Mathe1_Übung9.5

```
import time

def det_calc(M):
    if M.nrows() == 2:
        determinant = (M[0, 0] * M[1, 1]) - (M[1, 0] * M[0, 1])
        return(determinant)
    else:
        determinant = 0
        for columns in range(M.nrows()):
            determinant = determinant + ((-1)**columns * M[0, columns] *
            det_calc(M.delete_rows([0]).delete_columns([columns])))
        return(determinant)

def results(matrix):
    print(matrix)

    start_time1 = time.time()
    det = det_calc(matrix)
    end_time1 = time.time()
    calc_time1 = end_time1 - start_time1

    start_time2 = time.time()
    det2 = matrix.det()
    end_time2 = time.time()
    calc_time2 = end_time2 - start_time2

    print('\nDeterminant of self written function: ' + str(det))
    print('Calculation time: ' + str(calc_time1) + ' seconds')
    print('\nDeterminant of build in function: ' + str(det2))
    print('Calculation time: ' + str(calc_time2) + ' seconds')
```

```
to_calculate = matrix.random(QQ, 8)
results(to_calculate)
```

```
[  -2   -1 -1/2    0   -2 -1/2    0    2]
[   1    0    2    1    0    0    0    0]
[  -1    1    1   -1   -1    0   -2    0]
[-1/2    2    1    1    2    0   -1    1]
[   0    0    0 -1/2 -1/2    0   -2   -1]
[   1    1    2    2    0    0   -1    1]
[  -1   -1    0   -1    0  1/2    0    2]
[  -1    1    0    1    1   -1    0  1/2]

Determinant of self written function: 2093/32
Calculation time: 12.277974844 seconds

Determinant of build in function: 2093/32
Calculation time: 2.47955322266e-05 seconds
```