Ejercicios 9 y 10

February 4, 2018

Ejercicio 9. 1. Hay otras constantes de las que podemos calcular la cifra n-ésima sin calcular las anteriores. Por ejemplo, se puede usar la serie X 1 log(2) = , k2 k k=1 para calcular cifras del logaritmo neperiano de 2. Modifica el programa anterior para adaptarlo a este caso. £Cuál podra ser la forma general de series a las que se les puede aplicar este método?

```
In [54]: def F0(n):
             S = RR(0.0)
             k = 1
             while k <= n:
                 S += RR((2^(n-k))%k/k)
                 k += 1
             return RR(S)
         def F1(n):
             S = RR(0.0)
             k = n+1
             while 1:
                 nS = S + RR((2^(n-k))/k)
                 if nS == S:
                     break
                 else:
                     S = nS
                 k += 1
             return RR(S)
         def cifra_log2(n):
             n -= 1
             x = RR(F0(n)) + RR(F1(n))
             return (x-floor(x)).str(base=2)
```

```
In [55]: cifra_log2(2)
```

```
Out[55]: '0.01100010111001000010111111101111101000111001111011101 1'
```

Ejercicio 10. 1. Define una función de Sage que encuentre, y devuelva, la fracción, con denominador de como máximo k cifras (en base 10), que mejor aproxime a . No se permite usar el método exact rational() de Sage , que más o menos puede hacer lo que se pide en el ejercicio. S se puede usar el valor de que tiene internamente Sage. £Cuántos bucles tendrá tu función? 2. Jugando con los rangos de los bucles, pero sin usar explcitamente los resultados mencionados más abajo, trata de conseguir un programa lo más eficiente posible.

```
In [96]: def den_pi(n):
             den = 1
             res = 0
             dif = 100
             frac = 0
             while len(den.digits()) <= n:
                 for num in xsrange (3*den,4*den):
                     frac = num/den
                     if abs(RR(frac) - RR (pi)) < dif:
                         res = frac
                         dif = abs(RR(frac) - RR (pi))
                 den += 1
             return RR(res),RR(dif),frac

In [97]: %%time
         den_pi(4)


         ---------------------------------------------------------------------------

         KeyboardInterrupt                         Traceback (most recent call last)

         <ipython-input-97-a6c2cd09380d> in <module>()
        ----> 1 get_ipython().run_cell_magic(u'time', u'', u'den_pi(4)')


         /usr/local/SageMath/local/lib/python2.7/site-packages/IPython/core/interactiveshell.pyc
        2113             magic_arg_s = self.var_expand(line, stack_depth)
        2114             with self.builtin_trap:
        -> 2115                 result = fn(magic_arg_s, cell)
        2116             return result
        2117


         <decorator-gen-59> in time(self, line, cell, local_ns)


         /usr/local/SageMath/local/lib/python2.7/site-packages/IPython/core/magic.pyc in <lambda
         186     # but it's overkill for just that one bit of state.
         187     def magic_deco(arg):
        --> 188         call = lambda f, *a, **k: f(*a, **k)
         189
         190         if callable(arg):


         /usr/local/SageMath/local/lib/python2.7/site-packages/IPython/core/magics/execution.pyc
        1174         if mode=='eval':
        1175             st = clock2()
```

```
-> 1176             out = eval(code, glob, local_ns)
   1177             end = clock2()
   1178         else:


    <timed eval> in <module>()


    <ipython-input-96-8dd3ba7e4c8c> in den_pi(n)
      7         for num in xsrange (Integer(3)*den,Integer(4)*den):
      8             frac = num/den
----> 9             if abs(RR(frac) - RR (pi)) < dif:
     10                 res = frac
     11                 dif = abs(RR(frac) - RR (pi))


    /usr/local/SageMath/src/sage/structure/parent.pyx in sage.structure.parent.Parent.__cal
    932         if mor is not None:
    933             if no_extra_args:
--> 934                 return mor._call_(x)
    935             else:
    936                 return mor._call_with_args(x, args, kwds)


    /usr/local/SageMath/src/sage/structure/coerce_maps.pyx in sage.structure.coerce_maps.Na
    280             raise TypeError("Cannot coerce {} to {}".format(x, C))
    281         cdef Map m
--> 282         cdef Element e = method(C)
    283         if e is None:
    284             raise RuntimeError("BUG in coercion model: {} method of {} returned Non


    /usr/local/SageMath/src/sage/symbolic/expression.pyx in sage.symbolic.expression.Expres
   1280             0.14112000805986722210074480281
   1281         """
-> 1282         return self._eval_self(R)
   1283
   1284     def _real_mpfi_(self, R):


    /usr/local/SageMath/src/sage/symbolic/expression.pyx in sage.symbolic.expression.Expres
   1191         cdef GEx res
   1192         try:
-> 1193             res = self._gobj.evalf(0, {'parent':R})
   1194         except TypeError as err:
   1195             # try the evaluation again with the complex field
```

```
/usr/local/SageMath/src/sage/libs/pynac/pynac.pyx in sage.libs.pynac.pynac.py_eval_cons
   2197     from sage.symbolic.constants import constants_table
   2198     constant = constants_table[serial]
-> 2199     return kwds['parent'](constant)
   2200
   2201 cdef py_eval_unsigned_infinity():


/usr/local/SageMath/src/sage/structure/parent.pyx in sage.structure.parent.Parent.__cal
    932         if mor is not None:
    933             if no_extra_args:
--> 934                 return mor._call_(x)
    935             else:
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/usr/local/SageMath/local/lib/python2.7/site-packages/sage/symbolic/constants.py in _mp
    569         return math.pi
    570
--> 571     def _mpfr_(self, R):
    572         """
    573         EXAMPLES::


src/cysignals/signals.pyx in cysignals.signals.python_check_interrupt (build/src/cysign


src/cysignals/signals.pyx in cysignals.signals.sig_raise_exception (build/src/cysignals


KeyboardInterrupt:
```

In [ ]:
```
den_pi(3)
```

In [ ]: