

Решение задачи 7-8 класс.

```
folder "prjs" "IORSol"
```

```
include "IORSolLIB"
```

```
Sensor.SetMode(4,0)
```

```
dir = 0
```

```
line_perekrestok(50,6,2,0,2)
```

```
turn(50,-90)
```

```
line_perekrestok(50,0,2,0,2)
```

```
line_encoder(20,4.2,0,0)
```

```
r1 = Row.Init(2,0)
```

```
a1 = Row.Init(3,0)
```

```
r2 = Row.Init(2,0)
```

```
a2 = Row.Init(3,0)
```

```
r3 = Row.Init(2,0)
```

```
a3 = Row.Init(3,0)
```

```
r4 = Row.Init(2,0)
```

```
a4 = Row.Init(3,0)
```

```
'@kp = @kp/1.5
```

```
'@kd = @kd/1.5
```

```
Speaker.Tone(95,1500,500)
```

```
Speaker.Tone(95,80,500)
```

```
Program.Delay(1000)
```

```
For i = 0 To 2
```

```
  If Sensor.ReadPercent(4) < 50 Then' если датчик видит черный то пишем 1
```

```
    Row.Write(a4, i, 1)
```

```
    Speaker.Tone(95,1500,50)
Else
    Speaker.Tone(95,800,50)
EndIf
'LCD.Clear()
'LCD.Text(1,10,10,2,i + "," + Row.Read(a4,i))
'LCD.Update()
'Program.Delay(2000)
line_encoder(20,2.5,0,0)

Program.Delay(500)
EndFor

For i = 0 To 1
    If Sensor.ReadPercent(4) < 50 Then' если датчик видит черный то пишем 1
        Row.Write(r4, i, 1)
        Speaker.Tone(95,1500,50)
    Else
        Speaker.Tone(95,800,50)
    EndIf
    'LCD.Clear()
    'LCD.Text(1,10,10,2,i + "," + Row.Read(r4,i))
    'LCD.Update()
    'Program.Delay(2000)
    line_encoder(20,2.5,0,0)

    Program.Delay(500)
EndFor
```

```
For i = 0 To 2
```

```
  If Sensor.ReadPercent(4) < 50 Then' если датчик видит черный то пишем 1
```

```
    Row.Write(a3, i, 1)
```

```
    Speaker.Tone(95,1500,50)
```

```
  Else
```

```
    Speaker.Tone(95,800,50)
```

```
  EndIf
```

```
'LCD.Clear()
```

```
'LCD.Text(1,10,10,2,i + "," + Row.Read(a3,i))
```

```
'LCD.Update()
```

```
'Program.Delay(2000)
```

```
line_encoder(20,2.5,0,0)
```

```
Program.Delay(500)
```

```
EndFor
```

```
For i = 0 To 1
```

```
  If Sensor.ReadPercent(4) < 50 Then' если датчик видит черный то пишем 1
```

```
    Row.Write(r3, i, 1)
```

```
    Speaker.Tone(95,1500,50)
```

```
  Else
```

```
    Speaker.Tone(95,800,50)
```

```
  EndIf
```

```
'LCD.Clear()
```

```
'LCD.Text(1,10,10,2,i + "," + Row.Read(r3,i))
```

```
'LCD.Update()
```

```
'Program.Delay(2000)
```

```
line_encoder(20,2.5,0,0)
```

```
Program.Delay(500)
```

EndFor

rad4 = 0

alpha4 = 0

rad3 = 0

alpha3 = 0

For i = 0 To Row.Size(a4)-1

alpha4 += Row.Read(a4,i)*Math.Power(2,i)

EndFor

For i = 0 To Row.Size(r4)-1

rad4 += Row.Read(r4,i)*Math.Power(2,i)

EndFor

For i = 0 To Row.Size(a3)-1

alpha3 += Row.Read(a3,i)*Math.Power(2,i)

EndFor

For i = 0 To Row.Size(r3)-1

rad3 += Row.Read(r3,i)*Math.Power(2,i)

EndFor

'LCD.Clear()

'For i = 0 To 2 ' вывод значений на экран

'LCD.Text(1,0,10 + 10 * i,1,Row.Read(a4, i))

'LCD.Text(1,40,10 + 10 * i,1,Row.Read(a3, i))

'EndFor

'For i = 0 To 1 ' вывод значений на экран

'LCD.Text(1,0,40 + 10 * i,1,Row.Read(r4, i))

'LCD.Text(1,40,40 + 10 * i,1,Row.Read(r3, i))

'EndFor

```
'LCD.Update()
'Buttons.Wait()
'Program.Delay(100)
LCD.Clear()
LCD.Text(1,00,50,1,"(R_3, Alpha_3): " + "("+rad3+", "+alpha3+")")
LCD.Text(1,00,70,1,"(R_4, Alpha_4): " + "("+rad4+", "+alpha4+")")
LCD.Update()
Buttons.Wait()
Buttons.Flush()
sync_move(50,50,8,2,0)
line_perekrestok(30,0,2,0,2)
line_encoder(20,4.2,0,0)

Speaker.Tone(95,1500,500)
Speaker.Tone(95,80,500)
Program.Delay(1000)
For i = 0 To 1
    If Sensor.ReadPercent(4) < 50 Then' если датчик видит черный то пишем 1
        Row.Write(r1, i, 1)
        Speaker.Tone(95,1500,50)
    Else
        Speaker.Tone(95,800,50)
    EndIf
'LCD.Clear()
'LCD.Text(1,10,10,2,i + ", " + Row.Read(r1,i))
'LCD.Update()
'Program.Delay(2000)
line_encoder(20,2.5,0,0)
```

```
Program.Delay(500)
EndFor

For i = 0 To 2
    If Sensor.ReadPercent(4) < 50 Then' если датчик видит черный то пишем 1
        Row.Write(a1, i, 1)
        Speaker.Tone(95,1500,50)
    Else
        Speaker.Tone(95,800,50)
    EndIf
    'LCD.Clear()
    'LCD.Text(1,10,10,2,i + "," + Row.Read(a1,i))
    'LCD.Update()
    'Program.Delay(2000)
    line_encoder(20,2.5,0,0)

    Program.Delay(500)
EndFor

For i = 0 To 1
    If Sensor.ReadPercent(4) < 50 Then' если датчик видит черный то пишем 1
        Row.Write(r2, i, 1)
        Speaker.Tone(95,1500,50)
    Else
        Speaker.Tone(95,800,50)
    EndIf
    'LCD.Clear()
```

```
'LCD.Text(1,10,10,2,i + "," + Row.Read(r2,i))
'LCD.Update()
'Program.Delay(2000)
line_encoder(20,2.5,0,0)
Program.Delay(500)
EndFor
For i = 0 To 2
  If Sensor.ReadPercent(4) < 50 Then' если датчик видит черный то пишем 1
    Row.Write(a2, i, 1)
    Speaker.Tone(95,1500,50)
  Else
    Speaker.Tone(95,800,50)
  EndIf
  'LCD.Clear()
  'LCD.Text(1,10,10,2,i + "," + Row.Read(a2,i))
  'LCD.Update()
  'Program.Delay(2000)
  line_encoder(20,2.5,0,0)
  Program.Delay(500)
EndFor

rad1 = 0
alpha1 = 0
rad2 = 0
alpha2 = 0
For i = 0 To Row.Size(a1)-1
  alpha1 += Row.Read(a1,i)*Math.Power(2,Row.Size(a1)-(i+1))
EndFor
```

```
For i = 0 To Row.Size(r1)-1
```

```
    rad1 += Row.Read(r1,i)*Math.Power(2,Row.Size(r1)-(i+1))
```

```
EndFor
```

```
For i = 0 To Row.Size(a2)-1
```

```
    alpha2 += Row.Read(a2,i)*Math.Power(2,Row.Size(a2)-(i+1))
```

```
EndFor
```

```
For i = 0 To Row.Size(r2)-1
```

```
    rad2 += Row.Read(r2,i)*Math.Power(2,Row.Size(r2)-(i+1))
