MeetingNovember8

November 15, 2019

```
[1]: from sympy import *
     from IPython.display import *
     #from sympy.polys.orderings import monomial_key
     init_printing()

     var('a:z');
```

```
[2]: s,t,u=symbols('s,t,u',commutative=False)
```

```
[3]: expand((s+t)**3)
```

$$[3]: \quad sts + st^2 + s^2t + s^3 + tst + ts^2 + t^2s + t^3$$

```
[4]: A=Matrix(2,2,[0,1,1,1]);B=Matrix(2,2,[2,0,1,3]);C=Matrix(2,2,[0,1,1,0])
     A,B,C
```

$$[4]: \quad \left(\begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix}, \begin{bmatrix} 2 & 0 \\ 1 & 3 \end{bmatrix}, \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} \right)$$

```
[5]: pow=3
     X=s*A+t*B+u*C
     X2=(X**pow).expand()
     X2
```

$$[5]: \quad \begin{bmatrix} 3sts + 3stu + 5st^2 + 2sut + 3s^2t + s^2u + s^3 + 2tst + 2tsu + 2ts^2 + 2tus + 2tut + 2tu^2 + 8t^3 + 3ust + \\ 3sts + 3stu + 9st^2 + sus + 3sut + su^2 + 4s^2t + 2s^2u + 2s^3 + 10tst + 4tsu + 4ts^2 + tus + 7tut + tu^2 + 9t^2s + 9t^2 \end{bmatrix}$$

```
[6]: L=list(itermonomials([s,t,u],pow)-itermonomials([s,t,u],pow-1))
     #L=sorted(IL,key=monomial_key('lex',[s,t,u]))
     L,L[0]
```

$$[6]: \quad \left(\left[u^3, \, sut, \, t^2s, \, tu^2, \, u^2t, \, usu, \, s^2u, \, tus, \, stu, \, s^2t, \, utu, \, tst, \, sus, \, ts^2, \, u^2s, \, tsu, \, sts, \, st^2, \, t^2u, \, ut^2, \, su^2, \, tut, \, ust, \, uts, \right. \right.$$

```
[13]: C**3,Matrix(2,2,lambda i,j:X2[i,j].coeff(L[0])),Matrix(2,2,lambda i,j:X2[i,j].
      →coeff(L[1])),A*C*B
```

$$[13]: \quad \left(\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}, \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}, \begin{bmatrix} 2 & 0 \\ 3 & 3 \end{bmatrix}, \begin{bmatrix} 2 & 0 \\ 3 & 3 \end{bmatrix} \right)$$

```
[14]: M=[]
      for i in range(len(L)):
          M.append([L[i],Matrix(2,2,lambda a,b:X2[a,b].coeff(L[i]))])
```

```
[15]: M
```

[15]: $$\left[\left[u^3, \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}\right], \left[sut, \begin{bmatrix} 2 & 0 \\ 3 & 3 \end{bmatrix}\right], \left[t^2s, \begin{bmatrix} 0 & 4 \\ 9 & 14 \end{bmatrix}\right], \left[tu^2, \begin{bmatrix} 2 & 0 \\ 1 & 3 \end{bmatrix}\right], \left[u^2t, \begin{bmatrix} 2 & 0 \\ 1 & 3 \end{bmatrix}\right], \left[usu, \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}\right], \left[s^2u, \begin{bmatrix} 1 & 1 \\ 2 & 1 \end{bmatrix}\right]\right.$$

[10]: `M[1][0],M[1][1]`

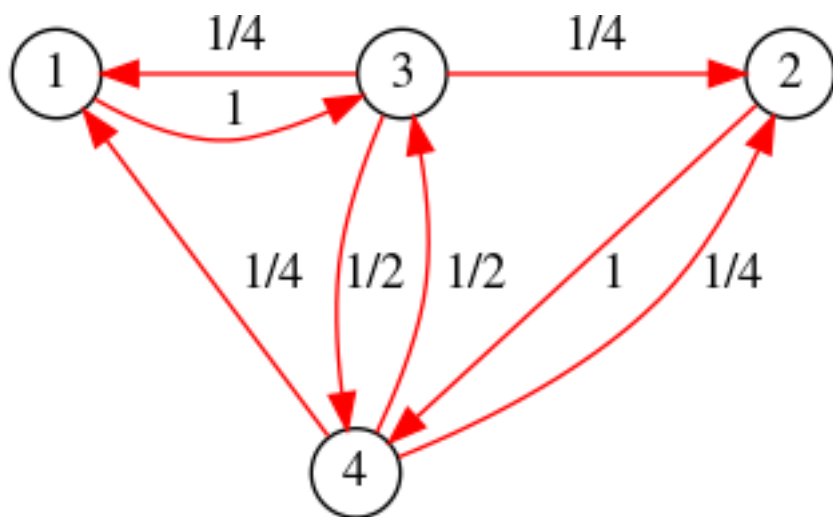[10]: $$\left(sut, \begin{bmatrix} 2 & 0 \\ 3 & 3 \end{bmatrix}\right)$$

[11]: `IFrame(src="adjlump.pdf", width="800", height="800")`

[11]: `<IPython.lib.display.IFrame at 0x7f72eaf76550>`

[12]: `Image('adjlump.png')`

[12]:

[ ]: