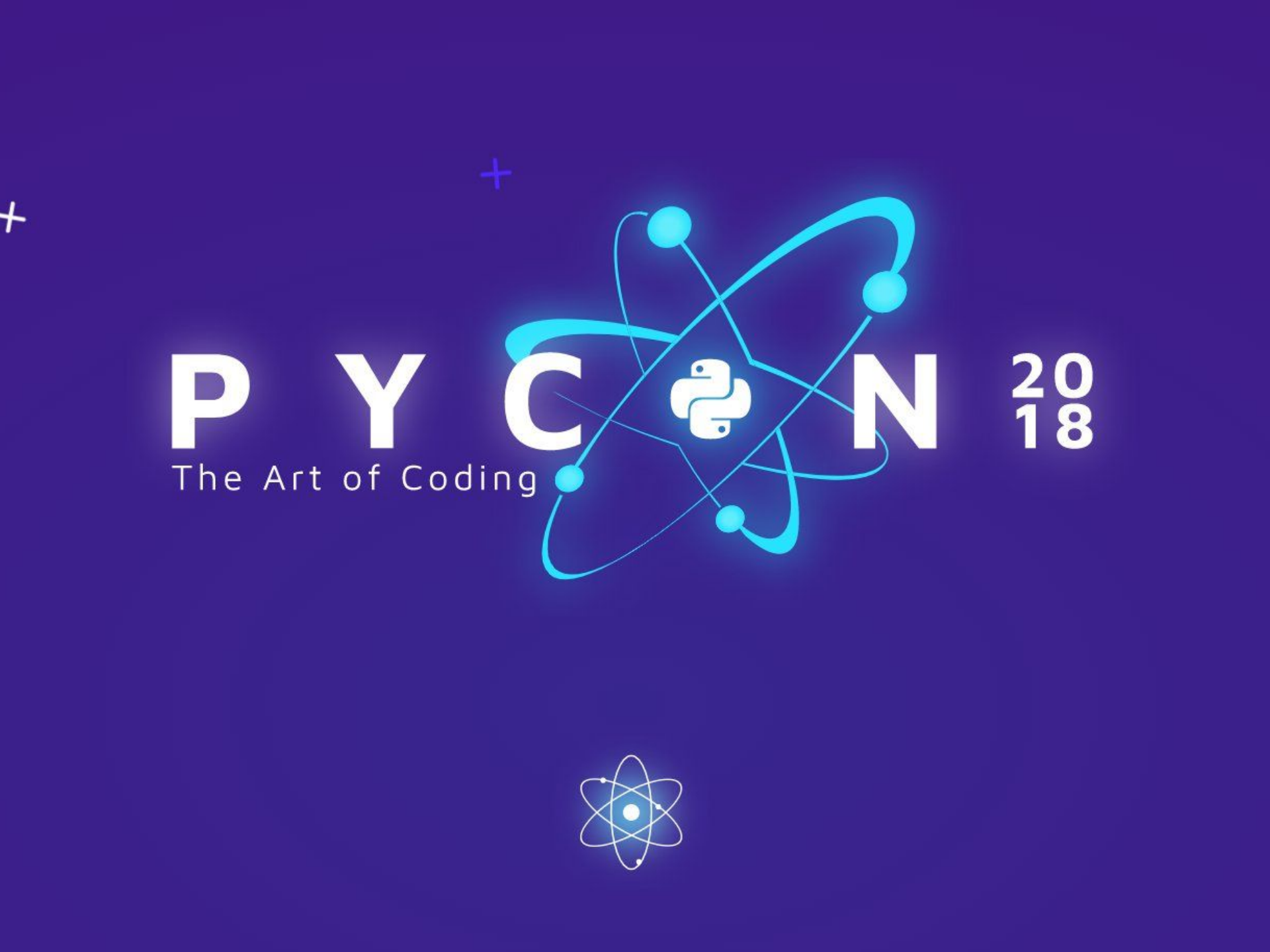

PYCON
2018
The Art of Coding

Speaker

PYCON 2018

The Art of Coding

Max Humber (Canada)

Personal Pynance

PyCon Colombia- Python Conference
February 9, 10 and 11 - 2018 in Medellin, Colombia

WWW.PYCON.CO

personal **py**nance

@maxhumber

<link to slides>


irr
borrow
budget
balance

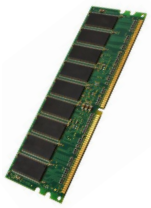
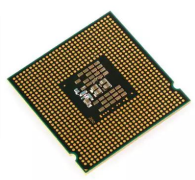

irr
borrow
budget
balance


LEMONADE
10¢


LEMONADE
10¢


WOW
very currency wow much coin how money so crypto plz mine v rich very


1+2=?

$3000

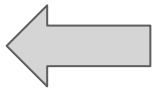
date	income	expenses
2017-01-01	0	-3000
2018-01-01	1000	0
2019-01-01	1000	0
2020-01-01	1000	0
2021-01-01	1000	0

date	income	expenses	
2017-01-01	0	-3000	-3000
2018-01-01	1000	0	1000
2019-01-01	1000	0	1000
2020-01-01	1000	0	1000
2021-01-01	1000	0	1000

```
ROI = (4000 - 3000) / 3000
```

date	income	expenses	
2017-01-01	0	-3000	-3000
2018-01-01	1000	0	1000
2019-01-01	1000	0	1000
2020-01-01	1000	0	1000
2021-01-01	1000	0	1000
			=IRR(...)

date	income	expenses	
2017-01-01	0	-3000	-3000
2018-01-01	1000	0	1000
2019-01-01	1000	0	1000
2020-01-01	1000	0	1000
2021-01-01	1000	0	1000
			13%



date	income	expenses
2017-01-01	40	-3000
2017-01-25	40	0
2017-02-12	80	0
2017-02-14	100	0
2017-03-04	100	0
2017-04-23	160	0
2017-05-07	140	0
2017-05-21	140	0
2017-06-04	80	0
2017-06-19	180	0
2017-07-16	360	0
2017-08-27	160	0
2017-09-24	240	0
2017-10-21	420	0
2017-11-19	400	0
2017-12-03	340	0
2017-12-17	360	0
2017-12-31	540	0

date	income	expenses
2017-01-01	40	-3000
2017-01-25	40	0
2017-02-12	80	0
2017-02-14	100	0
2017-03-04	100	0
2017-04-23	160	0
2017-05-07	140	0
2017-05-21	140	0
2017-06-04	80	0
2017-06-19	180	0
2017-07-16	360	0
2017-08-27	160	0
2017-09-24	240	0
2017-10-21	420	0
2017-11-19	400	0
2017-12-03	340	0
2017-12-17	360	0
2017-12-31	540	0

=XIRR([v],[d])

date	income	expenses	
2017-01-01	40	-3000	-2960
2017-01-25	40	-50	-10
2017-02-12	80	-50	30
2017-02-14	100	-30	70
2017-03-04	100	-20	80
2017-04-23	160	-30	130
2017-05-07	140	-20	120
2017-05-21	140	-40	100
2017-06-04	80	-40	40
2017-06-19	180	-30	150
2017-07-16	360	-40	320
2017-08-27	160	-30	130
2017-09-24	240	-20	220
2017-10-21	420	-50	370
2017-11-19	400	-20	380
2017-12-03	340	-40	300
2017-12-17	360	-40	320
2017-12-31	540	-40	500
			=XIRR(...)

