cslsi-05-mueller

November 11, 2018

1 Sheet 05

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```
In [164]: def matrix_get_submatrix(m, ii, jj):
              cols = len(m)
              rows = len(m[0])
              assert all([len(m[i]) == len(m[0]) for i in range(cols)])
              assert 0 <= ii < rows
              assert 0 <= jj < cols

              return [m[i][0:jj] + m[i][jj+1:] for i in range(rows) if i != jj]

          def matrix_det(m):
              rows = len(m)      # number of rows of m
              assert rows > 0
              cols = len(m[0])  # number of cols of m
              if rows != cols:
                  raise Exception("matrix must be square")
              if rows == 1:
                  return m[0][0]
              elif rows == 2:
                  return m[0][0] * m[1][1] - m[0][1] * m[1][0]
              elif rows == 3:
                  return m[0][0]*m[1][1]*m[2][2] + m[0][1]*m[1][2]*m[2][0] + m[0][2]*m[1][0]*m[2
              sgn = -1      #Fixed sign problem
              sum = 0
              for i in range(1, cols): #idx had to start at 1, not 0
                  sum += sgn**(i) * m[i][1] * matrix_det(matrix_get_submatrix(m, i, 1)) # added
              return sum
```

1.1 Exercise 1

```
In [165]: import unittest

          class TestMatrixDet(unittest.TestCase):
```

```
        def test_submatrix(self):
            testMat = [[1, 2, 3], [4, 5, 6], [7, 8, 9]]
            newMat = matrix_get_submatrix(testMat, 0, 0)

            self.assertEqual(len(newMat), len(testMat) - 1, 'Test cols')
            self.assertEqual(len(newMat[0]), len(testMat[0]) - 1, 'Test rows')
            self.assertEqual(newMat[0][0], testMat[1][1])
            self.assertEqual(newMat[0][1], testMat[1][2])


            testMat = [[1, 2], [4, 5, 6], [7, 8, 9]]

            with self.assertRaises(AssertionError):
                newMat = matrix_get_submatrix(testMat, 0, 0)

        def test_determinate(self):
            testMat = [[1, 2, 3, 4], [5, 1, 7, 8], [10, 10, 11, 12], [13, 14, 15, 16]]
            det = matrix_det(testMat)

            self.assertEqual(det, -60)
```

```
In [166]: unittest.main(argv=['first-arg-is-ignored'], exit=False)

..
----------------------------------------------------------------------
Ran 2 tests in 0.001s

OK


Out[166]: <unittest.main.TestProgram at 0x7f99fc0f3518>
```

```
In [172]: import random

          for d in range(1, 11):
              print("Testing dimension: " + str(d))
              testMat = [[random.randrange(-5, 5) for x in range(d)] for y in range(d)]
              %timeit -n 3 matrix_det(testMat)
```

```
Testing dimension: 1
808 ns ± 295 ns per loop (mean ± std. dev. of 7 runs, 3 loops each)
Testing dimension: 2
1.22 µs ± 301 ns per loop (mean ± std. dev. of 7 runs, 3 loops each)
Testing dimension: 3
2.79 µs ± 351 ns per loop (mean ± std. dev. of 7 runs, 3 loops each)
Testing dimension: 4
30.1 µs ± 1.2 µs per loop (mean ± std. dev. of 7 runs, 3 loops each)
Testing dimension: 5
154 µs ± 11.6 µs per loop (mean ± std. dev. of 7 runs, 3 loops each)
```

```
Testing dimension: 6
639 μs ± 167 μs per loop (mean ± std. dev. of 7 runs, 3 loops each)
Testing dimension: 7
3.04 ms ± 354 μs per loop (mean ± std. dev. of 7 runs, 3 loops each)
Testing dimension: 8
17.7 ms ± 980 μs per loop (mean ± std. dev. of 7 runs, 3 loops each)
Testing dimension: 9
144 ms ± 9.12 ms per loop (mean ± std. dev. of 7 runs, 3 loops each)
Testing dimension: 10
1.24 s ± 18.9 ms per loop (mean ± std. dev. of 7 runs, 3 loops each)
```

In [ ]:

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