Traffic Light Project Report

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Module:	Theory of Computations
Lectures:	David White

State Diagram

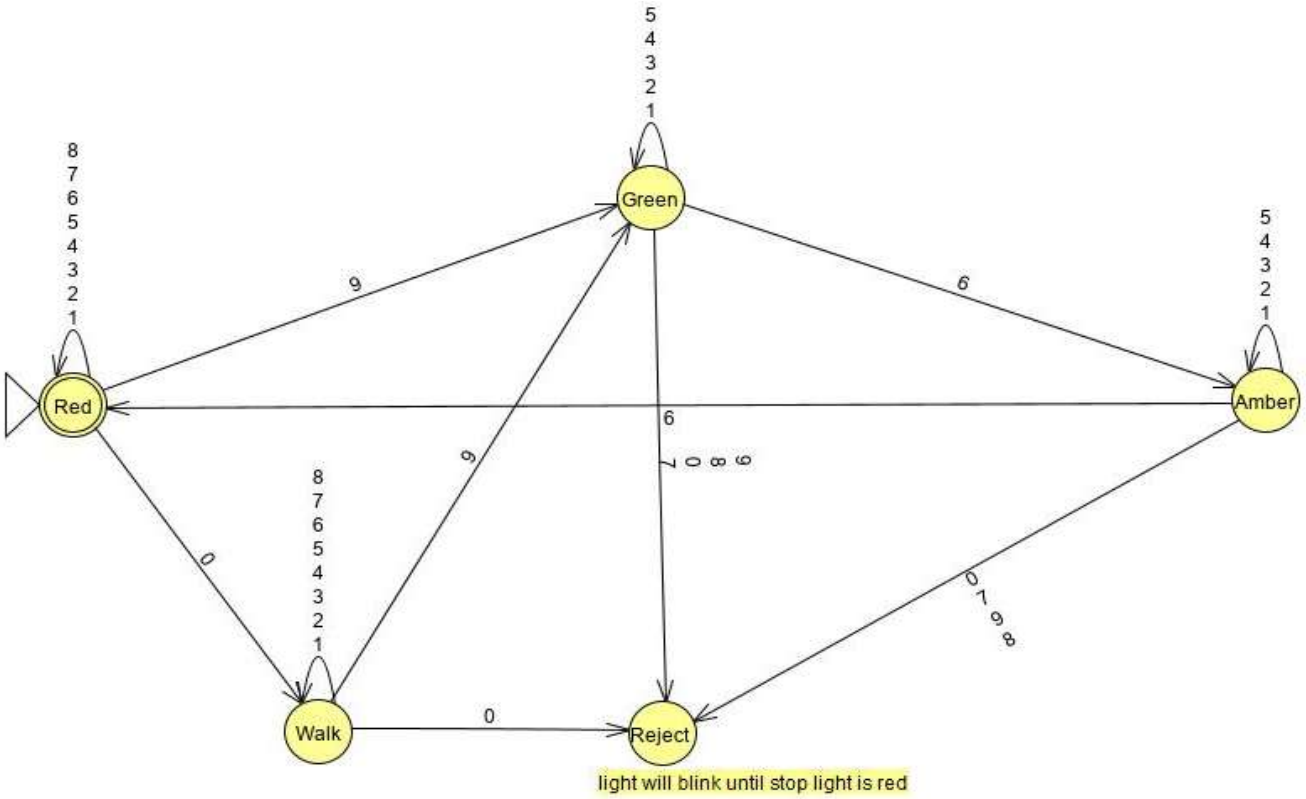

Figure 1: Finite Automaton M1

Formal Description

$M_1 = (Q, \sum, \delta, q_0, F)$, where:

- $Q = \{Red, Green, Amber, Walk, Reject\}$
- $\sum = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$
- $\delta = Q \times \sum$

	0	1	2	3	4	5	6	7	8	9
Red	Walk	Red	Red	Red	Red	Red	Red	Red	Red	Green
Green	Reject	Green	Green	Green	Green	Green	Amber	Reject	Reject	Reject
Amber	Reject	Amber	Amber	Amber	Amber	Amber	Red	Reject	Reject	Reject
Walk	Reject	Walk	Walk	Walk	Walk	Walk	Walk	Walk	Walk	Green
Reject	Reject	Reject	Reject	Reject	Reject	Reject	Reject	Reject	Reject	Reject

Figure 2: Table showing δ

- $q_0 = Red$
- $F = \{Red\}$

Language Description

$L(M_1) = \{w \mid w$ is a string of numbers from 0 to 9 in ascending order. w is repeated any number of times and 0 can fall anywhere in the beginning of the first w in the string.$\}$

C++ Code Implemented in Arduino

```
int LED0 = 13;
int LED1 = 12;
int LED2 = 8;
int LED3 = 4;

void setup() {
  pinMode(LED0,OUTPUT);
  pinMode(LED1,OUTPUT);
  pinMode(LED2,OUTPUT);
  pinMode(LED3,OUTPUT);
  Serial.begin(9600);
 }


void loop() {
//each switch represents a state
//for loop provides input

int walk=1;

 //red state
for(int x=1;x<10;x++){

    switch(x){

    case 1: if(Serial.available() >0 || walk==0){
              walk=0;
```

```
  digitalWrite(LED0,HIGH);
 }
 else{
  digitalWrite(LED0,LOW);
 }
 digitalWrite(LED1,HIGH);
 digitalWrite(LED2,LOW);
 digitalWrite(LED3,LOW);
 delay(1000);
 break;

case 2: if(Serial.available() >0 || walk==0){

  digitalWrite(LED0,HIGH);
 }
 else{
  digitalWrite(LED0,LOW);
 }
 digitalWrite(LED1,HIGH);
 digitalWrite(LED2,LOW);
 digitalWrite(LED3,LOW);
 delay(1000);
 break;
case 3: if(Serial.available() >0 || walk==0){
  digitalWrite(LED0,HIGH);
 }
 else{
  digitalWrite(LED0,LOW);
```

```
        }
        digitalWrite(LED1,HIGH);
        digitalWrite(LED2,LOW);
        digitalWrite(LED3,LOW);
        delay(1000);
        break;
case 4: if(Serial.available() >0 || walk==0){
          digitalWrite(LED0,HIGH);
        }
        else{
          digitalWrite(LED0,LOW);
        }
        digitalWrite(LED1,HIGH);
        digitalWrite(LED2,LOW);
        digitalWrite(LED3,LOW);
        delay(1000);
        break;
case 5: digitalWrite(LED0,LOW);
        digitalWrite(LED1,HIGH);
        digitalWrite(LED2,LOW);
        digitalWrite(LED3,LOW);
        delay(1000);
        break;

case 6: if(Serial.available() >0 || walk==0){
          digitalWrite(LED0,HIGH);
        }
        else{
```

```
          digitalWrite(LED0,LOW);
        }
        digitalWrite(LED1,HIGH);
        digitalWrite(LED2,LOW);
        digitalWrite(LED3,LOW);
        delay(1000);
        break;
case 7: digitalWrite(LED0,LOW);
        digitalWrite(LED1,HIGH);
        digitalWrite(LED2,LOW);
        digitalWrite(LED3,LOW);
        delay(1000);
        break;
case 8: if(Serial.available() >0 || walk==0){
          digitalWrite(LED0,HIGH);
        }
        else{
          digitalWrite(LED0,LOW);
        }
        digitalWrite(LED1,HIGH);
        digitalWrite(LED2,LOW);
        digitalWrite(LED3,LOW);
        delay(1000);
        break;

case 9: digitalWrite(LED0,LOW);
        digitalWrite(LED1,LOW);
        digitalWrite(LED2,LOW);
```

```
        digitalWrite(LED3,HIGH);
        delay(1000);
        break;
   }
}


   //reset walk
if(Serial.available() >0 || walk==0){
  Serial.end();
  Serial.begin(9600);
}

//green state
for(int x=1;x<7;x++){

   switch(x){

   case 1: if(Serial.available() >0 || walk==0){
            walk=0;
            digitalWrite(LED0,HIGH);
          }
          else{
            digitalWrite(LED0,LOW);
          }
          digitalWrite(LED1,LOW);
          digitalWrite(LED2,LOW);
          digitalWrite(LED3,HIGH);
```

```
        delay(1000);
        break;

case 2: digitalWrite(LED0,LOW);
        digitalWrite(LED1,LOW);
        digitalWrite(LED2,LOW);
        digitalWrite(LED3,HIGH);
        delay(1000);
        break;
case 3: if(Serial.available() >0 || walk==0){
          digitalWrite(LED0,HIGH);
        }
        else{
          digitalWrite(LED0,LOW);
        }
        digitalWrite(LED1,LOW);
        digitalWrite(LED2,LOW);
        digitalWrite(LED3,HIGH);
        delay(1000);
        break;
case 4: digitalWrite(LED0,LOW);
        digitalWrite(LED1,LOW);
        digitalWrite(LED2,LOW);
        digitalWrite(LED3,HIGH);
        delay(1000);
        break;
case 5:if(Serial.available() >0 || walk==0){
          digitalWrite(LED0,HIGH);
```

```
        }
        else{
          digitalWrite(LED0,LOW);
        }
        digitalWrite(LED1,LOW);
        digitalWrite(LED2,LOW);
        digitalWrite(LED3,HIGH);
        delay(1000);
        break;
   case 6: digitalWrite(LED0,LOW);
        delay(1000);
        digitalWrite(LED1,LOW);
        digitalWrite(LED2,LOW);
        digitalWrite(LED3,HIGH);
        break;
   }
}


//Amber State
for(int x=1;x<7;x++){

   switch(x){

   case 1: if(Serial.available() >0 || walk==0){
          digitalWrite(LED0,HIGH);
        }
        else{
```

```
  digitalWrite(LED0,LOW);
 }
 digitalWrite(LED1,LOW);
 digitalWrite(LED2,HIGH);
 digitalWrite(LED3,LOW);
 delay(1000);
 break;

case 2: digitalWrite(LED0,LOW);
 digitalWrite(LED1,LOW);
 digitalWrite(LED2,HIGH);
 digitalWrite(LED3,LOW);
 delay(1000);
 break;
case 3: if(Serial.available() >0 || walk==0){
  digitalWrite(LED0,HIGH);
 }
 else{
  digitalWrite(LED0,LOW);
 }
 digitalWrite(LED1,LOW);
 digitalWrite(LED2,HIGH);
 digitalWrite(LED3,LOW);
 delay(1000);
 break;
case 4: digitalWrite(LED0,LOW);
 digitalWrite(LED1,LOW);
 digitalWrite(LED2,HIGH);
```

```
        digitalWrite(LED3,LOW);
        delay(1000);
        break;
    case 5:if(Serial.available() >0 || walk==0){
          digitalWrite(LED0,HIGH);
        }
        else{
          digitalWrite(LED0,LOW);
        }
        digitalWrite(LED1,LOW);
        digitalWrite(LED2,HIGH);
        digitalWrite(LED3,LOW);
        delay(1000);
        break;
    case 6: digitalWrite(LED0,LOW);
        delay(1000);
        digitalWrite(LED1,LOW);
        digitalWrite(LED2,HIGH);
        digitalWrite(LED3,LOW);
        break;
    }
}
}
```