

Problema: Determinante de una matriz cuadrada (triangularizando)

```
In [1]: m=[[2,1,3],[4,2,3],[2,3,2]]
```

```
In [2]: def multiplicaFila(m,f,e):  
        n=len(m)  
        for c in range(n):  
            m[f][c]=m[f][c]*e
```

```
In [3]: multiplicaFila(m,0,1./2)
```

```
In [4]: m
```

```
Out[4]: [[1.0, 0.5, 1.5], [4, 2, 3], [2, 3, 2]]
```

```
In [5]: def muestra(m):  
        for f in m:  
            print '[',  
            for e in f:  
                print "{:.2f}".format(e).rjust(6),  
            print ']'
```

```
In [6]: muestra(m)
```

```
[  1.00  0.50  1.50 ]  
[  4.00  2.00  3.00 ]  
[  2.00  3.00  2.00 ]
```

The logo for Cartagena99 features the word "Cartagena99" in a stylized, teal-colored font. The "99" is significantly larger and more prominent than the "Cartagena" part. The text is set against a light blue and white background with a subtle wave-like pattern.

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```
In [8]: combinacion(m,0,1,-m[1][0])
```

In [9]: muestra(m)

```
[ 1.00  0.50  1.50 ]
[ 0.00  0.00 -3.00 ]
[ 2.00  3.00  2.00 ]
```

In [10]: combinacion(m,0,2,-m[2][0])

In [11]: muestra(m)

```
[ 1.00  0.50  1.50 ]
[ 0.00  0.00 -3.00 ]
[ 0.00  2.00 -1.00 ]
```

In [12]: **def** intercambiaFilas(m,i,j):
m[i],m[j] = m[j],m[i]

Intercambiar columnas sería más difícil

In [13]: intercambiaFilas(m,1,2)
muestra(m)

```
[ 1.00  0.50  1.50 ]
[ 0.00  2.00 -1.00 ]
[ 0.00  0.00 -3.00 ]
```

In [14]: multiplicaFila(m,1,1./m[1][1])

The logo for Cartagena99 features the word "Cartagena99" in a stylized, bold font. The "C" is large and blue, while the rest of the text is in a dark green color. The "99" is significantly larger than the other characters. The logo is set against a light blue and orange gradient background.

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In [16]: multiplicaFila(m,2,1./m[2][2])

In [17]: muestra(m)

```
[ 1.00  0.50  1.50 ]
[ 0.00  1.00 -0.50 ]
[ -0.00 -0.00  1.00 ]
```

In [18]: **def** determinante(m):
n=len(m)

```
det=1
for i in range(len(m)):
    j=primeroNoNulo(m,i)
    if j==len(m):
        return 0
    if i!=j:
        det=-1*det
    intercambiaFilas(m,i,j)
    det=det*m[i][i]
    multiplicaFila(m,i,1./m[i][i])
    for k in range(i+1,n):
        combinacion(m,i,k,-m[k][i])
return det

def primeroNoNulo(m,i):
    result=i
    while result<len(m) and m[result][i]==0:
        result=result+1
    return result
```

In [19]: m=[[2,1,3],[4,2,6],[2,3,2]]

In [20]: determinante(m)

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Para no modificar m en la función debemos crear una copia y trabajar en ella

```
In [22]: def copy(m):  
         result=[]  
         for f in m:  
             result.append(f[:])  
         return result
```

```
In [23]: def determinante(m1):  
         m=copy(m1)  
         n=len(m)  
         det=1  
         for i in range(len(m)):  
             j=primeroNoNulo(m,i)  
             if j==len(m):  
                 return 0  
             det=-1*det  
             intercambiaFilas(m,i,j)  
             det=det*m[i][i]  
             multiplicaFila(m,i,1./m[i][i])  
             for k in range(i+1,n):  
                 combinacion(m,i,k,-m[k][i])  
         return det
```

```
In [24]: m=[[2,1,3],[4,2,3],[2,3,2]]
```

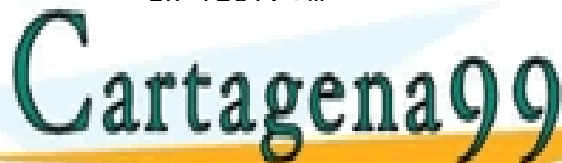
```
In [25]: determinante(m)
```

```
Out[25]: 12.0
```

```
In [26]: m
```

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Sólo necesitamos la matriz identidad del mismo tamaño que m

```
In [27]: def unitMatrix(n):  
        result=[]  
        for f in range(n):  
            fila=[0]*n  
            fila[f]=1  
            result.append(fila)  
        return result
```

```
In [28]: unitMatrix(3)
```

```
Out[28]: [[1, 0, 0], [0, 1, 0], [0, 0, 1]]
```

```
In [29]: def inversa(m1):  
        m=copy(m1)  
        n=len(m)  
        inversa=unitMatrix(n)  
        det=1  
        for i in range(len(m)):  
            j=primeroNoNulo(m,i)  
            if j==len(m):  
                raise Exception('La matriz no es invertible')  
            det=-1*det  
            intercambiaFilas(m,i,j)  
            intercambiaFilas(inversa,i,j)  
            multiplicaFila(inversa,i,1./m[i][i])  
            multiplicaFila(m,i,1./m[i][i])  
            for k in range(0,n):  
                if k!=i:  
                    combinacion(inversa,i,k,-m[k][i])  
                    combinacion(m,i,k,-m[k][i])  
        return inversa
```

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```
In [31]: def matrizNula(n,m):
          result=[]
          for i in range(n):
              result.append([0]*m)
          return result

          def mult(a,b):
              n,m=len(a),len(b[0])
              prod=matrizNula(n,m)
              for i in range(n):
                  for j in range(m):
                      for k in range(len(a[0])):
                          prod[i][j]=prod[i][j]+a[i][k]*b[k][j]
              return prod
```

```
In [32]: muestra(mult(m,inversa(m)))
```

```
[ 1.00 -0.00  0.00 ]
[ 0.00  1.00  0.00 ]
[ 0.00 -0.00  1.00 ]
```

```
In [32]:
```

The logo for Cartagena99 features the text 'Cartagena99' in a stylized, teal-colored font. The '99' is significantly larger and more prominent than the 'Cartagena' part. The text is set against a background of light blue and orange geometric shapes, including a large, light blue 'C' shape on the left and a horizontal orange bar at the bottom.

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