def collage():
    # original picture file, this is the picture that is being transformed
    pic = makePicture(getMediaPath("butterfly.png"))
    width = getWidth(pic)
    height = getHeight(pic)

    # this is an empty canvas that all the following modifications are placed upon
    finalCanv = makeEmptyPicture(1000, 684, green)

    # the original picture's dimensions are outside the range of the canvas and the
    # maximum possible canvas for this project, so I first make an empty canvas that's
    # a quarter of the original size and scale the picture down
    # there are four copies of this picture to be transformed individually
    smallerPic1 = makeEmptyPicture(int(width/4), int(height/4))
    smallerPic2 = makeEmptyPicture(int(width/4), int(height/4))
    smallerPic3 = makeEmptyPicture(int(width/4), int(height/4))
    smallerPic4 = makeEmptyPicture(int(width/4), int(height/4))
    scaleDown(pic, smallerPic1, width, height, 4)
    scaleDown(pic, smallerPic2, width, height, 4)
    scaleDown(pic, smallerPic3, width, height, 4)
    scaleDown(pic, smallerPic4, width, height, 4)

    # here's another scaled picture, this one being half the size of the original
    medPic = makeEmptyPicture(int(width/2), int(height/2))
    scaleDown(pic, medPic, width, height, 2)

    # this medium picture is copied to the bottom left corner of the canvas
    copy(medPic, finalCanv, 0, 684-int(height/2))

    # here I flip medPic both horizontally and vertically and invert its colors
    # I place it opposite the first one in the top right corner
    flipH(medPic, int(width/2), int(height/2))
    flipV(medPic, int(width/2), int(height/2))
    swapColorPic(medPic)
    copy(medPic, finalCanv, 1000-int(width/2)-1, 0)

    # horizontally flipped and color-swapped small picture
    # copied to top left corner
    flipH(smallerPic1, int(width/4), int(height/4))
    swapColorPic(smallerPic1)
    copy(smallerPic1, finalCanv, 0, 0)

    # small picture mirrored horizontally and copied next to smallerPic1
    mirrorH(smallerPic2, int(width/4), int(height/4))
    copy(smallerPic2, finalCanv, getWidth(smallerPic1), 0)

    # mirrored small picture both horizontally and vertically and copied to lower
    # right side
    mirrorH(smallerPic3, int(width/4), int(height/4))
mirrorV(smallerPic3, int(width/4), int(height/4))
copy(smallerPic3, finalCanv, int(width/2), 684-getHeight(smallerPic3))

# chromakey background of smaller picture and replace it with a redder background
# copied to lower right corner
chromaKey(smallerPic4)
copy(smallerPic4, finalCanv, 1000-getWidth(smallerPic4), 684-getHeight(smallerPic4))

# add signature
sign = makePicture(getMediaPath("signature.png"))
smallerSign = makeEmptyPicture(getWidth(sign)/2, getHeight(sign)/2)
scaleDown(sign, smallerSign, 250, 250, 2)
signature(smallerSign, finalCanv, finalCanv)

# touch up to fix border/copy issues
vertBar(finalCanv, finalCanv, 0, 0, 228)
vertBar2(finalCanv, finalCanv, 499, 227, 684)
horBar(finalCanv, finalCanv, 227, 0, 500)
horBar2(finalCanv, finalCanv, 0, 500, 1000)
vertBar2(finalCanv, finalCanv, 999, 0, 684)
horBar2(finalCanv, finalCanv, 683, 0, 500)
horBar2(finalCanv, finalCanv, 683, 750, 1000)

show(finalCanv)

def scaleDown(pic, canv, width, height, factor):
    widthNew = int(width/factor)
    heightNew = int(height/factor)
    xIn = 0
    for x in range(0, widthNew-1):
        yIn = 0
        for y in range(0, heightNew-1):
            color = getColor(getPixel(pic, xIn, yIn))
            setColor(getPixel(canv, x, y), color)
            yIn = yIn + factor
        xIn = xIn + factor