date	income	expenses	
2017-01-01	40	-3000	-2960
2017-01-25	40	-50	-10
2017-02-12	80	-50	30
2017-02-14	100	-30	70
2017-03-04	100	-20	80
2017-04-23	160	-30	130
2017-05-07	140	-20	120
2017-05-21	140	-40	100
2017-06-04	80	-40	40
2017-06-19	180	-30	150
2017-07-16	360	-40	320
2017-08-27	160	-30	130
2017-09-24	240	-20	220
2017-10-21	420	-50	370
2017-11-19	400	-20	380
2017-12-03	340	-40	300
2017-12-17	360	-40	320
2017-12-31	540	-40	500
			13.8%

why you shouldn’t use excel...

why you shouldn’t use excel...

```
import pandas as pd


df = pd.read_excel('data/irr.xlsx', sheet_name='regular')
```

```python
import pandas as pd


df = pd.read_excel('data/irr.xlsx', sheet_name='regular')
df['total'] = df.income + df.expenses
```

```
df
```

	date	income	expenses	total
0	2017-01-01	0	-3000	-3000
1	2018-01-01	1000	0	1000
2	2019-01-01	1000	0	1000
3	2020-01-01	1000	0	1000
4	2021-01-01	1000	0	1000

IRR ~ the discount rate at which the NPV is of a potential investment is 0.

IRR ~ the discount rate at which the NPV is of a potential investment is 0.

NPV ~ the difference between the PV value of cash inflows (discounted) and the PV of cash outflows over a period of time.

```
def xnpv(rate, values, dates):
    '''Replicates the XNPV() function'''
    min_date = min(dates)
    return sum([
        value / (1 + rate)**((date - min_date).days / 365)
        for value, date
        in zip(values, dates)
    ])
```

```
def xnpv(rate, values, dates):
    '''Replicates the XNPV() function'''
    min_date = min(dates)
    return sum([
        value / (1 + rate)**((date - min_date).days / 365)
        for value, date
        in zip(values, dates)
    ])


xnpv(0.05, df.total, df.date)
```

```python
def xnpv(rate, values, dates):
    '''Replicates the XNPV() function'''
    min_date = min(dates)
    return sum([
        value / (1 + rate)**((date - min_date).days / 365)
        for value, date
        in zip(values, dates)
    ])


xnpv(0.05, df.total, df.date)
```

```
>>> 545.84
```

```
xnpv(0.06, df.total, df.date)  464.97917229138625
```

```
xnpv(0.06, df.total, df.date) 464.97917229138625
xnpv(0.07, df.total, df.date) 387.0698546137953
```

```
xnpv(0.06, df.total, df.date) 464.97917229138625
xnpv(0.07, df.total, df.date) 387.0698546137953
xnpv(0.08, df.total, df.date) 311.9718737447598
```

```
xnpv(0.06, df.total, df.date) 464.97917229138625
xnpv(0.07, df.total, df.date) 387.0698546137953
xnpv(0.08, df.total, df.date) 311.9718737447598
xnpv(0.09, df.total, df.date) 239.55263528320688
xnpv(0.11, df.total, df.date) 102.25737356965487
xnpv(0.13, df.total, df.date) -25.734005456105 82
xnpv(0.127, df.total, df.date) -7.095187489694013
xnpv(0.1265, df.total, df.date) -3.969988566829 67
```

```
xnpv(0.06, df.total, df.date) 464.97917229138625
xnpv(0.07, df.total, df.date) 387.0698546137953
xnpv(0.08, df.total, df.date) 311.9718737447598
xnpv(0.09, df.total, df.date) 239.55263528320688
xnpv(0.11, df.total, df.date) 102.25737356965487
xnpv(0.13, df.total, df.date) -25.734005456105 82
xnpv(0.127, df.total, df.date) -7.095187489694013
xnpv(0.1265, df.total, df.date) -3.969988566829 67
xnpv(0.1261, df.total, df.date) -1.465953615344688
xnpv(0.1259, df.total, df.date) -0.21264203303235263
xnpv(0.12587, df.total, df.date) -0.024570813019181514
```

```
from scipy.optimize import newton

def xirr(values, dates):
    '''Replicates the XIRR() function'''
    return newton(lambda r: xnpv(r, values, dates), 0)
```

```python
from scipy.optimize import newton

def xirr(values, dates):
    '''Replicates the XIRR() function'''
    return newton(lambda r: xnpv(r, values, dates), 0)
```

```
xirr(df.total, df.date) 0.1258660808393406
```

date	income	expenses
2017-01-01	40	-3000
2017-01-25	40	-50
2017-02-12	80	-50
2017-02-14	100	-30
2017-03-04	100	-20
2017-04-23	160	-30

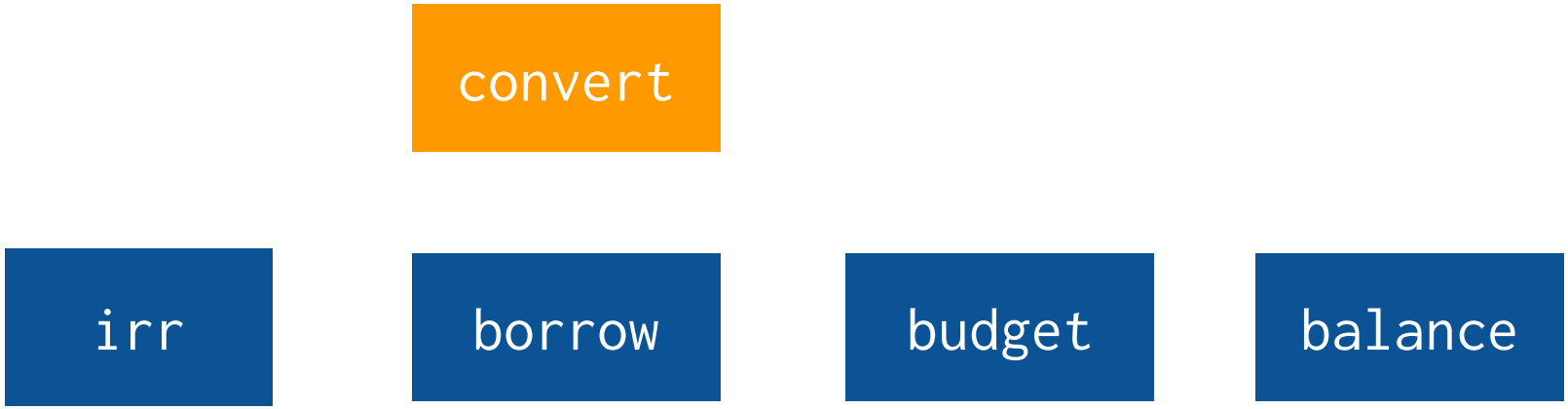
```
df = pd.read_excel('data/irr.xlsx', sheet_name='irregular')
df['total'] = df.income + df.expenses
```

date	income	expenses
2017-01-01	40	-3000
2017-01-25	40	-50
2017-02-12	80	-50
2017-02-14	100	-30
2017-03-04	100	-20
2017-04-23	160	-30

```
df = pd.read_excel('data/irr.xlsx', sheet_name='irregular')
df['total'] = df.income + df.expenses
```

```
xirr(df.total, df.date) 0.13812581670383556
```


irr
borrow
budget
balance


convert
irr
borrow
budget
balance

Google

100 cad to cop

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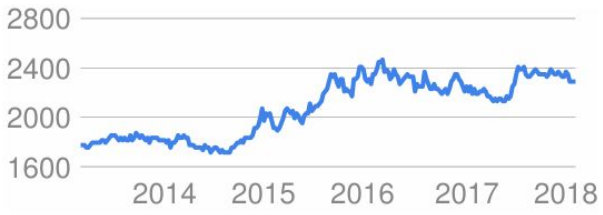
About 8,520,000 results (0.38 seconds)

100 Canadian Dollar equals

230335.21 Colombian Peso

100	Canadian Dollar
230335.21	Colombian Peso



Disclaimer

open exchange rates

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Our currency data API powers the Internet's most dynamic startups, brands and organisations.

