In [1]:
```
import numpy as np
import pandas as pd
from scipy.optimize import minimize, Bounds, LinearConstraint
import matplotlib.pyplot as plt
```

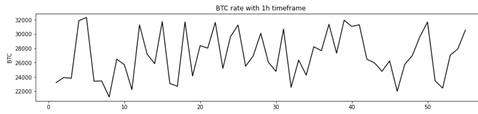
In [2]:
```
df = pd.read_csv('120812.csv', sep = ';', encoding='latin-1')
del df['ds']
df
```

Out[2]:

	y
0	30823
1	30549
2	27918
3	27037
4	22447
5	23458
6	31656
7	29641
8	26990
9	25756
10	22002
11	26245
12	24785
13	25964
14	26473
15	31280
16	31040
17	31918
18	27314
19	31348
20	27664
21	28206
22	24261
23	26356
24	22559
25	30669
26	24778
27	26051
28	30094
29	26938
30	25496
31	31244
32	29609
33	25193
34	31605
35	28016
36	28373
37	24128
38	31659
39	22698
40	23089
41	31725
42	25847
43	27192
44	31259
45	22234
46	25707
47	26486
48	21212
49	23447
50	23392
51	32292
52	31856
53	23823
54	23917
55	23216
56	24665

In [15]:
```
n = 56 # размер выборки
btc = [df.values[i][0] for i in range(len(df) - 2, len(df)-n-1, -1)] # вектор значений битко
ина
```

In [4]:
```
fig = plt.figure(figsize=(15, 3))
plt.plot (np.linspace (1, n-1, n-1), btc, color='black')
plt.title('BTC rate with 1h timeframe')
plt.ylabel('BTC')
plt.show()
```



In [5]:
```
X = [(btc[i]-btc[i-1])/btc[i-1] for i in range(len(btc) - 1)] # доходность
```

In [6]:
```
training_sample = np.array(X[:int(len(X)*0.7)]) # разделяем выборку : 90% обучающая и 10% те
стовая
test_sample = np.array(X[int(len(X)*0.7):])
```

In [7]:
```
m = 10

def S(a, sample = training_sample):
    Sum = 0
    Length = len(sample)
    for l in range(m, Length):
        x = sample[l-m:l]
        y = sample[l]
        Sum += abs(np.dot(x, a) - y)
    return Sum/Length
```

In [8]:
```
bound = Bounds(np.zeros(m), [np.inf for i in range(m)]) # условие неотрицательности - веса >
= 0
lc = LinearConstraint(np.ones(m), [1], [1])
a = minimize(S, np.zeros(m), bounds=bound, constraints=lc)
```

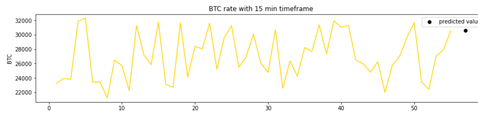
In [9]:
```
print('Training sample error:', S(a.x, training_sample))
print('Test sample error: ', S(a.x, test_sample))
print('Prediction accuracy: ' + str(round((1-S(a.x, test_sample))*100, 3)) + " %")
```

```
Training sample error: 0.09513228799093715
Test sample error:  0.05084069463708846
Prediction accuracy: 94.916 %
```

In [10]:
```
Return = np.dot(a.x, X[len(X)-m:])
print("Difference:", Return)
btc_predict = btc[len(btc)-1] + Return
print("Predict:", round(btc_predict, 4))
```

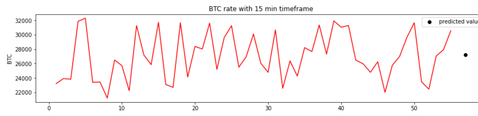
```
Difference: 0.051105767370067 72
Predict: 30549.0511
```

In [11]:
```
fig = plt.figure(figsize=(15, 3))
plt.plot (np.linspace (1, n-1, n-1), btc, color='gold')
plt.scatter(n+1, btc_predict , color='black', label='predicted value')
plt.title('BTC rate with 15 min timeframe')
plt.ylabel('BTC')
plt.legend()
plt.show()
```



In [12]:
```
# посмотрим, что будет, если не вычислять доходность, а просто вычислить значение биткоина н
а основе изначальной выборки
training_sample_btc = np.array(btc[:int(len(btc)*0.7)])
test_sample_btc = np.array(btc[int(len(btc)*0.7):])
a_btc = minimize(S, np.zeros(m), bounds=bound, constraints=lc)
btc_next = np.dot(a_btc.x, btc[len(btc) - m:])
```

In [13]:
```
fig = plt.figure(figsize=(15, 3))
plt.plot (np.linspace (1, n-1, n-1), btc, color='red')
plt.scatter(n+1, btc_next , color='black', label='predicted value')
plt.title('BTC rate with 15 min timeframe')
plt.ylabel('BTC')
plt.legend()
plt.show()
```



In [14]:
```
print('Difference between 1-st and 2-nd predictions: ' + str(abs(round(btc_next, 4) - btc_pr
edict)))
print('Prediction using yield: ' + str(btc_predict))
print('Prediction using BTC rate: ' + str(btc_next))
```

```
Difference between 1-st and 2-nd predictions: 3302.321605767367
Prediction using yield: 30549.05110576737
Prediction using BTC rate: 27246.72951391516
```

In [ ]:
```

```

In [ ]:
```

```