

```
#include <SoftwareSerial.h>
```

```
SoftwareSerial BTSerial(11,12);
```

```
String b;
```

```
String current;
```

```
char wc;
```

```
char xc;
```

```
char yc;
```

```
char zc;
```

```
int w;
```

```
int x;
```

```
int y;
```

```
int z;
```

```
int wait;
```

```
int trigger; //start with 1 in case of power interrupt
```

```
int temptrigger = 1;
```

```
int gap = 600;
```

```
void setup()
```

```
{
```

```
  // put your setup code here, to run once:
```

```
  BTSerial.begin(9600);
```

```
  pinMode(2,OUTPUT); //extend actuator 1
```

```
  pinMode(3,OUTPUT); //extend actuator 2
```

```
  pinMode(4,OUTPUT); //extend actuator 3
```

```
  pinMode(5,OUTPUT); //extend actuator 4
```

```
  pinMode(6,OUTPUT); //depress actuator 1
```

```
pinMode(7,OUTPUT); //depress actuator 2
pinMode(8,OUTPUT); //depress actuator 3
pinMode(9,OUTPUT); //depress actuator 4
}
void restart()
{
digitalWrite(6, HIGH);
digitalWrite(7, HIGH);
digitalWrite(8, HIGH);
digitalWrite(9, HIGH);
delay(6000);
digitalWrite(6, LOW);
digitalWrite(7, LOW);
digitalWrite(8, LOW);
digitalWrite(9, LOW);
}

void loop()
{
Serial.setTimeout(2500);
// put your main code here, to run repeatedly:
if(BTSerial.available())
{
b = BTSerial.readString();
delay(1000);
wc = b[0];
xc = b[1];
yc = b[2];
zc = b[3];
```

```
w = wc - '0';
```

```
x = xc - '0';
```

```
y = yc - '0';
```

```
z = zc - '0';
```

```
/*
```

```
delay(300);
```

```
BTSerial.println(b);
```

```
delay(300);
```

```
BTSerial.println(w);
```

```
delay(300);
```

```
BTSerial.println(x);
```

```
delay(300);
```

```
BTSerial.println(y);
```

```
delay(1);
```

```
BTSerial.println(z); */ //verifying correct input
```

```
if(temptrigger == 1) //safety restart sequence in case of power interrupt
```

```
{
```

```
restart;
```

```
temptrigger = 0;
```

```
BTSerial.println("restart");
```

```
}
```

```
if(trigger == 1 && (w != 0) && (x != 0) && (y != 0) && (z != 0)) //general reset sequence
```

```
{
```

```
restart;
```

```
trigger = 0;
```

```

    BTSerial.println("restart");
}

if((w != 0) && (x != 0) && (y != 0) && (z != 0)) //prevents if loop entrance is all settings 0
{

if((w >= x) && (w >= y) && (w >= z)) //piston w is longest
{
if(x >= y && x >= z) //piston w->x
{
if(y >= z) //piston w->x->y->z, 2->3->4->5
{
digitalWrite(2, HIGH); //time delays between each actuator ending with goto to end
digitalWrite(3, HIGH);
digitalWrite(4, HIGH);
digitalWrite(5, HIGH);
wait = z*gap;
delay(wait);
digitalWrite(5, LOW);
wait = (y - z)*gap;
delay(wait);
digitalWrite(4, LOW);
wait = (x - y)*gap;
delay(wait);
digitalWrite(3, LOW);
wait = (w - x)*gap;
delay(wait);
digitalWrite(2, LOW);
BTSerial.println("wxyz");
}
}
}
}
}
}

```

```

goto ending;

}

else          //piston w->x->z->y 2->3->5->4
{
    digitalWrite(2, HIGH);
    digitalWrite(3, HIGH);
    digitalWrite(4, HIGH);
    digitalWrite(5, HIGH);
    wait = y*gap;
    delay(wait);
    digitalWrite(4, LOW);
    wait = (z - y)*gap;
    delay(wait);
    digitalWrite(5, LOW);
    wait = (x - z)*gap;
    delay(wait);
    digitalWrite(3, LOW);
    wait = (w - x)*gap;
    delay(wait);
    digitalWrite(2, LOW);
    BTSerial.println("wxzy");
    goto ending;

}

}

if(y >= x && y >= z) //piston w->y
{
    if(x >= z)        //piston w->y->x->z

```

```
{
  digitalWrite(2, HIGH);
  digitalWrite(3, HIGH);
  digitalWrite(4, HIGH);
  digitalWrite(5, HIGH);
  wait = z*gap;
  delay(wait);
  digitalWrite(5, LOW);
  wait = (x-z)*gap;
  delay(wait);
  digitalWrite(3, LOW);
  wait = (y-x)*gap;
  delay(wait);
  digitalWrite(4, LOW);
  wait = (w-y)*gap;
  delay(wait);
  digitalWrite(2, LOW);
  BTSerial.println("wyxz");
  goto ending;
}
else //piston w->y->z->x
{
  digitalWrite(2, HIGH);
  digitalWrite(3, HIGH);
  digitalWrite(4, HIGH);
  digitalWrite(5, HIGH);
  wait = x*gap;
  delay(wait);
```

```

digitalWrite(3, LOW);
wait = (z-x)*gap;
delay(wait);
digitalWrite(5, LOW);
wait = (y-z)*gap;
delay(wait);
digitalWrite(4, LOW);
wait = (w-y)*gap;
delay(wait);
digitalWrite(2, LOW);
BTSerial.println("wyzx");
goto ending;
}
}
if(z >= x && z >= y) //piston w->z
{
if(x >= y) //piston w->z->x->y
{
digitalWrite(2, HIGH);
digitalWrite(3, HIGH);
digitalWrite(4, HIGH);
digitalWrite(5, HIGH);
wait = y*gap;
delay(wait);
digitalWrite(4, LOW);
wait = (x-y)*gap;
delay(wait);
digitalWrite(3, LOW);
wait = (z-x)*gap;

```

```
delay(wait);
digitalWrite(5, LOW);
wait = (w-z)*gap;
delay(wait);
digitalWrite(2,LOW);
BTSerial.println("wzxy");
goto ending;
}
else //piston w->z->y->x
{
digitalWrite(2, HIGH);
digitalWrite(3, HIGH);
digitalWrite(4, HIGH);
digitalWrite(5, HIGH);
wait = x*gap;
delay(wait);
digitalWrite(3, LOW);
wait = (y-x)*gap;
delay(wait);
digitalWrite(4, LOW);
wait = (z-y)*gap;
delay(wait);
digitalWrite(5, LOW);
wait = (w-z)*gap;
delay(wait);
digitalWrite(2, LOW);
BTSerial.println("wzyx");
goto ending;
```



```

    }
  }
}
if((x >= w) && (x >= y) && (x >= z)) //piston x is longest
{
  if(w >= y && w >= z) //piston x->w
  {
    if(y >= z) //piston x->w->y->z
    {
      digitalWrite(2, HIGH);
      digitalWrite(3, HIGH);
      digitalWrite(4, HIGH);
      digitalWrite(5, HIGH);
      wait = z*gap;
      delay(wait);
      digitalWrite(5, LOW);
      wait = (y-z)*gap;
      delay(wait);
      digitalWrite(4, LOW);
      wait = (w-y)*gap;
      delay(wait);
      digitalWrite(2, LOW);
      wait = (x-w)*gap;
      delay(wait);
      digitalWrite(3, LOW);
      BTSerial.println("xyz");
      goto ending;
    }
  }
  else //piston x->w->z->y

```

```

{
    digitalWrite(2, HIGH);
    digitalWrite(3, HIGH);
    digitalWrite(4, HIGH);
    digitalWrite(5, HIGH);
    wait = y*gap;
    delay(wait);
    digitalWrite(4, LOW);
    wait = (z-y)*gap;
    delay(wait);
    digitalWrite(5, LOW);
    wait = (w-z)*gap;
    delay(wait);
    digitalWrite(2, LOW);
    wait = (x-w)*gap;
    delay(wait);
    digitalWrite(3, LOW);
    BTSerial.println("xwzy");
    goto ending;
}
}
if(y >= w && y >= z) //piston x->y
{
    if(w >= z) //piston x->y->w->z
    {
        digitalWrite(2, HIGH);
        digitalWrite(3, HIGH);
        digitalWrite(4, HIGH);
        digitalWrite(5, HIGH);
    }
}

```

```
wait = z*gap;
delay(wait);
digitalWrite(5, LOW);
wait = (w-z)*gap;
delay(wait);
digitalWrite(2, LOW);
wait = (y-w)*gap;
delay(wait);
digitalWrite(4, LOW);
wait = (x-y)*gap;
delay(wait);
digitalWrite(3, LOW);
BTSerial.println("xyz");
goto ending;
}
else // piston x->y->z->w
{
digitalWrite(2, HIGH);
digitalWrite(3, HIGH);
digitalWrite(4, HIGH);
digitalWrite(5, HIGH);
wait = w*gap;
delay(wait);
digitalWrite(2, LOW);
wait = (z-w)*gap;
delay(wait);
digitalWrite(5, LOW);
wait = (y-z)*gap;
delay(wait);
```

```
digitalWrite(4, LOW);
wait = (x-y)*gap;
delay(wait);
digitalWrite(3, LOW);
BTSerial.println("xyzw");
goto ending;
}
}
if(z >= w && z >= y) //piston x->z
{
if(w >= y) //piston x->z->w->y
{
digitalWrite(2, HIGH);
digitalWrite(3, HIGH);
digitalWrite(4, HIGH);
digitalWrite(5, HIGH);
wait = y*gap;
delay(wait);
digitalWrite(4, LOW);
wait = (w-y)*gap;
delay(wait);
digitalWrite(2, LOW);
wait = (z-w)*gap;
delay(wait);
digitalWrite(5, LOW);
wait = (x-z)*gap;
delay(wait);
digitalWrite(3, LOW);
BTSerial.println("xzwy");
```

```

    goto ending;
}
else          //piston x->z->y->w
{
    digitalWrite(2, HIGH);
    digitalWrite(3, HIGH);
    digitalWrite(4, HIGH);
    digitalWrite(5, HIGH);
    wait = w*gap;
    delay(wait);
    digitalWrite(2, LOW);
    wait = (y-w)*gap;
    delay(wait);
    digitalWrite(4, LOW);
    wait = (z-y)*gap;
    delay(wait);
    digitalWrite(5, LOW);
    wait = (x-z)*gap;
    delay(wait);
    digitalWrite(3, LOW);
    BTSerial.println("xzyw");
    goto ending;
}
}
}
if((y >= w) && (y >= x) && (y >= z)) //piston y is longest
{
    if(w >= x && w >= z) //piston y->w
    {

```

```
if(x >= z)          //piston y->w->x->z
{
  digitalWrite(2, HIGH);
  digitalWrite(3, HIGH);
  digitalWrite(4, HIGH);
  digitalWrite(5, HIGH);
  wait = z*gap;
  delay(wait);
  digitalWrite(5, LOW);
  wait = (x-z)*gap;
  delay(wait);
  digitalWrite(3, LOW);
  wait = (w-x)*gap;
  delay(wait);
  digitalWrite(2, LOW);
  wait = (y-w)*gap;
  delay(wait);
  digitalWrite(4, LOW);
  BTSerial.println("ywxz");
  goto ending;
}
else                //piston y->w->z->x
{
  digitalWrite(2, HIGH);
  digitalWrite(3, HIGH);
  digitalWrite(4, HIGH);
  digitalWrite(5, HIGH);
  wait = x*gap;
  delay(wait);
```

```

digitalWrite(3, LOW);
wait = (z-x)*gap;
delay(wait);
digitalWrite(5, LOW);
wait = (w-z)*gap;
delay(wait);
digitalWrite(2, LOW);
wait = (y-w)*gap;
delay(wait);
digitalWrite(4, LOW);
BTSerial.println("ywzx");
goto ending;
}
}
if(x >= w && x >= z) //piston y->x
{
if(w >= z) //piston y->x->w->z
{
digitalWrite(2, HIGH);
digitalWrite(3, HIGH);
digitalWrite(4, HIGH);
digitalWrite(5, HIGH);
wait = z*gap;
delay(wait);
digitalWrite(5, LOW);
wait = (w-z)*gap;
delay(wait);
digitalWrite(2, LOW);
wait = (x-w)*gap;

```

```
delay(wait);
digitalWrite(3, LOW);
wait = (y-x)*gap;
delay(wait);
digitalWrite(4, LOW);
BTSerial.println("yxwz");
goto ending;
}
else //piston y->x->z->w
{
digitalWrite(2, HIGH);
digitalWrite(3, HIGH);
digitalWrite(4, HIGH);
digitalWrite(5, HIGH);
wait = w*gap;
delay(wait);
digitalWrite(2, LOW);
wait = (z-w)*gap;
delay(wait);
digitalWrite(5, LOW);
wait = (x-z)*gap;
delay(wait);
digitalWrite(3, LOW);
wait = (y-x)*gap;
delay(wait);
digitalWrite(4, LOW);
BTSerial.println("yxzw");
goto ending;
}
```



```

}
if(z >= w && z >= x) //piston y->z
{
  if(w >= x) //piston y->z->w->x
  {
    digitalWrite(2, HIGH);
    digitalWrite(3, HIGH);
    digitalWrite(4, HIGH);
    digitalWrite(5, HIGH);
    wait = x*gap;
    delay(wait);
    digitalWrite(3, LOW);
    wait = (w-x)*gap;
    delay(wait);
    digitalWrite(2, LOW);
    wait = (z-w)*gap;
    delay(wait);
    digitalWrite(5, LOW);
    wait = (y-z)*gap;
    delay(wait);
    digitalWrite(4, LOW);
    BTSerial.println("yzwx");
    goto ending;
  }
  else //piston y->z->x->w
  {
    digitalWrite(2, HIGH);
    digitalWrite(3, HIGH);
    digitalWrite(4, HIGH);

```

```

digitalWrite(5, HIGH);
wait = w*gap;
delay(wait);
digitalWrite(2, LOW);
wait = (x-w)*gap;
delay(wait);
digitalWrite(3, LOW);
wait = (z-x)*gap;
delay(wait);
digitalWrite(5, LOW);
wait = (y-z)*gap;
delay(wait);
digitalWrite(4, LOW);
BTSerial.println("yzxw");
goto ending;
}
}
}
if((z >= w) && (z >= x) && (z >= y)) //piston z is longest
{
  if(w >= x && w >= y) //piston z->w
  {
    if(y >= x) //piston z->w->y->x
    {
      digitalWrite(2, HIGH);
      digitalWrite(3, HIGH);
      digitalWrite(4, HIGH);
      digitalWrite(5, HIGH);
      wait = x*gap;

```

```
delay(wait);
digitalWrite(3, LOW);
wait = (y-x)*gap;
delay(wait);
digitalWrite(4, LOW);
wait = (w-y)*gap;
delay(wait);
digitalWrite(2, LOW);
wait = (z-w)*gap;
delay(wait);
digitalWrite(5, LOW);
BTSerial.println("zwyx");
goto ending;
}
else //piston z->w->x->y
{
digitalWrite(2, HIGH);
digitalWrite(3, HIGH);
digitalWrite(4, HIGH);
digitalWrite(5, HIGH);
wait = y*gap;
delay(wait);
digitalWrite(4, LOW);
wait = (x-y)*gap;
delay(wait);
digitalWrite(3, LOW);
wait = (w-x)*gap;
delay(wait);
digitalWrite(2, LOW);
```

```

wait = (z-w)*gap;
delay(wait);
digitalWrite(5, LOW);
BTSerial.println("zwxy");
goto ending;
}
}
if(x >= w && x >= y) //piston z->x
{
if(w >= y) //piston z->x->w->y
{
digitalWrite(2, HIGH);
digitalWrite(3, HIGH);
digitalWrite(4, HIGH);
digitalWrite(5, HIGH);
wait = y*gap;
delay(wait);
digitalWrite(4, LOW);
wait = (w-y)*gap;
delay(wait);
digitalWrite(2, LOW);
wait = (x-w)*gap;
delay(wait);
digitalWrite(2, LOW);
wait = (z-x)*gap;
delay(wait);
digitalWrite(5, LOW);
BTSerial.println("zxwy");
goto ending;
}
}
}

```

```

}
else //piston z->x->y->w
{
  digitalWrite(2, HIGH);
  digitalWrite(3, HIGH);
  digitalWrite(4, HIGH);
  digitalWrite(5, HIGH);
  wait = w*gap;
  delay(wait);
  digitalWrite(2, LOW);
  wait = (y-w)*gap;
  delay(wait);
  digitalWrite(4, LOW);
  wait = (x-y)*gap;
  delay(wait);
  digitalWrite(3, LOW);
  wait = (z-x)*gap;
  delay(wait);
  digitalWrite(5, LOW);
  BTSerial.println("zxyw");
  goto ending;
}
}
if(y >= w && y >= x) //piston z->y
{
  if(w >= x) //piston z->y->w->x
  {
    digitalWrite(2, HIGH);
    digitalWrite(3, HIGH);

```

```
digitalWrite(4, HIGH);
digitalWrite(5, HIGH);
wait = x*gap;
delay(wait);
digitalWrite(3, LOW);
wait = (w-x)*gap;
delay(wait);
digitalWrite(2, LOW);
wait = (y-w)*gap;
delay(wait);
digitalWrite(4, LOW);
wait = (z-y)*gap;
delay(wait);
digitalWrite(5, LOW);
BTSerial.println("zywx");
goto ending;
}
else //piston z->y->x->w
{
digitalWrite(2, HIGH);
digitalWrite(3, HIGH);
digitalWrite(4, HIGH);
digitalWrite(5, HIGH);
wait = w*gap;
delay(wait);
digitalWrite(2, LOW);
wait = (x-w)*gap;
delay(wait);
digitalWrite(3, LOW);
```

```
wait = (y-x)*gap;
delay(wait);
digitalWrite(4, LOW);
wait = (z-y)*gap;
delay(wait);
digitalWrite(5, LOW);
BTSerial.println("zyxw");
goto ending;
}
}
}
ending:
current = b;
//BTSerial.println(current);
b = "0000";
wc = xc = yc = zc = '0';
w = x = y = z = 0;
trigger = 1;
delay(300);
BTSerial.println("done");
delay(300);
}
}
}
```