```python
#!/usr/bin/env python3
# -*- coding: utf-8 -*-

#
# fichier: polynome_tests.py
# version: 0.5.0
#  auteur: Pascal CHAUVIN
#    date: 2014/10/28
#
# (tous les symboles non internationaux sont volontairement omis)
#

import sys
sys.path.append('../monome_mod')
sys.path.append('../rationnel_mod')

import polynome as po

import monome as mo
import rationnel as ra

def test_unitaire_0(visible =False):
  print("*** polynome: test_unitaire_0 ***")

  a = po.polynome()
  if visible: print(a)

  ok = (a.nombre_monomes() == 1)
  return ok



def test_unitaire_1(visible =False):
  print("*** polynome: test_unitaire_1 ***")

  a = po.polynome(mo.monome(ra.rationnel(12), "x"))
  if visible:
    print(a)
    print(repr(a))
    print(a.lire_monome())
    print(a.plat())

  ok = a.contient(mo.monome(ra.rationnel(1), "x"))
  return ok



def test_unitaire_2(visible =False):
  print("*** polynome: test_unitaire_2 ***")

  a = po.polynome(mo.monome(ra.rationnel(12), "x"))
  if visible: print(a.plat())

  a.inserer(mo.monome(ra.rationnel(1), "y"))
  if visible: print(a.plat())

  a.inserer(mo.monome(ra.rationnel(1), "a"))
  if visible: print(a.plat())

  if visible: print("---")

  b = po.polynome()
  for t in a.iterateur():
    b.inserer(t)

  if visible: print(b.plat())

  ok = (a.fin().lire_monome().lire_indet() == "y")
```

```
  return ok


def test_unitaire_3(visible =False):
  print("*** polynome: test_unitaire_3 ***")

  a = po.polynome()
  if visible: print(a.plat())

  a.inserer(mo.monome(ra.rationnel(12), "x"))
  if visible: print(a.plat())

  a.inserer(mo.monome(ra.rationnel(1), "y"))
  if visible: print(a.plat())

  a.inserer(mo.monome(ra.rationnel(1), "a"))
  if visible: print(a.plat())

  if visible: print("---")

  b = po.polynome()
  for t in a.iterateur():
    b.inserer(t)

  if visible: print(b.plat())

  ok = (a.nombre_monomes() == 3)
  return ok



def test_unitaire_4(visible =False):
  print("*** polynome: test_unitaire_4 ***")

  a = po.polynome()
  if visible: print(a.plat())

  a.inserer(mo.monome(ra.rationnel(12), "x"))
  if visible: print(a.plat())

  a.inserer(mo.monome(ra.rationnel(1), "y"))
  if visible: print(a.plat())

  a.inserer(mo.monome(ra.rationnel(1), "a"))
  if visible: print(a.plat())

  a = a.joindre(mo.monome(ra.rationnel(100), "t"))
  if visible: print(a.plat())

  ok = (a.debut().lire_monome().lire_coeff() == ra.rationnel(1)) and \
    (a.nombre_monomes() == 4)
  return ok



def test_unitaire_5(visible =False):
  print("*** polynome: test_unitaire_5 ***")

  a = po.polynome()
  if visible: print(a.plat())

  a = a.joindre(mo.monome(ra.rationnel(12), "x"))
  if visible: print(a.plat())

  a = a.joindre(mo.monome(ra.rationnel(1), "y"))
  if visible: print(a.plat())
```

```
  a = a.joindre(mo.monome(ra.rationnel(-12), "x"))
  if visible: print(a.plat())

  a = a.joindre(mo.monome(ra.rationnel(100), "t"))
  if visible: print(a.plat())

# ok = (a.debut().lire_monome().lire_coeff().est_un())
#   (a.nombre_monomes() == 2)
  ok = (a.nombre_monomes() == 2) and \
    (a.debut().lire_monome().lire_coeff().lire_num().lire_valeur() == 100)
  return ok



def test_unitaire_6(visible =False):
  print("*** polynome: test_unitaire_6 ***")

  a = po.polynome()
  if visible: print(a.plat())

  a = a.joindre(mo.monome(ra.rationnel(12), "x"))
  if visible: print(a.plat())

  a = a.joindre(mo.monome(ra.rationnel(1), "y"))
  if visible: print(a.plat())

  a = a.joindre(mo.monome(ra.rationnel(), "y"))
  if visible: print(a.plat())

  a = a.joindre(mo.monome(ra.rationnel(-1), "y"))
  if visible: print(a.plat())

  a = a.joindre(mo.monome(ra.rationnel(100), "t"))
  if visible: print(a.plat())

  ok = (a.nombre_monomes() == 2) and \
    (a.debut().lire_monome().lire_coeff().lire_num().lire_valeur() == 100)
  return ok



def test_unitaire_7(visible =False):
  print("*** polynome: test_unitaire_7 ***")

  a = po.polynome()
  if visible: print(a.plat())

  a = a.joindre(mo.monome(ra.rationnel(12), "x"))
  if visible: print(a.plat())

  a = a.joindre(mo.monome(ra.rationnel(1), "y"))
  if visible: print(a.plat())

  a = a.joindre(mo.monome(ra.rationnel(5), "x"))
  if visible: print(a.plat())

  a = a.joindre(mo.monome(ra.rationnel(100), "t"))
  if visible: print(a.plat())

  ok = a.contient(mo.monome(ra.rationnel(1), "x"))
  return ok



def test_unitaire_8(visible =False):
  print("*** polynome: test_unitaire_8 ***")

  a = po.polynome()
```

```
  if visible: print(a.plat())

  a = a.joindre(mo.monome(ra.rationnel(12), "x"))
  if visible: print(a.plat())

  a = a.joindre(mo.monome(ra.rationnel(1), "y"))
  if visible: print(a.plat())

  a = a.joindre(mo.monome(ra.rationnel(5), "x"))
  if visible: print(a.plat())

  a = a.joindre(mo.monome(ra.rationnel(100), "t"))
  if visible: print(a.plat())

  a = a.joindre(mo.monome(ra.rationnel(-12), "x"))
  if visible: print(a.plat())

  a = a.joindre(mo.monome(ra.rationnel(-1), "y"))
  if visible: print(a.plat())

  a = a.joindre(mo.monome(ra.rationnel(-5), "x"))
  if visible: print(a.plat())

  a = a.joindre(mo.monome(ra.rationnel(-100), "t"))
  if visible: print(a.plat())

  a = a.joindre(mo.monome(ra.rationnel(0), "t"))
  if visible: print(a.plat())

  a = a.joindre(mo.monome(ra.rationnel(3, -30), "xx"))
  if visible: print(a.plat())

  ok = (a.nombre_monomes() == 1) and \
    (a.debut().lire_monome().lire_coeff() == ra.rationnel(-1, 10))
  return ok



def test_unitaire_9(visible =False):
  print("*** polynome: test_unitaire_9 ***")

  p = po.polynome()
  if visible: print(p)

  p = p.joindre(mo.monome(ra.rationnel(2), "x"))
  if visible: print(p)

  p = p.joindre(mo.monome(ra.rationnel(-2,3), "x"))
  if visible: print(p)

  ok = (p.nombre_monomes() == 1) and \
    (p.lire_monome().lire_coeff() == ra.rationnel(4, 3)) and \
    (p.lire_monome().lire_indet() == "x")
  return ok



def test_unitaire_10(visible =False):
  print("*** polynome: test_unitaire_10 ***")

  p = po.polynome()
  p = p.joindre(mo.monome(ra.rationnel(2), "x"))
  p = p.joindre(mo.monome(ra.rationnel(1), "y"))
