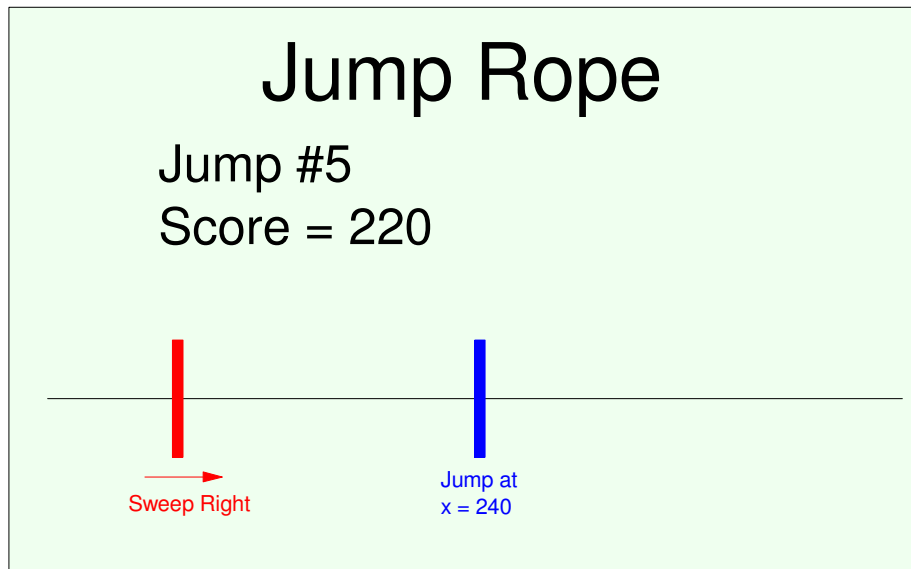


ECE 476/676 - Homework #6

Math Library, Random Library, Matrix Library, Edge Interrupts



Jump Rope

Write a python program to play the game of jump rope.

- At the start of each round, a random number is generated in the range of $T = 500$ to 1500 . This is how long it takes for the rope to travel from $x=0$ to $x=479$
- The jump rope (red line) then sweeps from $x=0$ to $x=479$ in T ms (500ms to 1500ms).
- The player is to press button GP15 before the jump rope crosses midband ($x = 240$)
- A new game is initiated by pressing GP14 (Jump goes to 0, Score goes to 0)

If you jump too late, the game starts over at jump #0

If you jump before the jump rope crosses $x = 240$, you score points

- Points = $100 - (\text{the number of milli-seconds you jumped too early})$

note: To measure time, please use the `ticks_ms` or `ticks_us` routines from the Timer library.

- Timer interrupts come next week

Grading:

- 10pt Generate a random number each round in the range of $T = 500$ to 1500
- 10pt Use edge interrupts to record the time you press GP15
- 10pt Use edge interrupts to start a new game when you press GP14
- 10pt Rope sweeps along the LCD display
- 10pt LCD displays jump number and score
- 10pt Demonstrate your code

Version 1: Get the rope to slide along the screen

Execution time: 6662 us



Code:

```
def New_Game():
    LCD.Clear(Black)
    LCD.Box(1,1,479,319,White)
    LCD.Title('Jump Rope v1', White, Black)

def Display():
    global Jump, Score, X, flag
    if(flag):
        LCD.Text3('Jump #' + str(Jump), 5, 50, White, Black)
        LCD.Text3('Score = ' + str(Score), 5, 100, White, Black)
    if(X != 251):
        LCD.Line(X-1, 200, X-1, 300, Black)
    if(X == 250):
        LCD.Line(X, 200, X, 300, Blue)
    elif(X < 450):
        LCD.Line(X, 200, X, 300, Red)

# Main Routine
New_Game()

Round = 0
while(1):
    for i in range(50, 451):
        T0 = ticks_us()
        if(i == 0):
            flag = 1
        else:
            flag = 0
        X = i
        Score = 1
        Jump = 2
        Display()
        T1 = ticks_us()
        if(i == 70):
            print('Loop time = ', T1-T0, 'us')
        sleep_us(10)
```

Version 2: Edge Interrupt

- Record the time the rope crosses $x = 250$
- Record the time you press the button using edge interrupts
- Display the time difference

Interrupt Service Routine

```
pin = Pin(15,Pin.IN,Pin.PULL_UP)
def IntServe(pin):
    global T1
    T1 = ticks_ms()

pin.irq(trigger=Pin.IRQ_FALLING, handler=IntServe)

# Main Routine
New_Game()
T1 = T2 = ticks_ms()

Round = 0
while(1):
    for i in range(50, 451):
        if(i == 0):
            flag = 1
        else:
            flag = 0
        X = i
        Score = 1
        Jump = 2
        Display()
        if(i == 450):
            print('dT = ', T2 - T1)
            T1 = ticks_ms()
        sleep_us(10)
```

