

Curs 14

(plan de curs)

1 ½ oră Mulțimea lui Mandelbrot = valorile parametrului complex c pentru care șirul $z_0=0, z_{n+1}=z_n^2+c$ este mărginit, $|z_n| \leq 2$.

½ oră: Laborator:

```
import ComplexPygame as C
import Color

def MandelbrotExplorer():
    x0 = -0.5
    y0 = 0.0
    r0 = 2.0
    nrIter = 101

    def oDerulareCompleta():
        C.fillScreen()
        for coloana in C.screenColumns():
            for c in coloana:
                z = 0
                for k in range(nrIter):
                    z = z * z + c
                    if abs(z) > 2:
                        break
                C.setPixel(c, Color.Index(k))
            if unClick():
                return False
        return True

    def unClick():
        nonlocal x0, y0, r0, nrIter
        C.refreshScreen()
        rez = False
        for event in C.pygame.event.get():
            if event.type == C.pygame.QUIT:
                C.mustExit = True
                return True # parasim unClick()
```

```

    if event.type == C.pygame.KEYDOWN:
        if event.key == C.pygame.K_SPACE:
            C.mustPainting = False
            rez = True
        elif event.key == C.pygame.K_n:
            nrIter *= 2
            rez = True
        elif event.key == C.pygame.K_m:
            nrIter //= 2
            rez = True
        elif event.key == C.pygame.K_b:
            r0 *= 5
            rez = True
    if event.type == C.pygame.MOUSEBUTTONDOWN:
        ii, jj = event.pos
        x0, y0 = C.getXY(ii, C.dim - jj)
        r0 *= 0.1
        rez = True
    return rez

# bucla derularilor
while True:
    C.setXminXmaxYminYmax(x0 - r0, x0 + r0, y0 - r0, y0 + r0)
    C.pygame.display.set_caption("x0={0}, y0={1}, r0={2:.2e},"
                                " nrIter={3}".format(x0, y0, r0, nrIter))
    saDerulatPanaLaCapat = oDerulareCompleta()
    if C.mustExit or not C.mustPainting:
        break # parasim bucla derularilor
    if saDerulatPanaLaCapat:
        C.saveScreenPNG("mandelbrot")
        C.pygame.display.set_caption("Click! x0={0}, y0={1}, r0={2:.2e},"
                                    "nrIter={3}".format(x0, y0, r0, nrIter))
        while not unClick(): # asteptam un click
            pass
        if C.mustExit or not C.mustPainting:
            break # parasim bucla derularilor
    # reluam derularea
return

if __name__ == '__main__':
    C.initPygame()
    C.run(MandelbrotExplorer)

```

Click! $x_0=0.2725452667900002$, $y_0=0.005292454080000089$, $r_0=1.00e-10$, nrIter...