def mirrorH(pic, width, height):
    mirrorPt = width/2
    for y in range(0, height):
        for x in range(0, mirrorPt):
            leftPixel = getPixel(pic, x, y)
            rightPixel = getPixel(pic, width-x-1, y)
            setColor(rightPixel, getColor(leftPixel))

def mirrorV(pic, width, height):
    mirrorPt = height/2
    for x in range(0, width):
        for y in range(0, mirrorPt):
            topPixel = getPixel(pic, x, y)
            bottomPixel = getPixel(pic, x, height-y-1)
            setColor(bottomPixel, getColor(topPixel))

def flipH(pic, width, height):
    for y in range(0, height):
        for x in range(0, width/2):
            leftPixel = getPixel(pic, x, y)
            rightPixel = getPixel(pic, width-x-1, y)
            rightPixel2 = getPixel(pic, width-x-1, y)
            setColor(rightPixel, getColor(leftPixel))
def flipV(pic, width, height):
    for x in range(0, width):
        for y in range(0, height//2):
            topPixel = getPixel(pic, x, y)
            bottomPixel = getPixel(pic, x, height-y-1)
            bottomPixel2 = getPixel(pic, x, height-y-1)
            setColor(bottomPixel, getColor(topPixel))
            setColor(topPixel, getColor(bottomPixel2))

def copy(pic, canv, startX, startY):
    for x in range(0, getWidth(pic)):
        for y in range(0, getHeight(pic)):
            px = getPixel(pic, x, y)
            canvPx = getPixel(canv, startX, startY)
            color = getColor(px)
            setColor(canvPx, color)
            startY += 1
            startY -= getHeight(pic)
            startX += 1

def chromaKey(source):
    for px in getPixels(source):
        x = getX(px)
        y = getY(px)
        if (getRed(px) > 0 and getGreen(px) > 0 and getBlue(px) < 100):
            bgPx = getPixel(source, x, y)
            setColor(px, incrRed(bgPx))

def incrRed(pixel):
    r = getRed(pixel)
    rNew = r+80
    gNew = getGreen(pixel)-210
    bNew = getBlue(pixel)+100
    setRed(pixel, rNew)
    setGreen(pixel, gNew)
    setBlue(pixel, bNew)
    return(getColor(pixel))

def swapColorPic(pic):
    for pixel in getPixels(pic):
        r = getRed(pixel)
        b = getBlue(pixel)
        g = getGreen(pixel)
        setRed(pixel, b)
        setBlue(pixel, g)
        setGreen(pixel, r)

def signature(sign, bg, canv):
    bgX = 375
    bgY = 200
    for x in range(0, getWidth(sign)):
        for y in range(0, getHeight(sign)):
            px = getPixel(sign, x, y)
            if (getRed(px) > 200 and getGreen(px) > 200 and getBlue(px) > 200):
                signPx = getPixel(sign, x, y)
                bgPx = getPixel(bg, bgX, bgY)
                bgColor = getColor(bgPx)
                setColor(signPx, bgColor)
bgY +=1
bgX +=1
bgY -=getHeight(sign)
copy(sign, canv, 375, 200)

def vertBar(pic, canv, startX, startY, stopY):
    x = startX
    for y in range(startY, stopY):
        px = getPixel(pic, x+1, y)
        canvPx = getPixel(canv, x, y)
        color = getColor(px)
        setColor(canvPx, color)

def vertBar2(pic, canv, startX, startY, stopY):
    x = startX
    for y in range(startY, stopY):
        px = getPixel(pic, x-1, y)
        canvPx = getPixel(canv, x, y)
        color = getColor(px)
        setColor(canvPx, color)

def horBar(pic, canv, startY, startX, stopX):
    y = startY
    for x in range(startX, stopX):
        px = getPixel(pic, x, y+1)
        canvPx = getPixel(canv, x, y)
        color = getColor(px)
        setColor(canvPx, color)

def horBar2(pic, canv, startY, startX, stopX):
    y = startY
    for x in range(startX, stopX):
        px = getPixel(pic, x, y-1)
        canvPx = getPixel(canv, x, y)
        color = getColor(px)
        setColor(canvPx, color)