```

```
EndFor
```

```
LCD.Text(1,00,10,1,"(R_1, Alpha_1): " + "("+rad1+", "+alpha1+")")
```

```
LCD.Text(1,00,30,1,"(R_2, Alpha_2): " + "("+rad2+", "+alpha2+")")
```

```
LCD.Update()
```

```
Buttons.Wait()
```

```
sync_move(50,50,4,2,0)
```

```
'Buttons.Wait()
```

```
line_perekrestok(50,6,2,0,2)
```

```
turn(50,90)
```

```
line_encoder(50,63,5,0)
```

```
TurnDegrees(-90, 50)
```

```
sync_move(20,20,5,0,0)
```

```
Program.Delay(500)
```

```
claw(150)
```

```
sync_move(-50,-50,5,0,0)
```

```
turn(50,90)
```

```
line_perekrestok(50,6,5,0,2)
```

```
cur_R = 3
```

```
cur_A = 7
```

```
dir = 0
```

```
'delivery
```

```
goRA(rad1, alpha1)
```

```
If cur_R < 3 Then
```

```
    sync_move(-20,-20,12,2,2)
```

```
    Speaker.Tone(95,1500,150)
```

```
    claw(0)
```

```
    sync_move(-20,-20,3,2,2)
```

```
    cur_R+=1
```

```
Else
```

```
    dA = cur_A - 1
```

```
    If dA = 0 Then
```

```
        turn_compass(0,1)
```

```
        sync_move(-20,-20,12,2,2)
```

```
        Speaker.Tone(95,1500,150)
```

```
        claw(0)
```

```
        sync_move(-20,-20,3,2,2)
```

```
    ElseIf dA <= 4 And dA > 0 Then
```

```
        turn_compass(1,1)
```

```
        sync_move(-20,-32,12,2,2)
```

```
        Speaker.Tone(95,1500,150)
```

```
        claw(0)
```

```
        sync_move(-20,-32,3,2,2)
```

```
    turn_compass(3,1)
    For i = 1 To Math.Abs(dA)
        line_perekrestok(50,6,2,0,2)
    EndFor
Else
    turn_compass(3,1)
    sync_move(-32,-20,12,2,2)
    Speaker.Tone(95,1500,150)
    claw(0)
    sync_move(-32,-20,3,2,2)
    turn_compass(1,1)
    For i = 1 To Math.Remainder(8-dA,8)
        line_perekrestok(50,6,2,0,2)
    EndFor
EndIf

turn_compass(2,1)

EndIf

goRA(3, 5)
turn_compass(2,1)
line_encoder(50,10,0,5)
claw(150)
sync_move(-50,-50,10,2,2)

goRA(rad3, alpha3)
If cur_R < 3 Then
    sync_move(-20,-20,12,2,2)
    Speaker.Tone(95,1500,150)
```

```
claw(0)
```

```
sync_move(-20,-20,3,2,2)
```

```
cur_R+=1
```

```
Else
```

```
  dA = cur_A - 1
```

```
  If dA = 0 Then
```

```
    turn_compass(0,1)
```

```
    sync_move(-20,-20,12,2,2)
```

```
    Speaker.Tone(95,1500,150)
```

```
    claw(0)
```

```
    sync_move(-20,-20,3,2,2)
```

```
  ElseIf dA <= 4 And dA > 0 Then
```

```
    turn_compass(1,1)
```

```
    sync_move(-20,-32,12,2,2)
```

```
    Speaker.Tone(95,1500,150)
```

```
    claw(0)
```

```
    sync_move(-20,-32,3,2,2)
```

```
    turn_compass(3,1)
```

```
    For i = 1 To Math.Abs(dA)
```

```
      line_perekrestok(50,6,2,0,2)
```

```
    EndFor
```

```
Else
```

```
  turn_compass(3,1)
```

```
  sync_move(-32,-20,12,2,2)
```

```
  Speaker.Tone(95,1500,150)
```

```
  claw(0)
```

```
  sync_move(-32,-20,3,2,2)
```

```
  turn_compass(1,1)
```

```
For i = 1 To Math.Remainder(8-dA,8)
    line_perekrestok(50,6,2,0,2)
EndFor
EndIf
turn_compass(2,1)

EndIf
```

```
goRA(3, 3)
turn_compass(2,1)
line_encoder(50,10,0,5)
claw(150)
sync_move(-50,-50,10,2,2)
```

```
claw(150)
```

```
goRA(rad2, alpha2)
If cur_R < 3 Then
    sync_move(-20,-20,12,2,2)
    Speaker.Tone(95,1500,150)
    claw(0)
    sync_move(-20,-20,3,2,2)
    cur_R+=1
```

```
Else
    dA = cur_A - 1
    If dA = 0 Then
        turn_compass(0,1)
        sync_move(-20,-20,11,2,2)
```

```
    Speaker.Tone(95,1500,150)
    claw(0)
    sync_move(-20,-20,5,2,2)
ElseIf dA <= 4 And dA > 0 Then
    turn_compass(1,1)
    sync_move(-20,-30,12,2,2)
    Speaker.Tone(95,1500,150)
    claw(0)
    sync_move(-20,-30,3,2,2)
    turn_compass(3,1)
    For i = 1 To Math.Abs(dA)
        line_perekrestok(50,6,2,0,2)
    EndFor
Else
    turn_compass(3,1)
    sync_move(-30,-20,12,2,2)
    Speaker.Tone(95,1500,150)
    claw(0)
    sync_move(-30,-20,3,2,2)
    turn_compass(1,1)
    For i = 1 To Math.Remainder(8-dA,8)
        line_perekrestok(50,6,2,0,2)
    EndFor
EndIf
turn_compass(2,1)

EndIf
```

```
If cur_R<>3 And cur_A<>1 Then
```

```
    goRA(3, 1)
```

```
EndIf
```

```
turn_compass(2,1)
```

```
Sensor.SetMode(4,4)
```

```
r = 0
```

```
g = 0
```

```
b = 0
```

```
error[5] = 0
```

```
error_i = 0
```

```
sum = 0
```

```
d2 = 0
```

```
d3 = 0
```

```
deltaB = 0
```

```
Sensor4.Raw3(r, g, b)
```

```
b_old = b
```

```
Time.Reset1()
```

```
While deltaB < 50
```

```
    Sensor4.Raw3(r, g, b)
```

```
    If Time.Get1() > 100 Then
```

```
        deltaB = math.Abs(b - b_old)
```

```
        Time.Reset1()
```

```
        b_old=b
```

```
    EndIf
```

```
readcalibrated(2, Ls)
```

```
readcalibrated(3, Rs)

e = Ls - Rs

If Math.Abs(e)<2 Then ' фильтр от защиты шумов датчиков (на белом
значение скачет +-1)

    e=0
EndIf

error[error_i] = e

error_i = Math.Remainder(error_i+1, 5) ' суммируем последние 5 ошибок
подряд

sum = sum + e - error[error_i] ' отняли ошибку которая была 5 шагов назад не
копим сумму

kp1=@Kp+@Kp*Math.Abs(e)/100
kd1=@Kd+@Kd*Math.Abs(e)/100
ki1=@Ki+@Ki*Math.Abs(e)/100

Up = e * kp1
Ud = (e-error[error_i])*kd1 ' вычитаем ошибку 5 шагов назад
Ui = sum*ki1
U = Up + Ud + Ui
mb = 50 + U
mc = 50 - U
MotorB.StartPower(mb)
MotorC.StartPower(mc)
Program.Delay(1)
EndWhile
Speaker.Tone(95,1500,150)
kp = kp * 5.5
Time.Reset1()
deltaG = 0
```

```
g_old = g
```

```
While deltaG < 50
```

```
    Sensor4.Raw3(r, g, b)
```

```
    If Time.Get1() > 100 Then
```

```
        deltaG = math.Abs(g - g_old)
```

```
        Time.Reset1()
```

```
        LCD.Clear()
```

```
        LCD.Text(1,0,30,2,"dA: "+deltaG)
```

```
        LCD.Update()
```

```
        g_old=g
```

```
    EndIf
```

```
readcalibrated(2, Ls)
```

```
readcalibrated(3, Rs)
```

```
e = Ls - Rs
```

```
If Math.Abs(e)<2 Then ' фильтр от защиты шумов датчиков (на белом  
значение скачет +-1)
```

```
    e=0
```

```
EndIf
```

```
error[error_i] = e
```

```
error_i = Math.Remainder(error_i+1, 5) ' суммируем последние 5 ошибок  
подряд
```

```
sum = sum + e - error[error_i] ' отняли ошибку которая была 5 шагов назад не  
копим сумму
```

```
kp1=@Kp+@Kp*Math.Abs(e)/100
```

```
kd1=@Kd+@Kd*Math.Abs(e)/100
```

```
ki1=@Ki+@Ki*Math.Abs(e)/100
```

```
Up = e * kp1
```

```
Ud = (e-error[error_i])*kd1 ' вычитаем ошибку 5 шагов назад
Ui = sum*ki1
U = Up + Ud + Ui
mb = 50 + U
mc = 50 - U
MotorB.StartPower(mb)
MotorC.StartPower(mc)
Program.Delay(1)
EndWhile
MotorBC.OffAndBrake()
'TurnDegrees(90, 50)
Speaker.Tone(95,1500,150)
TurnDegrees(-90, 50)
sync_move(20,20,5,0,0)
Program.Delay(500)
claw(150)
sync_move(-50,-50,5,0,0)
TurnDegrees(90, 50)
deltaB = 0
Sensor4.Raw3(r, g, b)
b_old = b
Time.Reset1()
While deltaB < 50
    Sensor4.Raw3(r, g, b)
    If Time.Get1() > 100 Then
        deltaB = math.Abs(b - b_old)
        Time.Reset1()
    LCD.Clear()
```

```
LCD.Text(1,0,30,2,"dA: "+deltaB)
```

```
LCD.Update()
```

```
b_old=b
```

```
EndIf
```

```
readcalibrated(2, Ls)
```

```
readcalibrated(3, Rs)
```

```
e = Ls - Rs
```

```
If Math.Abs(e)<2 Then ' фильтр от защиты шумов датчиков (на белом  
значение скачет +-1)
```

```
    e=0
```

```
EndIf
```

```
error[error_i] = e
```

```
error_i = Math.Remainder(error_i+1, 5) ' суммируем последние 5 ошибок  
подряд
```

```
sum = sum + e - error[error_i] ' отняли ошибку которая была 5 шагов назад не  
копим сумму
```

```
kp1=@Kp+@Kp*Math.Abs(e)/100
```

```
kd1=@Kd+@Kd*Math.Abs(e)/100
```

```
ki1=@Ki+@Ki*Math.Abs(e)/100
```

```
Up = e * kp1
```

```
Ud = (e-error[error_i])*kd1 ' вычитаем ошибку 5 шагов назад
```

```
Ui = sum*ki1
```

```
U = Up + Ud + Ui
```

```
mb = 50 + U
```

```
mc = 50 - U
```

```
MotorB.StartPower(mb)
```

```
MotorC.StartPower(mc)
```

```
Program.Delay(1)
```

```
EndWhile
```

```
Speaker.Tone(95,1500,150)
```

```
kp = kp / 5.5
```

```
line_encoder(50,50,0,0)
```

```
line_perekrestok(50,0,2,0,2)
```

```
claw(0)
```

```
'Speaker.Tone(95,1500,150)
```

```
'goRA(1, 1)
```

```
'goRA(1, 5)
```

```
'goRA(2, 4)
```