Results from playing a couple of rounds (time in milliseconds. negative means late)

```
dT = 1398
dT = 95
dT = 182
dT = 170
dT = 146
dT = 98
dT = -213
```

Version 3: Speed up the game

Pre-store byte-arrays for

- Drawing a blank rectangle (100 x 2)
- Drawing a rectangle with a red line (100x2)
- Drawing a rectangle with a blue line (100x2)

Dive into the LCD routine to see how to write these arrays directly rather than through the LCD.Line() routine

Result:

- Execution time reduced from 6662us to 1283us
- Speeds up the sweep

```
Line_Black = bytearray(400)
Line_Red = bytearray(400)
for i in range(0,100):
    Line_Red[4*i + 2] = 249
    Line_Red[4*i + 3] = 134
Line_Blue = bytearray(400)
for i in range(0,100):
    Line_Blue[4*i + 0] = 49
    Line_Blue[4*i + 1] = 159

def Display_Line(x, c):
    LCD.Address_Set(x, 200, x+1, 300)
    LCD.StartWrite()
    LCD.dc.value(1)
    LCD.cs.value(0)
    if(c == 0):
        LCD.spi.write(Line_Black)
    elif(c == 1):
        LCD.spi.write(Line_Red)
    elif(c == 2):
        LCD.spi.write(Line_Blue)
    LCD.EndWrite()

def Display():
    global Jump, Score, X, flag, T2
    if(flag):
        LCD.Text3('Jump #' + str(Jump), 20, 50, White, Black)
        LCD.Text3('Score = ' + str(Score), 220, 50, White, Black)
        flag = 0
    if(X == 250):
        Display_Line(X, 2)
        T2 = ticks_ms()
    elif(X < 300):
        Display_Line(X, 1)
    else:
        Display_Line(X, 0)
```

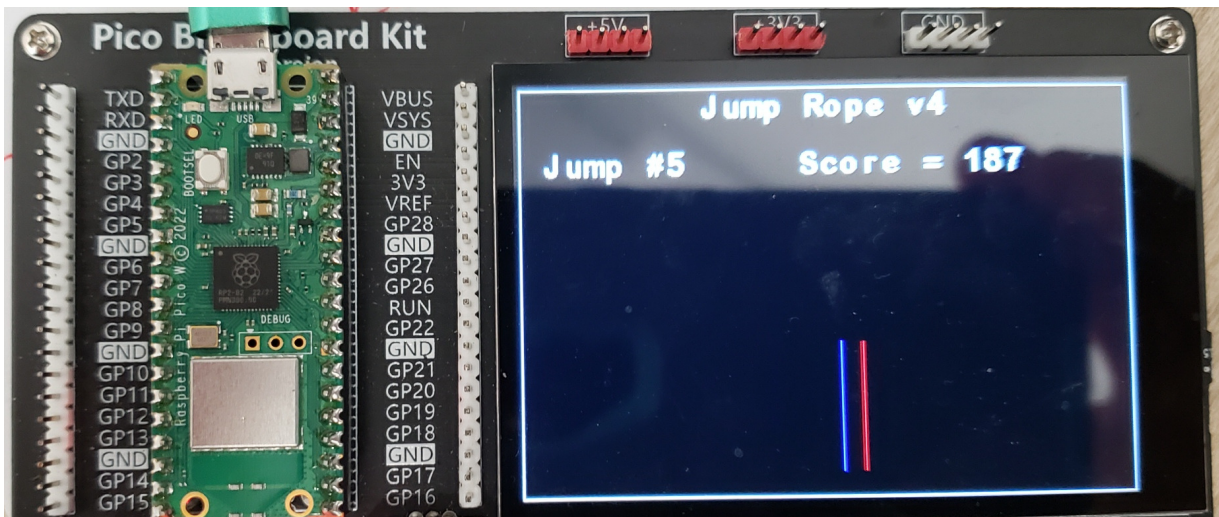
Version 4:

- Add in scoring
- Add in end of game (time is negative)
- Add random speed at the start

```
# Main Routine
```

```
while(1):
    New_Game()
    T1 = T2 = ticks_ms()
    T1 += 10_000
    Score = Jump = Game_Over = Points = 0
    flag = 1
    X = 50
    Display()
    sleep(1)
    Speed = randint(1,10000)

    while(Game_Over == 0):
        for i in range(50, 301):
            X = i
            Display()
            if(i == 300):
                dT = T2 - T1
                if(dT > 0):
                    Points = max(0, 100 - dT//2)
                    Score += Points
                    Jump += 1
                    flag = 1
                if(dT < 0):
                    Game_Over = 1
            print('dT = ', dT, ' Points = ', Points, ' Score = ', Score,
'Jump = ', Jump)
            T1 = ticks_ms() + 10_000
            sleep_us(Speed)
    LCD.Text3('Game Over', 180, 100, Yellow, Black)
    sleep(2)
```



Demo

Shows up better in the video

