);

    for (i = 0; i < num_states; i++) {
        for (j = 0; j < num_symbols; j++) {
            printf("How many transitions from state %d for the input %c: ", i, symbol[j]);
            scanf("%d", &n);
            for (k = 0; k < n; k++) {
                printf("Enter the transition %d from state %d for the input %c: ", k + 1, i, symbol[j]);
                scanf("%d", &trans_table[i][j][k]);
            }
        }
    }

    for (i = 0; i < 10; i++) {
        for (j = 0; j < 10; j++) {
            e_closure[i][j] = -1;
        }
    }
    for (i = 0; i < num_states; i++)
        e_closure[i][0] = i;

    for (i = 0; i < num_states; i++) {
        if (trans_table[i][0][0] == -1)
            continue;
        else {
            state = i;
            ptr = 1;
            find_e_closure(i);
        }
    }

    for (i = 0; i < num_states; i++) {
        printf("e-closure(%d) = {", i);
        for (j = 0; j < num_states; j++) {
            if (e_closure[i][j] != -1) {
                printf("%d, ", e_closure[i][j]);
            }
        }
        printf("}\n");
    }

    return 0;
}

void find_e_closure(int x) {
    int i, j, y[10], num_trans;
    i = 0;

    while (trans_table[x][0][i] != -1) {
        y[i] = trans_table[x][0][i];
        i = i + 1;
    }

    num_trans = i;

    for (j = 0; j < num_trans; j++) {
        e_closure[state][ptr] = y[j];
        ptr++;
        find_e_closure(y[j]);
    }
}
```

Execution:



```
#include <stdio.h>
#include <string.h>

int trans_table[10][5][3];
char symbol[5];
int e_closure[10][10], ptr, state;

void find_e_closure(int x);

int main() {
    int i, j, k, n, num_states, num_symbols;

    for (i = 0; i < 10; i++) {
        for (j = 0; j < 5; j++) {
            for (k = 0; k < 3; k++) {
                trans_table[i][j][k] = -1;
            }
        }
    }

    printf("How many states in the NFA with e-moves: ");
    scanf("%d", &num_states);

    printf("How many symbols in the input alphabet including e: ");
    scanf("%d", &num_symbols);
```

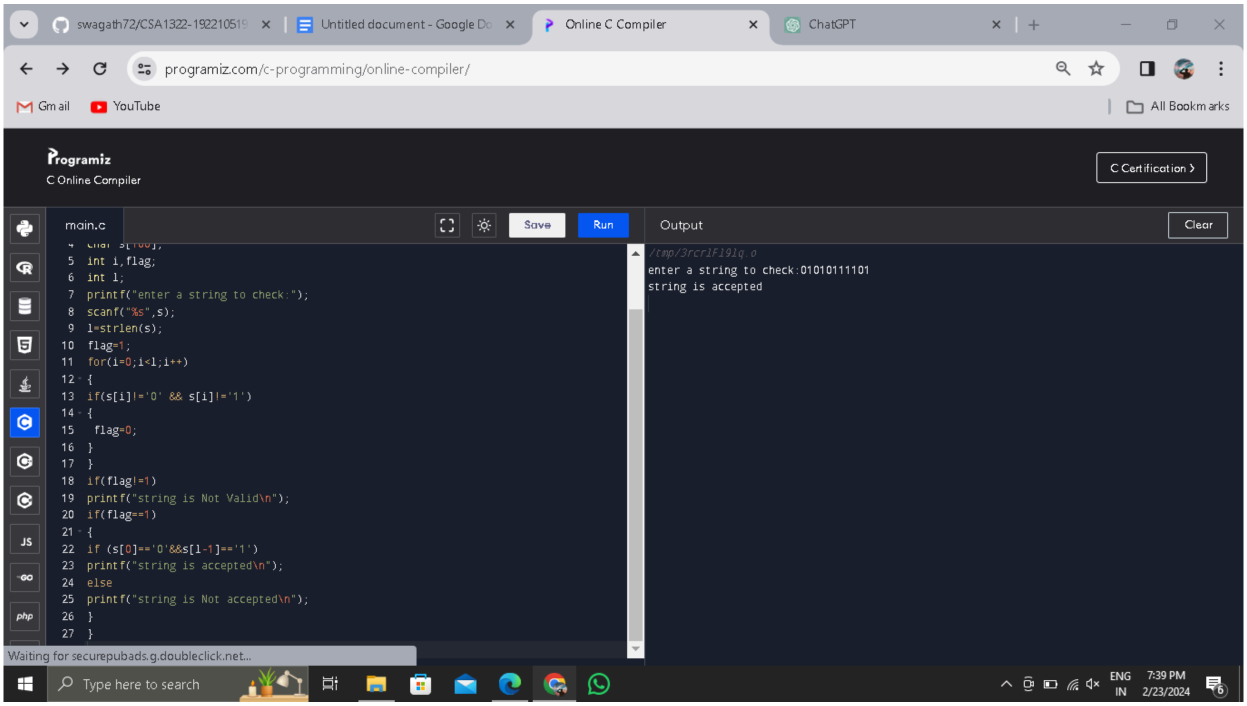
```
/tmp/3rcrlF19lq.o
How many states in the NFA with e-moves: 3
How many symbols in the input alphabet including e: 3
Enter the symbols without space. Give 'e' first: e01
How many transitions from state 0 for the input e: 1
Enter the transition 1 from state 0 for the input e: 1
How many transitions from state 0 for the input 0: 0
How many transitions from state 0 for the input 1: 1
Enter the transition 1 from state 0 for the input 1: 1
How many transitions from state 1 for the input e: 1
Enter the transition 1 from state 1 for the input e: 2
How many transitions from state 1 for the input 0: 2
Enter the transition 1 from state 1 for the input 0: 0
Enter the transition 2 from state 1 for the input 0: 1
How many transitions from state 1 for the input 1: 0
How many transitions from state 2 for the input e: 0
How many transitions from state 2 for the input 0: 0
How many transitions from state 2 for the input 1: 0
e-closure(0) = {0, 1, 2, }
e-closure(1) = {1, 2, }
e-closure(2) = {2, }
```

4.CHECKING WHETHER A STRING BELONGS TO A GRAMMAR

Code:

```
#include<stdio.h>
#include<string.h>
int main(){
char s[100];
int i,flag;
int l;
printf("enter a string to check:");
scanf("%s",s);
l=strlen(s);
flag=1;
for(i=0;i<l;i++)
{
if(s[i]!='0' && s[i]!='1')
{
 flag=0;
}
}
if(flag!=1)
printf("string is Not Valid\n");
if(flag==1)
{
if (s[0]=='0'&&s[l-1]=='1')
printf("string is accepted\n");
else
printf("string is Not accepted\n");
}
}
```

Execution:



```
char s[100];
int i,flag;
int l;
printf("enter a string to check:");
scanf("%s",s);
l=strlen(s);
flag=1;
for(i=0;i<l;i++)
{
if(s[i]!='0' && s[i]!='1')
{
 flag=0;
}
}
if(flag!=1)
printf("string is Not Valid\n");
if(flag==1)
{
if (s[0]=='0'&&s[l-1]=='1')
printf("string is accepted\n");
else
printf("string is Not accepted\n");
}
}
```

```
/tmp/3rcrlF19lq.o
enter a string to check:01010111101
string is accepted
```