## Program:

```
from sympy.galgebra.printer import Format,xpdf
from sympy.galgebra.ga import Ga
from sympy.galgebra.mv import Com

Format()
g4d = Ga('a b c d')
(a,b,c,d) = g4d.mv()

print 'g_{ij} =',g4d.g
print '\\bm{a|(b*c)} =',a|(b*c)
print '\\bm{a|(b^c)} =',a|(b^c)
print '\\bm{a|(b^c^d)} =',a|(b^c^d)
print '\\bm{a|(b|(c^d))} =',a|(b|(c^d))
print '\\bm{a|(b^c)+c|(a^b)+b|(c^a)} =',(a|(b^c))+(c|(a^b))+(b|(c^a))
print '\\bm{a*(b^c)-b*(a^c)+c*(a^b)} =',a*(b^c)-b*(a^c)+c*(a^b)
print '\\bm{a*(b^c^d)-b*(a^c^d)+c*(a^b^d)-d*(a^b^c)} =',\
      a*(b^c^d)-b*(a^c^d)+c*(a^b^d)-d*(a^b^c)
print '\\bm{(a^b)|(c^d)} =',(a^b)|(c^d)
print '\\bm{((a^b)|c)|d} =',((a^b)|c)|d
print '\\bm{(a^b)\\times (c^d)} =',Com(a^b,c^d)

xpdf(paper='letter',prog=True)
```

## Code Output:

$$g_{ij} = \begin{bmatrix} (a \cdot a) & (a \cdot b) & (a \cdot c) & (a \cdot d) \\ (a \cdot b) & (b \cdot b) & (b \cdot c) & (b \cdot d) \\ (a \cdot c) & (b \cdot c) & (c \cdot c) & (c \cdot d) \\ (a \cdot d) & (b \cdot d) & (c \cdot d) & (d \cdot d) \end{bmatrix}$$

$$\boldsymbol{a} \cdot (\boldsymbol{bc}) = -(a \cdot c)\,\boldsymbol{b} + (a \cdot b)\,\boldsymbol{c}$$

$$\boldsymbol{a} \cdot (\boldsymbol{b} \wedge \boldsymbol{c}) = -(a \cdot c)\,\boldsymbol{b} + (a \cdot b)\,\boldsymbol{c}$$

$$\boldsymbol{a} \cdot (\boldsymbol{b} \wedge \boldsymbol{c} \wedge \boldsymbol{d}) = (a \cdot d)\,\boldsymbol{b} \wedge \boldsymbol{c} - (a \cdot c)\,\boldsymbol{b} \wedge \boldsymbol{d} + (a \cdot b)\,\boldsymbol{c} \wedge \boldsymbol{d}$$

$$\boldsymbol{a} \cdot (\boldsymbol{b} \cdot (\boldsymbol{c} \wedge \boldsymbol{d})) = -(a \cdot c)\,(b \cdot d) + (a \cdot d)\,(b \cdot c)$$

$$\boldsymbol{a} \cdot (\boldsymbol{b} \wedge \boldsymbol{c}) + \boldsymbol{c} \cdot (\boldsymbol{a} \wedge \boldsymbol{b}) + \boldsymbol{b} \cdot (\boldsymbol{c} \wedge \boldsymbol{a}) = 0$$

$$\boldsymbol{a}(\boldsymbol{b} \wedge \boldsymbol{c}) - \boldsymbol{b}(\boldsymbol{a} \wedge \boldsymbol{c}) + \boldsymbol{c}(\boldsymbol{a} \wedge \boldsymbol{b}) = 3\boldsymbol{a} \wedge \boldsymbol{b} \wedge \boldsymbol{c}$$

$$\boldsymbol{a}(\boldsymbol{b} \wedge \boldsymbol{c} \wedge \boldsymbol{d}) - \boldsymbol{b}(\boldsymbol{a} \wedge \boldsymbol{c} \wedge \boldsymbol{d}) + \boldsymbol{c}(\boldsymbol{a} \wedge \boldsymbol{b} \wedge \boldsymbol{d}) - \boldsymbol{d}(\boldsymbol{a} \wedge \boldsymbol{b} \wedge \boldsymbol{c}) = 4\boldsymbol{a} \wedge \boldsymbol{b} \wedge \boldsymbol{c} \wedge \boldsymbol{d}$$

$$(\boldsymbol{a} \wedge \boldsymbol{b}) \cdot (\boldsymbol{c} \wedge \boldsymbol{d}) = -(a \cdot c)\,(b \cdot d) + (a \cdot d)\,(b \cdot c)$$

$$((\boldsymbol{a} \wedge \boldsymbol{b}) \cdot \boldsymbol{c}) \cdot \boldsymbol{d} = -(a \cdot c)\,(b \cdot d) + (a \cdot d)\,(b \cdot c)$$

$$(\boldsymbol{a} \wedge \boldsymbol{b}) \times (\boldsymbol{c} \wedge \boldsymbol{d}) = -(b \cdot d)\,\boldsymbol{a} \wedge \boldsymbol{c} + (b \cdot c)\,\boldsymbol{a} \wedge \boldsymbol{d} + (a \cdot d)\,\boldsymbol{b} \wedge \boldsymbol{c} - (a \cdot c)\,\boldsymbol{b} \wedge \boldsymbol{d}$$