Viviane Pons

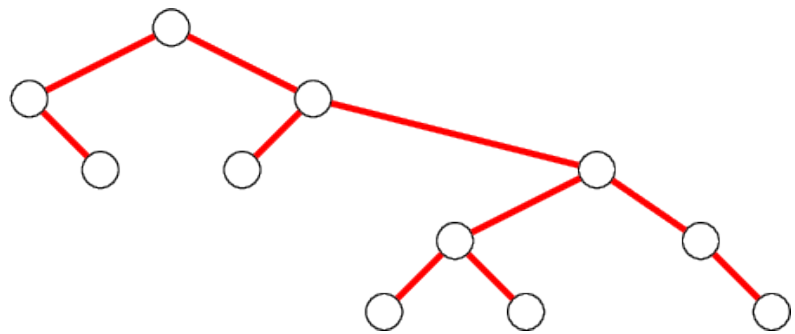
Maîtresse de conférence, Univ. Paris-Sud Orsay
viviane.pons@lri.fr – @PyViv

Science and Open Source

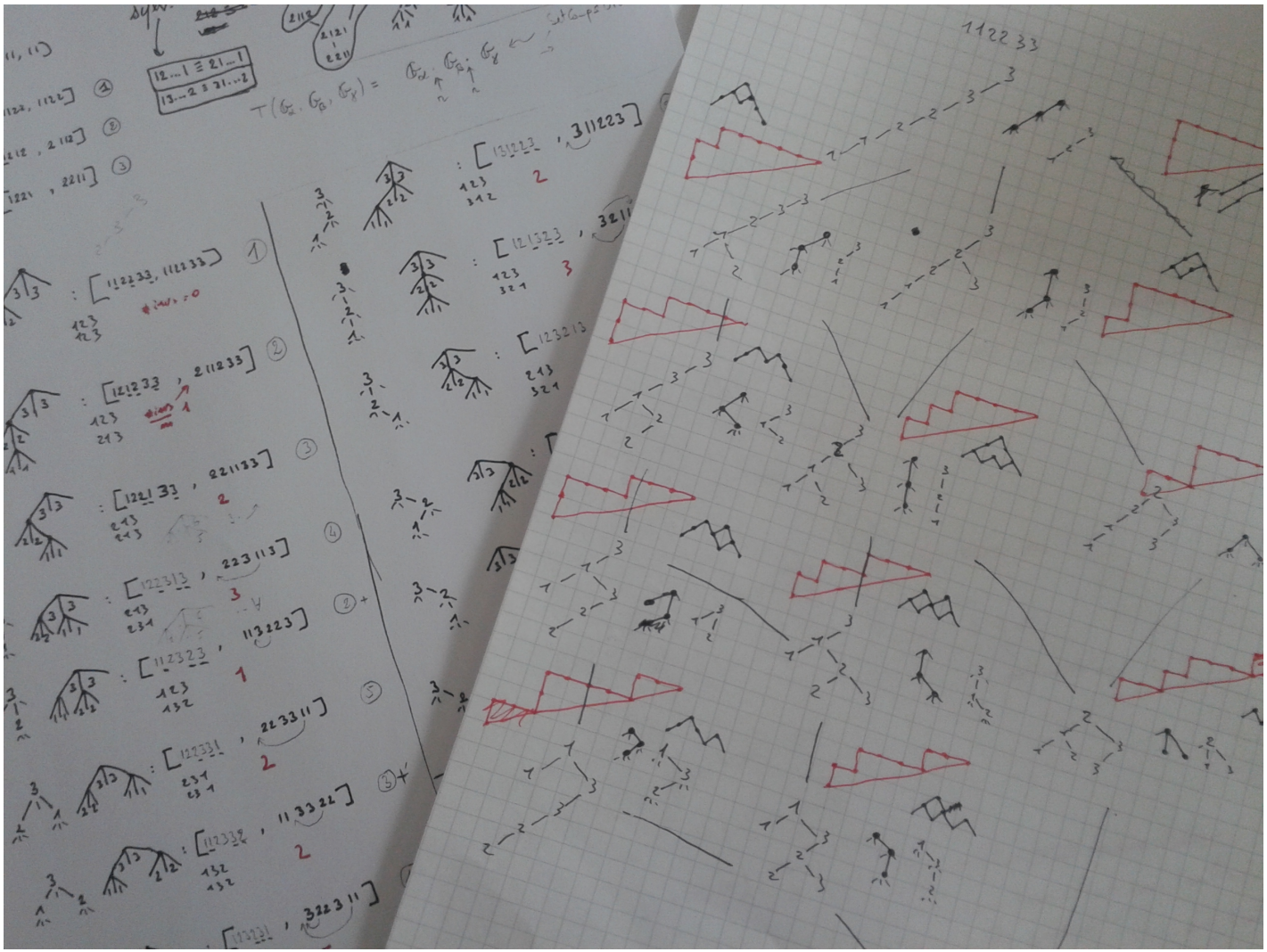
What do we learn from each other?

Who am I?

- Both a **mathematician** and a **computer scientist**.



- I do **combinatorics**.



```
def inf_mperms(p1,p2):
    m = len([i for i in p1 if i==1])
    return perm_to_mperm(inf_perms(mperm_to_perm(p1),mperm_to_perm(p2)),m)

def is_last(perm,i):
    for b in perm[i+1:]:
        if b == perm[i]:
            return False
    return True

def mperm_to_tree(perm):
    values = list(set(perm))
    values.sort()
    values.reverse()
    m = len(perm) / len(values)
    tree = MDecreasingTree(m+1,None)
    for v in values:
        tree = tree.insert_from_mperm(perm,v)
    return tree


def mperm_to_tree2(perm, mfor0 = 1):
    if len(perm)==0:
        return MDecreasingTree(mfor0,None)
    n = max(perm)
    posr = [i for i in xrange(len(perm)) if perm[i]==n]
    m = len(posr)
    children = [[] for i in xrange(m+1)]
    right = {a for a in perm if a!=n}
    for i in xrange(m):
        pos = posr[i]
        for j in xrange(pos-1,-1,-1):
            a = perm[j]
            if a!=n:
                if is_last(perm,j):
                    if a in right:
                        children[i].append(a)
                        right.remove(a)
                elif a in right:
                    right.update([aa for aa in children[i] if aa < a])
                    children[i] = [b for b in children[i] if b >a]
    children[-1] = list(right)
    children_trees = [mperm_to_tree2([a for a in perm if a in c], mfor0 =m) for c in children]
    return MDecreasingTree(m+1,children_trees, label=n)


#tested 2,2 to 2,5
#tested 3,2 to 3,4
def test_sup_max_classes(m,n):
    maxs = list(max_classes(m,n))
```

My research **relies on code**. For every paper I write, there is a program somewhere with experiments and tests.

To know more: see **Experimental pure mathematics using Sage**.

Science and Software

S.J. Hettrick et al, *UK Research Software Survey 2014*, DOI:10.5281/zenodo.1183562

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What about math?

39 computer algebra systems listed on Wikipedia.

Some **non** open-source

- Maple: \$2275 (Commercial), \$2155 (Government), \$1245 (Academic), \$239 (Personal), \$99 (Student)
- Mathematica: \$2495 (Professional), \$1095 (Education), \$295 (Personal), \$140 (Student)
- Magma: \$1440

(numbers from Wikipedia)

The shared values of science and open-source

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- **As a scientist, I want my results to be re-used and improved.**

As a scientist, I need to write open-source

I'm not the only one...

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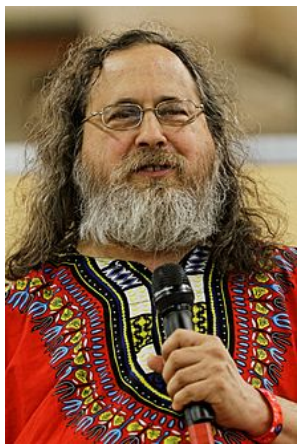

Richard Stallman
creator of Free Software Foundation
MIT

Donald Knuth
creator of TeX
Stanford

Math and open-source

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- General purpose systems: SageMath
- Interactive computing environments: IPython/Jupyter, CoCalc
- Together with the wider Scientific Python ecosystem

The SageMath project

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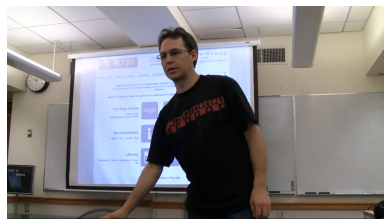

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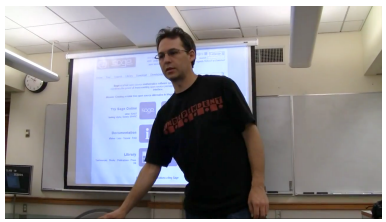

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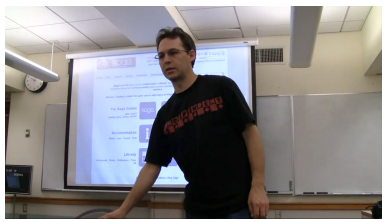

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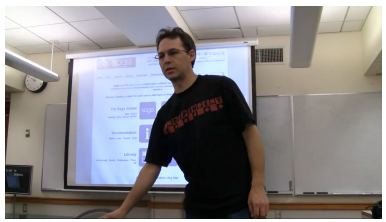

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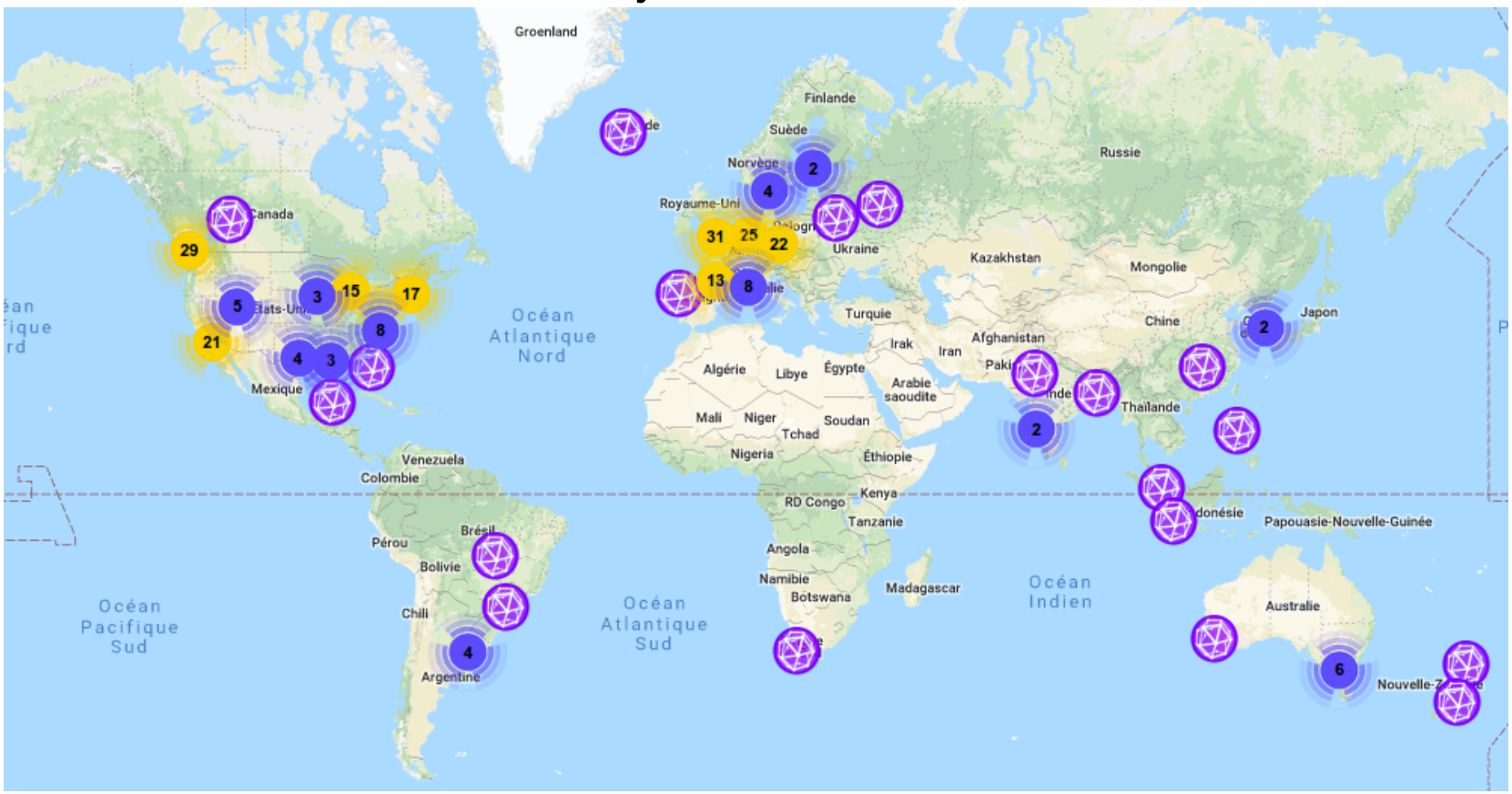
- Built around many pre-existing software.
- Grew its own python (and cython) library on top of it.
- And a vibrant community.

Currently, 271 contributors



Me and Sage

The combinatorics community "moved" to SageMath shortly before I joined in 2010.

I am a **SageMath native**!

The challenges...

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- How is the development work valued in the community?
- How is your software going to survive?

The SageMath development model

The motto is: **for users, by users**. Mostly developed by researchers:

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Packaging, interfaces, install scripts, low level software interaction, etc.

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56% of academics develop their own research software, **only 21%** of those have received training in software development.

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This requires

- Recurrent funding
- Proper career prospects
- Flexibility over time and missions

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to convince our institutions, our governments, that **open-source, user driven development** is the right way, and **it needs sustainable funding to function.**

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It was a first step...

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We need to develop software **for** everyone, **with** everyone.

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Open-source is free to use but can be difficult to access

- Never forget the technical cost.
- Never forget the cultural aspects.

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Lack of training? Lack of confidence? **What can we do?**

Support women coders and women initiative

pyladies

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- What is the color of your skin?
- Are you straight? Non disabled? Cis-gendered?

You want people in, who are not like you.

Remember...

We want software **for everybody, by everybody**.

- Science needs software
- Open science needs open software
- Open software needs Research Software Engineers
- This requires funding, career paths, recognition, etc.
- We all need a diverse community

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