  p = p.joindre(mo.monome(ra.rationnel(2), "x"))
  p = p.joindre(mo.monome(ra.rationnel(-3), "y"))

  if visible: print(p)
```

```
  v1 = p.fin().lire_monome().lire_coeff().lire_num().lire_valeur()
  v2 = p.debut().lire_monome().lire_coeff().lire_num().lire_valeur()

  ok = (v1 == -2) and (v2 == 4)
  return ok



def test_unitaire_11(visible =False):
  print("*** polynome: test_unitaire_11 ***")

  p = po.polynome()
  p = p.joindre(mo.monome(ra.rationnel(2), "x"))
  p = p.joindre(mo.monome(ra.rationnel(1), "y"))

  if visible: print(p)

  q = po.polynome()
  q = q.joindre(mo.monome(ra.rationnel(-5), "a"))
  q = q.joindre(mo.monome(ra.rationnel(10), "y"))

  if visible: print(q)

  r = p + q

  if visible: print(r)

  ok = (r.valuation().lire_num().lire_valeur() == 11)
  return ok



def test_unitaire_12(visible =False):
  print("*** polynome: test_unitaire_12 ***")

  p = po.polynome()
  p = p.joindre(mo.monome(ra.rationnel(2), "x"))
  p = p.joindre(mo.monome(ra.rationnel(1), "y"))

  if visible:
    print(p)
    print(-p)

  q = po.polynome()
  q = q.joindre(mo.monome(ra.rationnel(-5), "a"))
  q = q.joindre(mo.monome(ra.rationnel(10), "y"))

  if visible: print(q)

  r = p - q

  if visible: print(r)

  ok = (r.valuation().lire_num().lire_valeur() == -9)
  return ok



def test_unitaire_13(visible =False):
  print("*** polynome: test_unitaire_13 ***")

  p = po.polynome(mo.monome(ra.rationnel(20, -30), "xax"))
  if visible: print(p)

  p = p.joindre(mo.monome(ra.rationnel(1), "x"))
  if visible: print(p)

  p = p.joindre(mo.monome(ra.rationnel(1), "a"))
```

```
  if visible: print(p)

  p = p.joindre(mo.monome(ra.rationnel(-1), "x"))
  if visible: print(p)

  ok = (p.degre() == 3) and (p.valuation() == ra.rationnel(1))
  return ok



def test_unitaire_14(visible =False):
  print("*** polynome: test_unitaire_14 ***")

  p = po.polynome_nul()
  if visible: print("Polynome nul:", p)

  ok1 = p.valuation().est_zero()

  p = po.polynome_un()
  if visible: print("Polynome unite:", p)
  ok2 = p.valuation().est_un()

  p = po.polynome_err()
  if visible: print("Polynome erreur:", p)
  ok3 = not p.est_valide()

  ok = ok1 and ok2 and ok3
  return ok



def test_unitaire_15(visible =False):
  print("*** polynome: test_unitaire_15 ***")

  p = po.polynome()
  p = p.joindre(mo.monome(ra.rationnel(2), "x"))
  p = p.joindre(mo.monome(ra.rationnel(1), "y"))

  if visible: print(p)

  q = po.polynome()
  q = q.joindre(mo.monome(ra.rationnel(-5), "a"))
  q = q.joindre(mo.monome(ra.rationnel(10), "y"))

  if visible: print(q)

  r = p * q

  if visible: print(r)

  ok = (r.valuation() == ra.rationnel(10))
  return ok



def test_unitaire_16(visible =False):
  print("*** polynome: test_unitaire_16 ***")

  p = po.polynome(mo.monome(ra.rationnel(-5, 2), "a"))
  if visible: print(p)

  p = p.joindre(mo.monome(ra.rationnel(15, 4)))
  if visible: print(p)

  p = p.joindre(mo.monome(ra.rationnel(5), "x"))
  if visible: print(p)

  if visible: print(p.valuation())
```

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  ok = (p.valuation() == ra.rationnel(15, 4))
  return ok



def test_unitaire_17(visible =False):
  print("*** polynome: test_unitaire_17 ***")

  p = po.polynome()
  p = p.joindre(mo.monome(ra.rationnel(2, 3), "a"))
  p = p.joindre(mo.monome(ra.rationnel(1), "b"))

  if visible: print(p)

  q = po.polynome()
  q = q.joindre(mo.monome(ra.rationnel(2, 3), "a"))
  q = q.joindre(mo.monome(ra.rationnel(1), "b"))

  if visible: print(q)

  r = p * q

  if visible: print(r)

  if visible: print(r.valuation())

  ok = (r.valuation() == ra.rationnel(1))
  return ok



def test_unitaire_18(visible =False):
  print("*** polynome: test_unitaire_18 ***")

  p = po.polynome()
  p = p.joindre(mo.monome(ra.rationnel(2), "x"))
  p = p.joindre(mo.monome(ra.rationnel(-1)))

  if visible: print(p)

  q = po.polynome()
  q = q.joindre(mo.monome(ra.rationnel(2), "x"))
  q = q.joindre(mo.monome(ra.rationnel(1)))

  if visible: print(q)

  r = p * q

  if visible: print(r)

  if visible: print(r.valuation())

  ok = (r.valuation() == ra.rationnel(-1))
  return ok



def test_unitaire_19(visible =False):
  print("*** polynome: test_unitaire_19 ***")

  p = po.polynome()

  p = p.joindre(mo.monome(ra.rationnel(5, 7)))

  if visible:
    print(p)
    print(p.degre())
```

```
    print(p.valuation())

  ok = (p.degre() == 0) and (p.valuation() == ra.rationnel(5, 7))
  return ok



def test_unitaire_20(visible =False):
  print("*** polynome: test_unitaire_20 ***")

  p = po.polynome()

  p = p.joindre(mo.monome(ra.rationnel(2, 3), "xxxx"))
  p = p.joindre(mo.monome(ra.rationnel(1), "xxxyyy"))
  p = p.joindre(mo.monome(ra.rationnel(5, 3)))
  p = p.joindre(mo.monome(ra.rationnel(-5, 2), "a"))

  if visible:
    print(p)
    print(p.degre())
    print(p.valuation())

  ok = (p.degre() == 6) and (p.valuation() == ra.rationnel(5, 3))
  return ok



def test_unitaire_21(visible =False):
  print("*** polynome: test_unitaire_21 ***")

  a = po.polynome(mo.monome(ra.rationnel(1), "x"))
  a = a.joindre(mo.monome(ra.rationnel(1), ""))
  if visible: print(a)

  b = po.polynome(mo.monome(ra.rationnel(1), "x"))
  b = b.joindre(mo.monome(ra.rationnel(3)))
  if visible: print(b)

  ok = (b.valuation() == ra.rationnel(3))
  return ok



def test_unitaire_22(visible =False):
  print("*** polynome: test_unitaire_22 ***")

  a = po.polynome(mo.monome(ra.rationnel(1), "x"))
  a = a.joindre(mo.monome(ra.rationnel(1)))
  if visible: print(a)

  b = po.polynome(mo.monome(ra.rationnel(1), "x"))
  b = b.joindre(mo.monome(ra.rationnel(3)))
  if visible: print(b)

  c = po.polynome(mo.monome(ra.rationnel(-1), "xx"))
  if visible: print(c)

  d = po.polynome(mo.monome(ra.rationnel(1)))
  if visible: print(d)

  r = (a*d)
  if visible: print(r)

  r = (b*c)
  if visible: print(r)

  r = (a*d + b*c)
  if visible: print(r)
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```
  r = (b * d)
  if visible: print(r)

  ok = (r.valuation() == ra.rationnel(3))
  return ok



def test_unitaire_23(visible =False):
  print("*** polynome: test_unitaire_23 ***")

  p = po.polynome()
  p = p.joindre(mo.monome(ra.rationnel(1), "x"))
  p = p.joindre(mo.monome(ra.rationnel(1)))

  if visible: print(p)

  q = po.polynome()
  q = q.joindre(mo.monome(ra.rationnel(1), "x"))
  q = q.joindre(mo.monome(ra.rationnel(3)))

  if visible: print(q)

  r = p * q

  if visible:
    print(r)
    print(repr(r))

  ok = (r.degre() == 2)
  return ok



def test_unitaire_24(visible =False):
  print("*** polynome: test_unitaire_24 ***")

  p = po.polynome()
  ok1 = p.est_polynome_nul()

  p = p.joindre(mo.monome(ra.rationnel(8, -2)))
  ok2 = p.est_degre_nul()

  ok = ok1 and ok2
  return ok



def test_unitaire_25(visible =False):
  print("*** polynome: test_unitaire_25 ***")

  a = po.polynome(mo.monome(ra.rationnel(1), "a"))
  a = a.joindre(mo.monome(ra.rationnel(1), "b"))
  if visible: print(a)

  b = po.polynome(mo.monome(ra.rationnel(7)))
  if visible: print(b)

  r = a ** b
  if visible: print(r)

  ok = (r.valuation() == ra.rationnel(1))
  return ok



def test_unitaire_26(visible =False):
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```
  print("*** polynome: test_unitaire_26 ***")

  a = po.polynome(mo.monome(ra.rationnel(1), "a"))
  a = a.joindre(mo.monome(ra.rationnel(1), "b"))
  if visible: print(a)

  r = a ** 3
  if visible: print(r)

  ok = (r.valuation() == ra.rationnel(1))

  return ok



def test_unitaire_27(visible =False):
  print("*** polynome: test_unitaire_27 ***")

  a = po.polynome(mo.monome(ra.rationnel(1), "a"))
  a = a.joindre(mo.monome(ra.rationnel(1), "b"))
  a = a.joindre(mo.monome(ra.rationnel(-2, 3)))
  if visible: print(a)

  b = po.polynome(mo.monome(ra.rationnel(7)))
  if visible: print(b)

  r = a ** b

  t = r.liste_decroissante_monomes()
  c = t[-1].lire_coeff()

  if visible:
    print(r)

    print(t)
    print(c)

    print(r.pgcd_numerateurs())
    print(r.ppcm_denominateurs())

  ok = (c == ra.rationnel(-128, 2187))
  return ok



def test_unitaire_28(visible =False):
  print("*** polynome: test_unitaire_28 ***")

  a = po.polynome(mo.monome(ra.rationnel(1), "x"))
  a = a.joindre(mo.monome(ra.rationnel(-2, 3)))
# if visible: print(a)

  b = po.polynome(mo.monome(ra.rationnel(4)))
# if visible: print(b)

  r = a ** b

  pgcd = r.pgcd_numerateurs()
  ppcm = r.ppcm_denominateurs()

  if visible:
    print(r)

    print(pgcd)
    print(ppcm)

  ok = (pgcd == 1) and (ppcm == 19683)
  return ok
```

```python
def test_unitaire_29(visible =False):
  print("*** polynome: test_unitaire_29 ***")

  a = po.polynome(mo.monome(ra.rationnel(1), "a"))
  a = a.joindre(mo.monome(ra.rationnel(1), "b"))
  if visible: print(a)

  r = a ** 3
  if visible: print(r.joli())

  ok = (r.valuation() == ra.rationnel(1))
  return ok



def test_unitaire_30(visible =False):
  print("*** polynome: test_unitaire_30 ***")

  ok = True
  return ok



def test_unitaire_31(visible =False):
  print("*** polynome: test_unitaire_31 ***")

  ok = True
  return ok



def test_unitaire_32(visible =False):
  print("*** polynome: test_unitaire_32 ***")

  ok = True
  return ok



def test_unitaire_33(visible =False):
  print("*** polynome: test_unitaire_33 ***")

  ok = True
  return ok



def test_unitaire_34(visible =False):
  print("*** polynome: test_unitaire_34 ***")

  ok = True
  return ok



def test_unitaire_35(visible =False):
  print("*** polynome: test_unitaire_35 ***")

  ok = True
  return ok



def test_unitaire_(visible =False):
  print("*** polynome: test_unitaire_ ***")
```

```
  ok = True
  return ok



def tests_unitaires():
  return (
    test_unitaire_0() and \
    test_unitaire_1() and \
    test_unitaire_2() and \
    test_unitaire_3() and \
    test_unitaire_4() and \
    test_unitaire_5() and \
    test_unitaire_6() and \
    test_unitaire_7() and \
    test_unitaire_8() and \
    test_unitaire_9() and \

    test_unitaire_10() and \
    test_unitaire_11() and \
    test_unitaire_12() and \
    test_unitaire_13() and \
    test_unitaire_14() and \
    test_unitaire_15() and \
    test_unitaire_16() and \
    test_unitaire_17() and \
    test_unitaire_18() and \
    test_unitaire_19() and \

    test_unitaire_20() and \
    test_unitaire_21() and \
    test_unitaire_22() and \
    test_unitaire_23() and \
    test_unitaire_24() and \
    test_unitaire_25() and \
    test_unitaire_26() and \
    test_unitaire_27() and \
    test_unitaire_28() and \
    test_unitaire_29(True) and \

    test_unitaire_30() and \
    test_unitaire_31() and \
    test_unitaire_32() and \
    test_unitaire_33() and \
    test_unitaire_34() and \
    test_unitaire_35
  )



if __name__ == "__main__":
  ok = tests_unitaires()
  if ok:
    print("*** polynome: tests unitaires OK ***")
```