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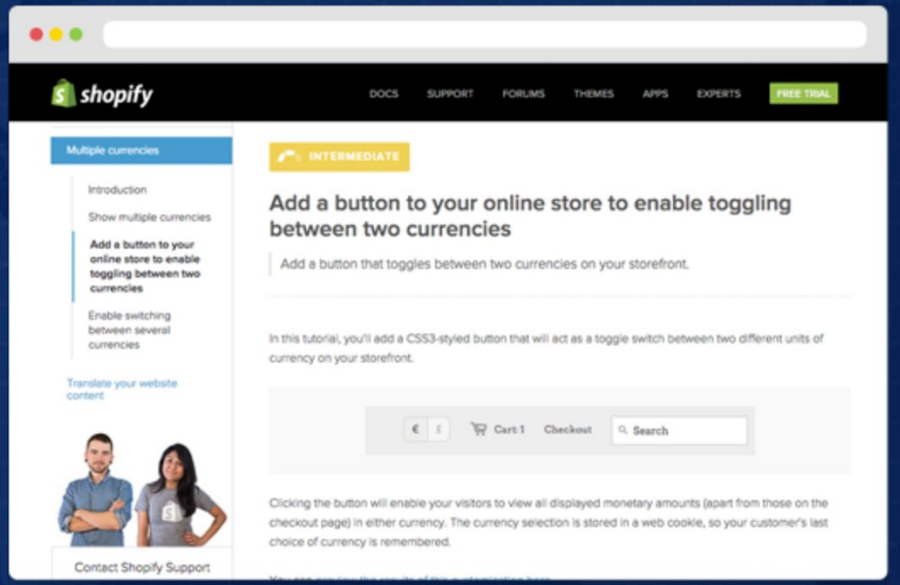


Powering seamless cross-currency payments at Shopify

Definition

https://openexchangerates.org/api/latest.json

Parameters

Query Params

app_id:	**string** *Required* Your unique App ID
base:	**string** *Optional* Change base currency (3-letter code, default: USD)
symbols:	**string** *Optional* Limit results to specific currencies (comma-separated list of 3-letter codes)
prettyprint:	**boolean** *Optional* Set to false to reduce response size (removes whitespace)
show_alternative:	**boolean** *Optional* Extend returned values with alternative, black market and digital currency rates

Examples

HTTP · jQuery

```
https://openexchangerates.org/api/latest.json?app_id=YOUR_APP_ID
```

```
symbols = ['CAD', 'USD', 'COP']


r = requests.get(
    'https://openexchangerates.org/api/latest.json',
    params = {
        'app_id': API_KEY,
        'symbols': symbols,
        'show_alternative': 'true'
        }
    )
```

convert.py .env

```
1 OPX_KEY = 9a17f58dfd528cc7356fdbc848c3cc7d
2
3
```

(^^fake)

```python
import os
import requests
from dotenv import load_dotenv, find_dotenv

load_dotenv(find_dotenv())

API_KEY = os.environ.get('OPX_KEY')
```

```
symbols = ['CAD', 'USD', 'COP']


r = requests.get(
    'https://openexchangerates.org/api/latest.json',
    params = {
        'app_id': API_KEY,
        'symbols': symbols,
        'show_alternative': 'true'
        }
    )

rates_ = r.json()['rates']
```

```
rates_ {'CAD': 1.242151, 'COP': 2840, 'USD': 1}
```

```
symbol_from = 'CAD'
symbol_to = 'COP'
value = 100

value * 1/rates_.get(symbol_from) * rates_.get(symbol_to)
```

```
symbol_from = 'CAD'
symbol_to = 'COP'
value = 100

value * 1/rates_.get(symbol_from) * rates_.get(symbol_to)
```

```
>>> 228635
```

```
class CurrencyConverter:

    def __init__(self, symbols, API_KEY):

        self.API_KEY = API_KEY
        self.symbols = symbols
        self._symbols = ','.join([str(s) for s in symbols])

        r = requests.get(
            'https://openexchangerates.org/api/latest.json',
            params = {
                'app_id': self.API_KEY,
                'symbols': self._symbols,
                'show_alternative': 'true'
                }
            )

        self.rates_ = r.json()['rates']
        self.rates_['USD'] = 1
```

(CurrencyConverter continued…)

```
    def convert(self, value, symbol_from, symbol_to, round_output=True):

        try:
            x = value * 1/self.rates_.get(symbol_from) * self.rates_.get(symbol_to)
            if round_output:
                return round(x, 2)
            else:
                return x
        except TypeError:
            print('Unavailable or invalid symbol')
            return None
```

```
API_KEY = os.environ.get("OPX_KEY")
c = CurrencyConverter(['CAD', 'USD', 'COP'], API_KEY)


c.convert(100, 'CAD', 'COP')
```

```
API_KEY = os.environ.get("OPX_KEY")
c = CurrencyConverter(['CAD', 'USD', 'COP'], API_KEY)


c.convert(100, 'CAD', 'COP')
```

```
>>> 228635
```

```
API_KEY = os.environ.get("OPX_KEY")
c = CurrencyConverter(['CAD', 'COP', 'DOGE'], API_KEY)


c.convert(100000, 'COP', 'DOGE')
```

```
API_KEY = os.environ.get("OPX_KEY")
c = CurrencyConverter(['CAD', 'COP', 'DOGE'], API_KEY)


c.convert(100000, 'COP', 'DOGE')
```

```
>>> 10599.63
```

```
API_KEY = os.environ.get("OPX_KEY")
c = CurrencyConverter(['CAD', 'COP', 'DOGE'], API_KEY)


c.convert(100000, 'COP', 'DOGE')
```

```
>>> 10599.63
```

	date	total
0	2017-01-01	-2960
1	2017-01-25	-10
2	2017-02-12	30
3	2017-02-14	70
4	2017-03-04	80
5	2017-04-23	130
6	2017-05-07	120
7	2017-05-21	100
8	2017-06-04	40
9	2017-06-19	150
10	2017-07-16	320
11	2017-08-27	130
12	2017-09-24	220
13	2017-10-21	370
14	2017-11-19	380
15	2017-12-03	300
16	2017-12-17	320
17	2017-12-31	500

```
df['total'] = df['total'].apply(lambda x: c.convert(x, 'CAD', 'COP'))
df = df[['date', 'total']]
df
```

	date	total
0	2017-01-01	-6844457.69
1	2017-01-25	-23123.17
2	2017-02-12	69369.50
3	2017-02-14	161862.18
4	2017-03-04	184985.34
5	2017-04-23	300601.18
6	2017-05-07	277478.01
7	2017-05-21	231231.68
8	2017-06-04	92492.67
9	2017-06-19	346847.52
10	2017-07-16	739941.37
11	2017-08-27	300601.18
12	2017-09-24	508709.69
13	2017-10-21	855557.21
14	2017-11-19	878680.38
15	2017-12-03	693695.04
16	2017-12-17	739941.37
17	2017-12-31	1156158.39


DEAL WITH IT


DEAL WITH IT


irr
borrow
budget
balance

3000.00 USD

3000.00 USD

8,520,000.00 COP

3000.00 USD

8,520,000.00 COP

Banco de Bogotá

Banco AV Villas

Bancolombia

8,520,000.00 COP

14 months

5.75%

20 months

3.99%

8 months

8.99%

Banco de Bogotá

14 months

5.75%

Banco AV Villas

20 months

3.99%

Bancolombia

8 months

8.99%

Amortization refers to the process of paying off a debt over time through regular payments. A portion of each payment is for interest while the remaining amount is applied towards the principal balance

```
import pandas as pd
import numpy as np
import datetime

loan = 8520000.00
rate = 0.05
term = 120
```

```
import pandas as pd
import numpy as np
import datetime

loan = 8520000.00
rate = 0.05
term = 120
```

$$P = \frac{r(PV)}{1-(1+r)^{-n}}$$

$P = Payment$
$PV = Present\ Value$
$r = rate\ per\ period$
$n = number\ of\ periods$

```
import pandas as pd
import numpy as np
import datetime

loan = 8520000.00
rate = 0.05
term = 120
```

$$P = \frac{r(PV)}{1-(1+r)^{-n}}$$

$P = Payment$
$PV = Present\ Value$
$r = rate\ per\ period$
$n = number\ of\ periods$

```
payment = loan * (rate / 12) / (1 - (1 + (rate / 12))**(-term))
```

```
import pandas as pd
import numpy as np
import datetime

loan = 8520000.00
rate = 0.05
term = 120
```

$$P = \frac{r(PV)}{1-(1+r)^{-n}}$$

$P = Payment$
$PV = Present\ Value$
$r = rate\ per\ period$
$n = number\ of\ periods$

```
payment = loan * (rate / 12) / (1 - (1 + (rate / 12))**(-term))
```

```
>>> 80317
```

```
import pandas as pd
import numpy as np
import datetime

loan = 8520000.00
rate = 0.05
term = 120
```

```
payment = np.round(-np.pmt(rate/12, term, loan), 2)
```

```
>>> 80317
```

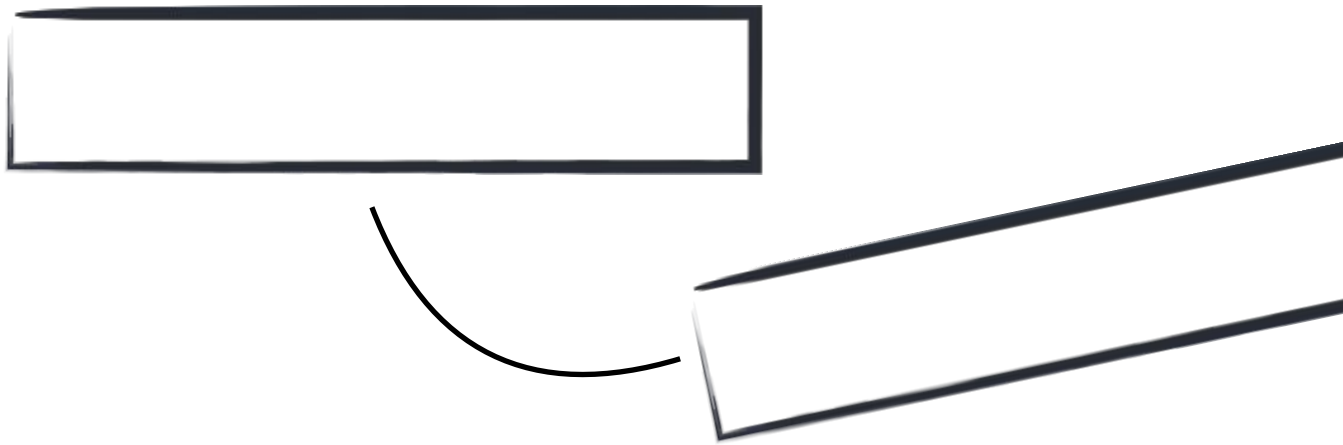
```
balance = loan
df = pd.DataFrame({
    'month': [0],
    'payment': [np.NaN],
    'interest': [np.NaN],
    'principal': [np.NaN],
    'balance': [balance]
})
df
```

	balance	interest	month	payment	principal
0	8520000.0	NaN	0	NaN	NaN

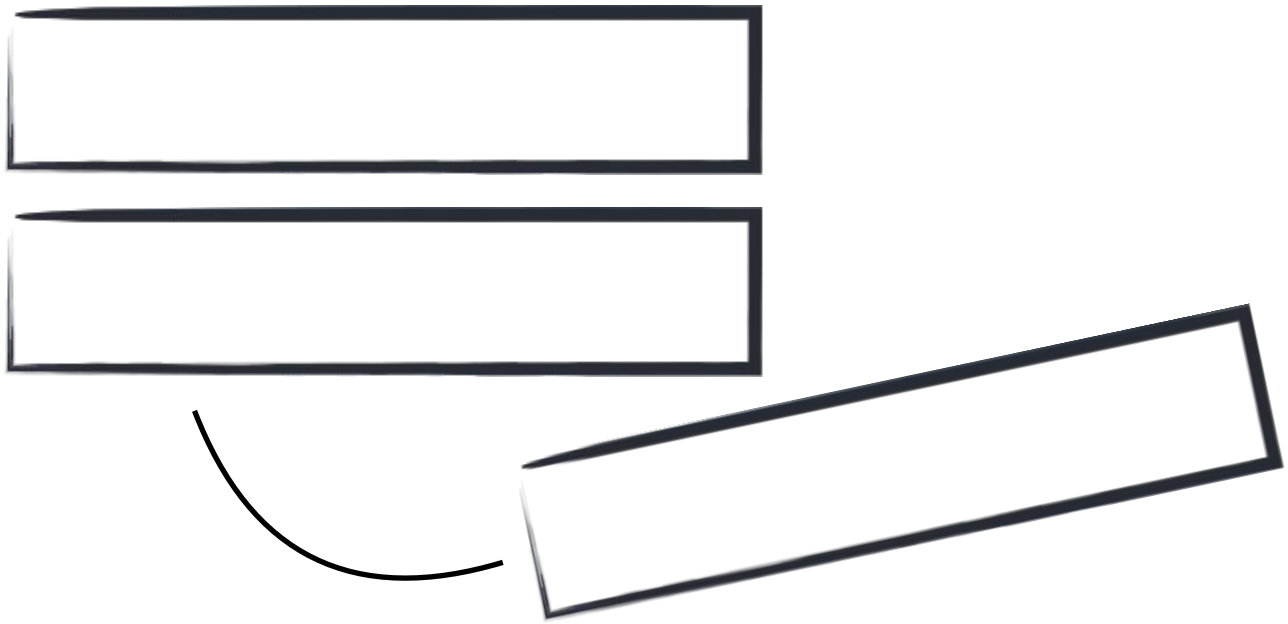
```
balance = loan

df = pd.DataFrame({
    'month': [0],
    'payment': [np.NaN],
    'interest': [np.NaN],
    'principal': [np.NaN],
    'balance': [balance]
})

for i in range(1, term + 1):
    interest = round(rate/12 * balance, 2)
    principal = payment - interest
    balance = balance - principal

    df = df.append(
        pd.DataFrame({
            'month': [i],
            'payment': [payment],
            'interest': [interest],
            'principal': [principal],
            'balance': [balance]
        })
    )
```

```
for i in range(1, term + 1):
    interest = round(rate/12 * balance, 2)
    principal = payment - interest
    balance = balance - principal

    df = df.append(
        pd.DataFrame({
            'month': [i],
            'payment': [payment],
            'interest': [interest],
            'principal': [principal],
            'balance': [balance]
        })
    )
```

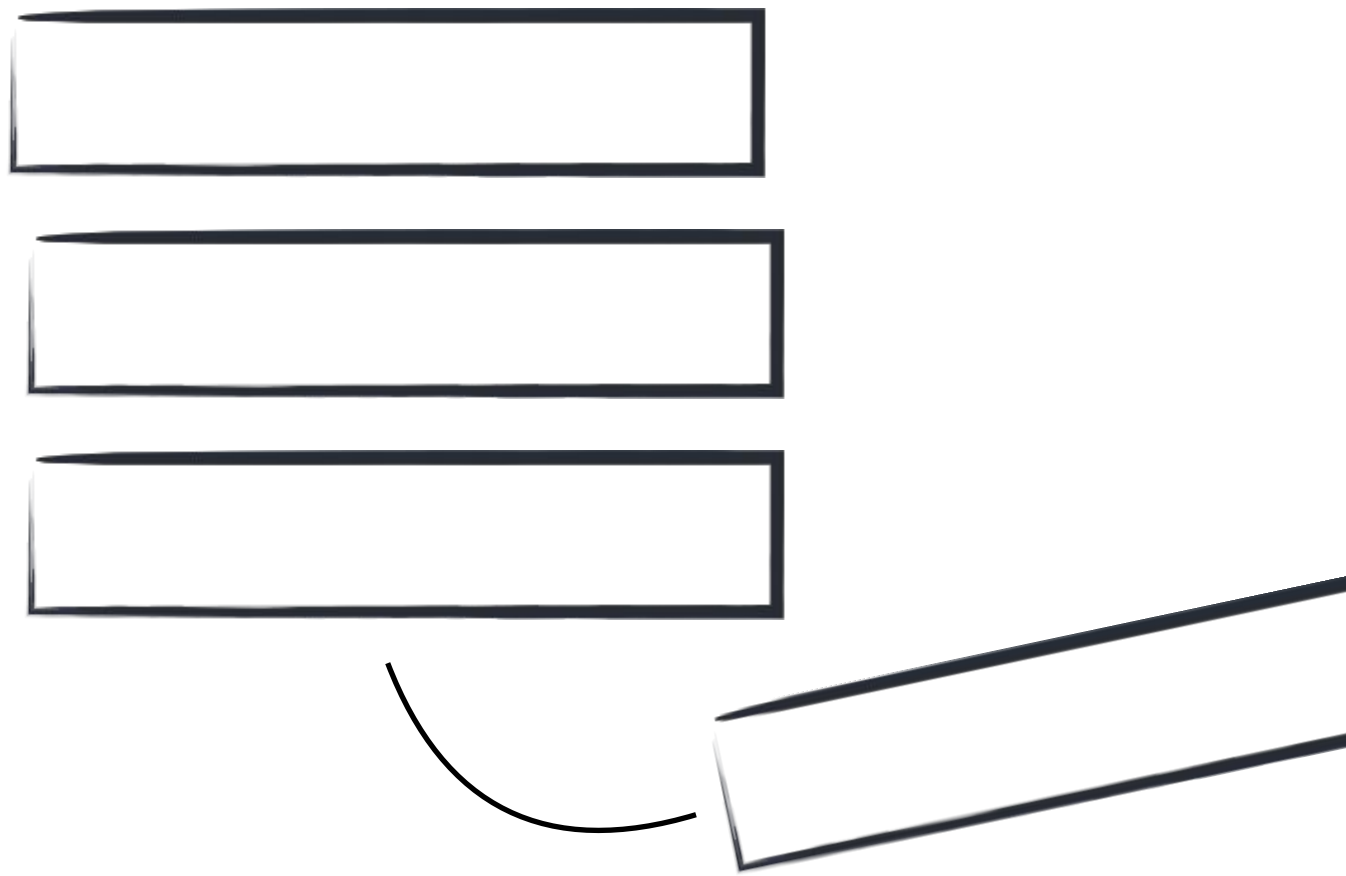
```
for i in range(1, term + 1):
    interest = round(rate/12 * balance, 2)
    principal = payment - interest
    balance = balance - principal

    df = df.append(
        pd.DataFrame({
            'month': [i],
            'payment': [payment],
            'interest': [interest],
            'principal': [principal],
            'balance': [balance]
        })
    )
```

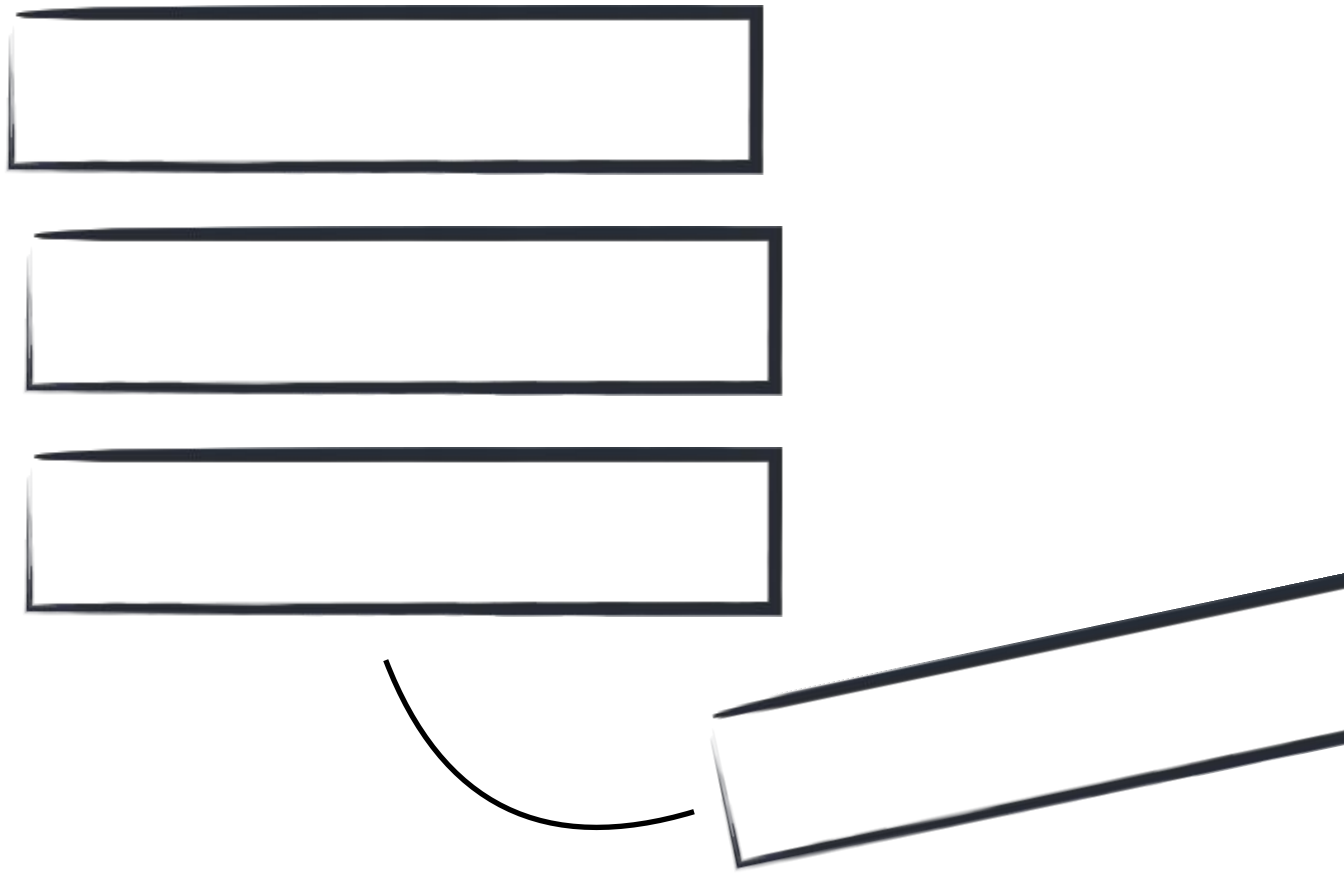


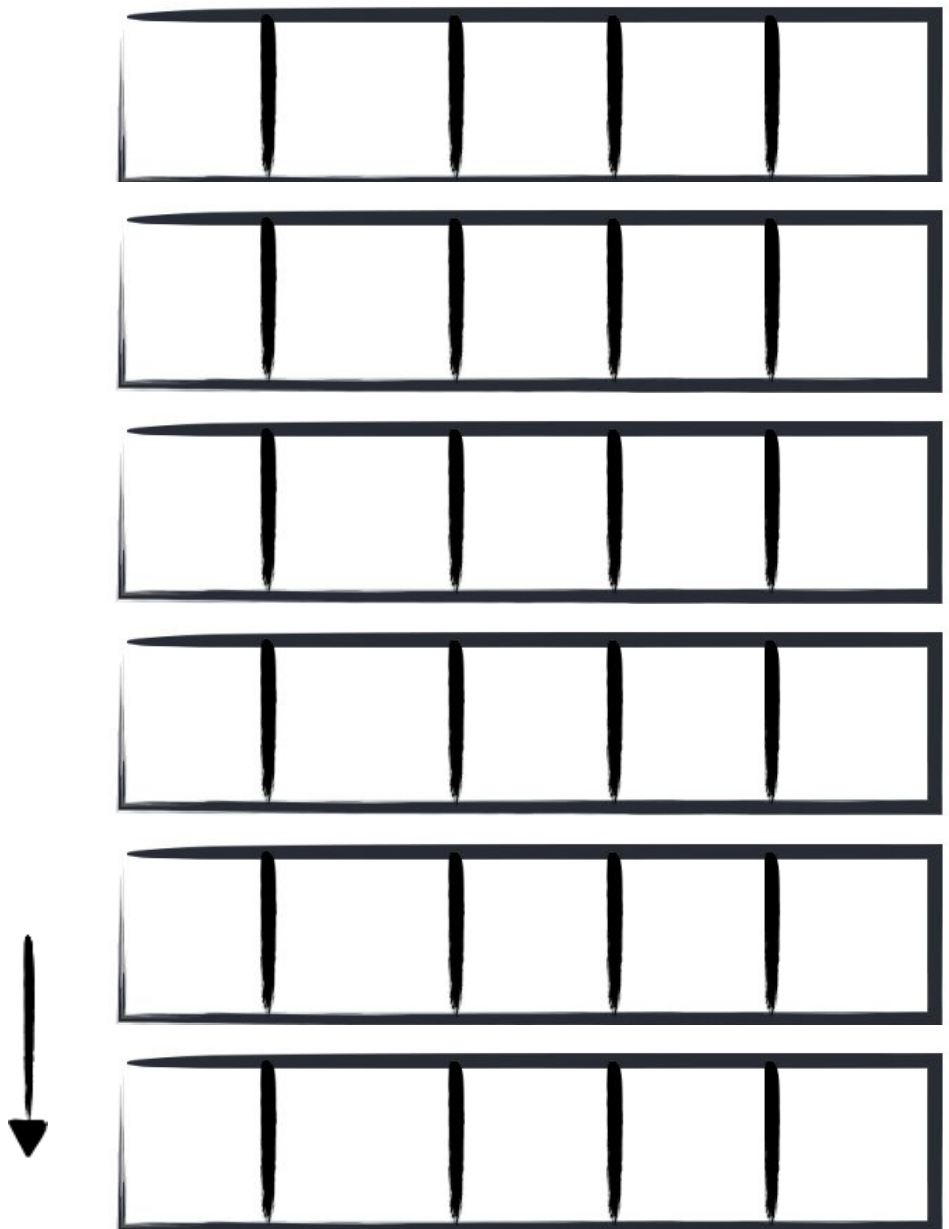
```
for i in range(1, term + 1):
    interest = round(rate/12 * balance, 2)
    principal = payment - interest
    balance = balance - principal

    df = df.append(
        pd.DataFrame({
            'month': [i],
            'payment': [payment],
            'interest': [interest],
            'principal': [principal],
            'balance': [balance]
        })
    )
```

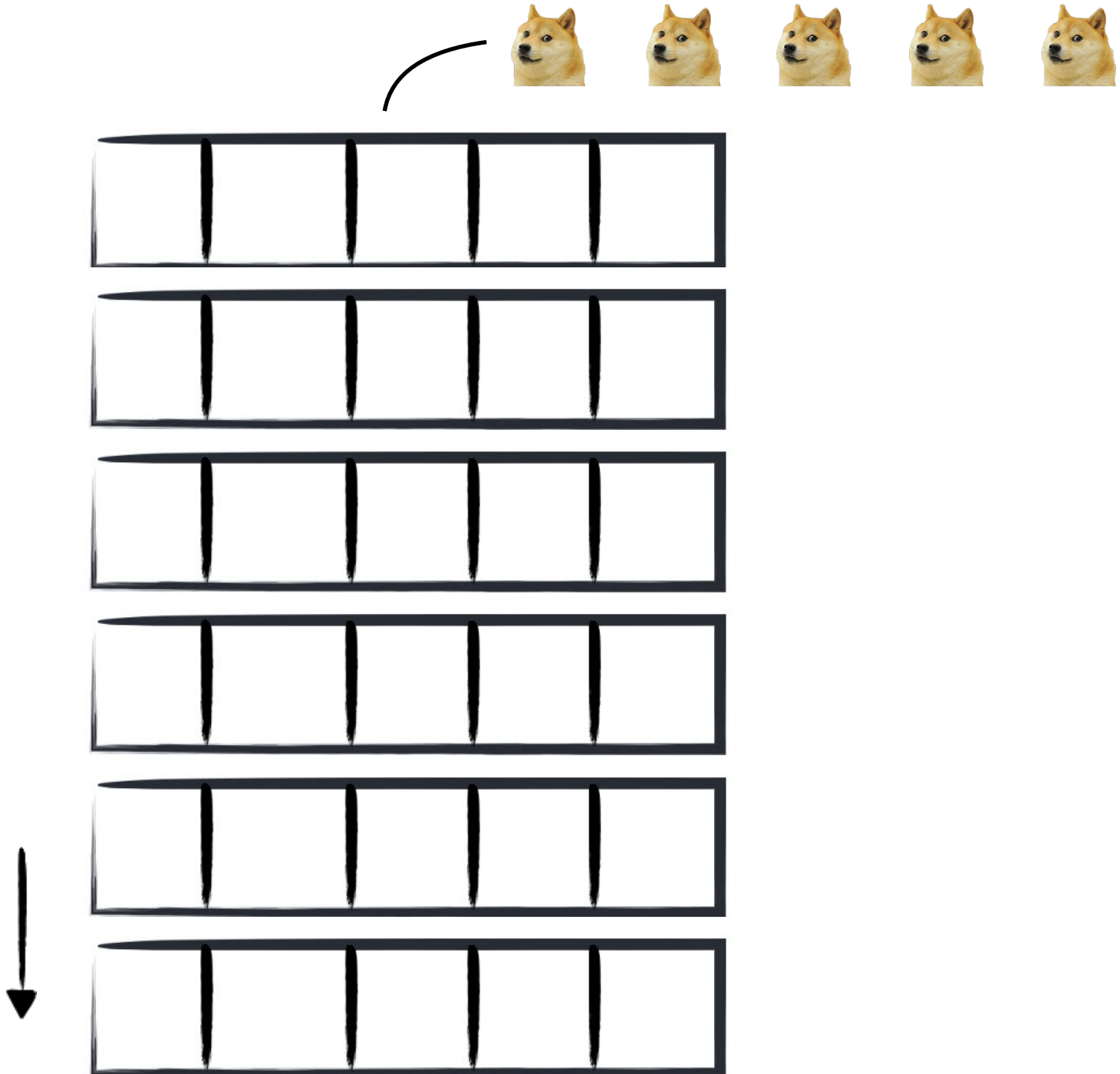


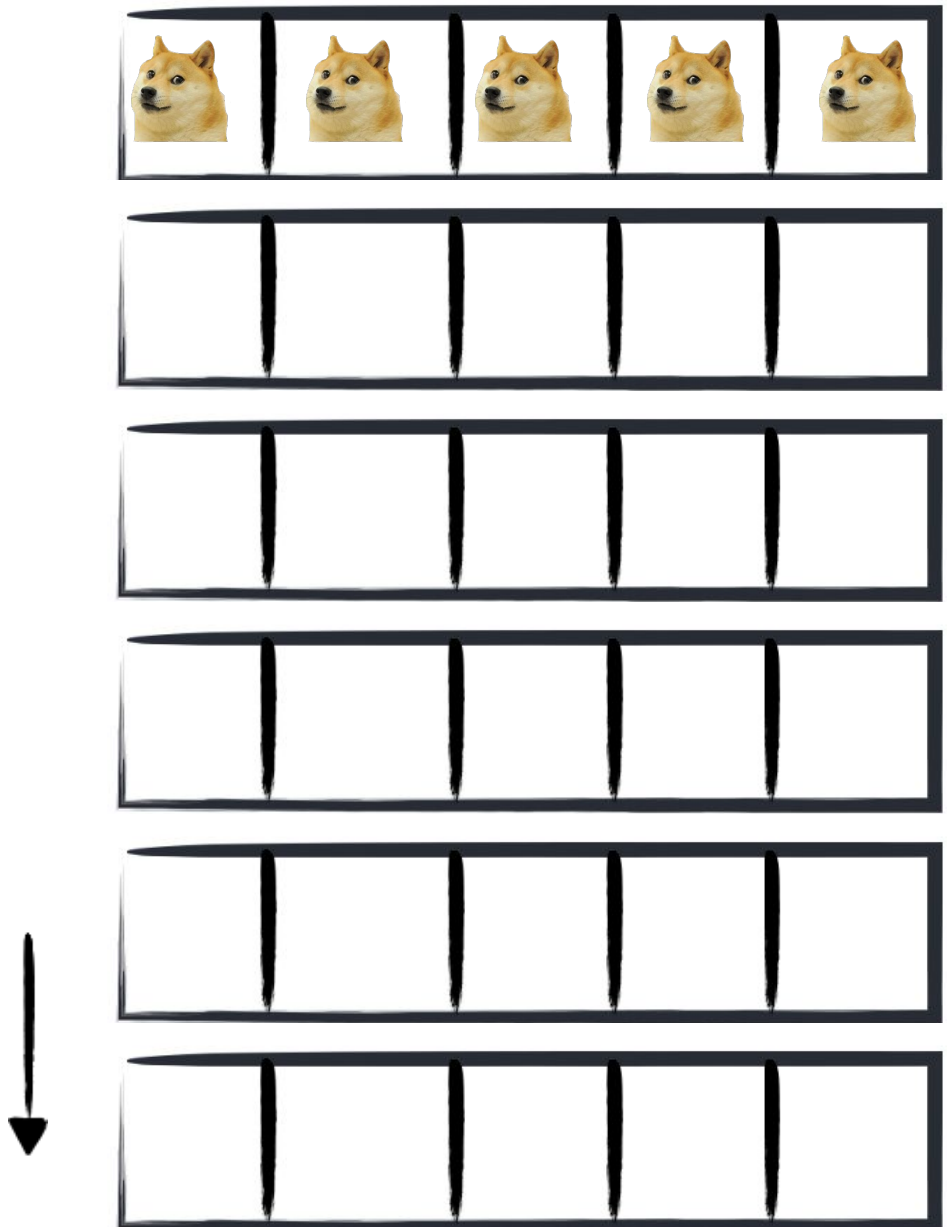
```
for i in range(1, term + 1):
    interest = round(rate/12 * balance, 2)
    principal = payment - interest
    balance = balance - principal

    df = df.append(
        pd.DataFrame({
            'month': [i],
            'payment': [payment],
            'interest': [interest],
            'principal': [principal],
            'balance': [balance]
        })
    )
```

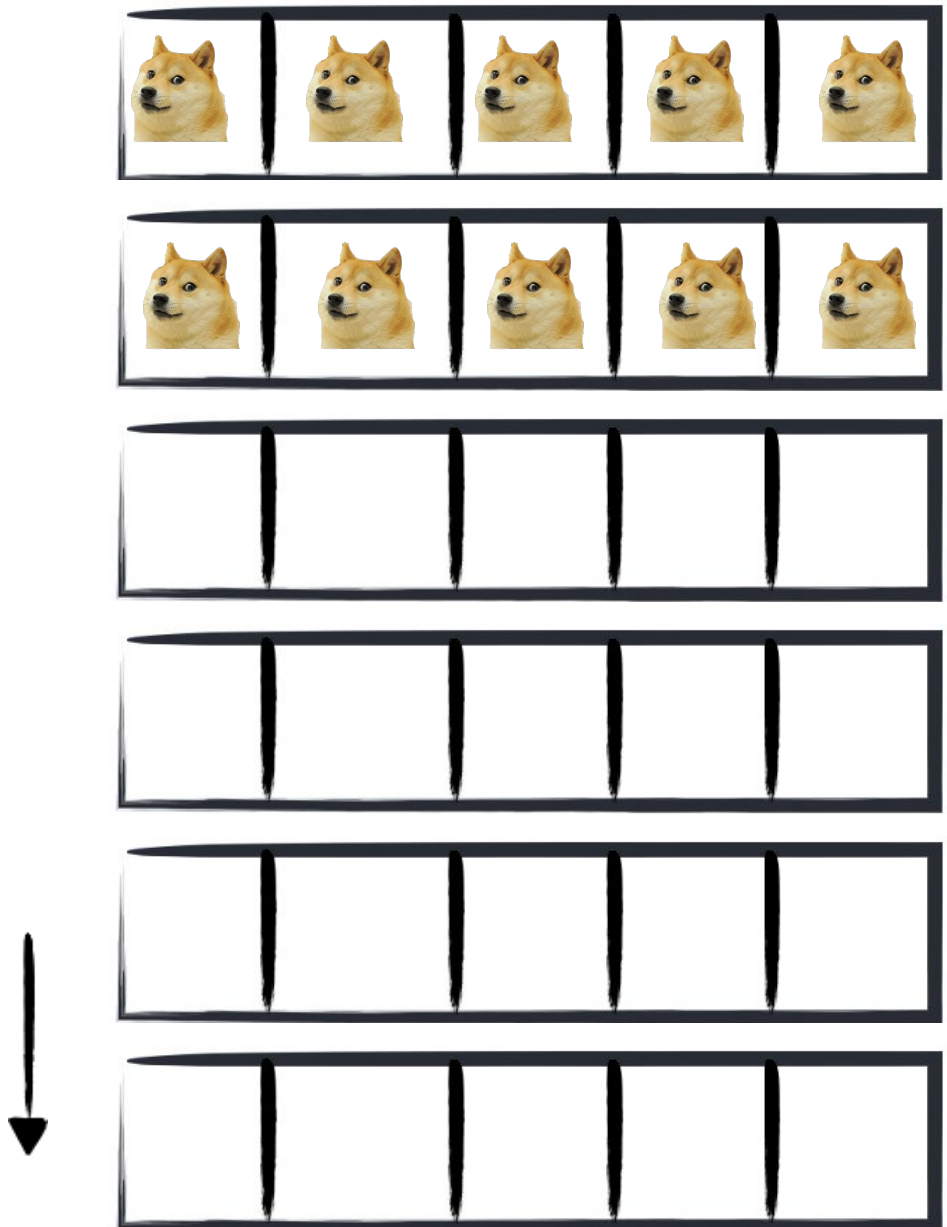


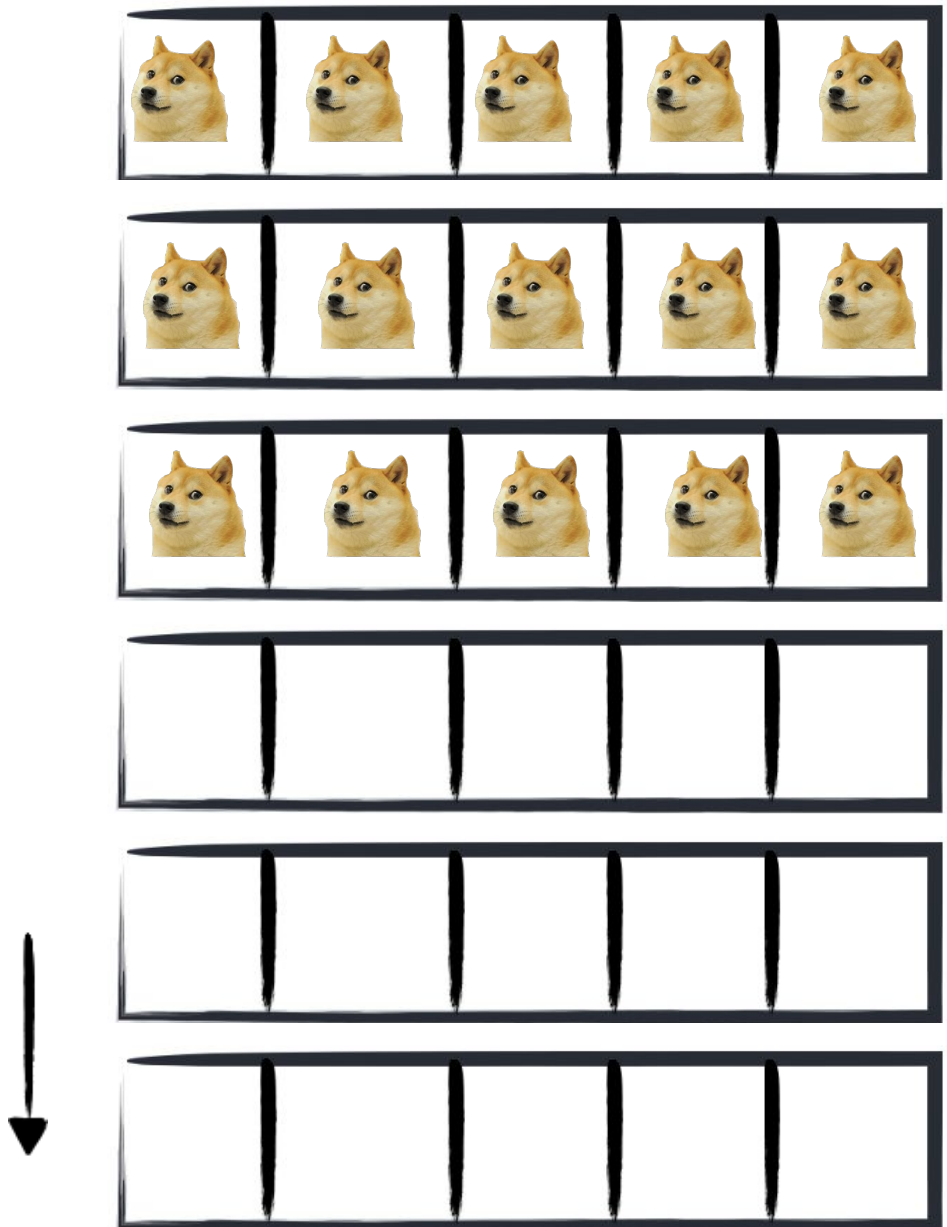












```
balance = loan
index = range(0, term)
columns = ['payment', 'interest', 'principal', 'balance']
df = pd.DataFrame(index=index, columns=columns)
```

```
df
```

	payment	interest	principal	balance
0	NaN	NaN	NaN	NaN
1	NaN	NaN	NaN	NaN
2	NaN	NaN	NaN	NaN
3	NaN	NaN	NaN	NaN
4	NaN	NaN	NaN	NaN
5	NaN	NaN	NaN	NaN
6	NaN	NaN	NaN	NaN
7	NaN	NaN	NaN	NaN
8	NaN	NaN	NaN	NaN
9	NaN	NaN	NaN	NaN
10	NaN	NaN	NaN	NaN
11	NaN	NaN	NaN	NaN
12	NaN	NaN	NaN	NaN

```
balance = loan
index = range(0, term)
columns = ['payment', 'interest', 'principal', 'balance']
df = pd.DataFrame(index=index, columns=columns)

for i in range(0, term):
    interest = round(rate/12 * balance, 2)
    principal = payment - interest
    balance = balance - principal

    df.iloc[i]['payment'] = payment
    df.iloc[i]['interest'] = interest
    df.iloc[i]['principal'] = principal
    df.iloc[i]['balance'] = balance
```

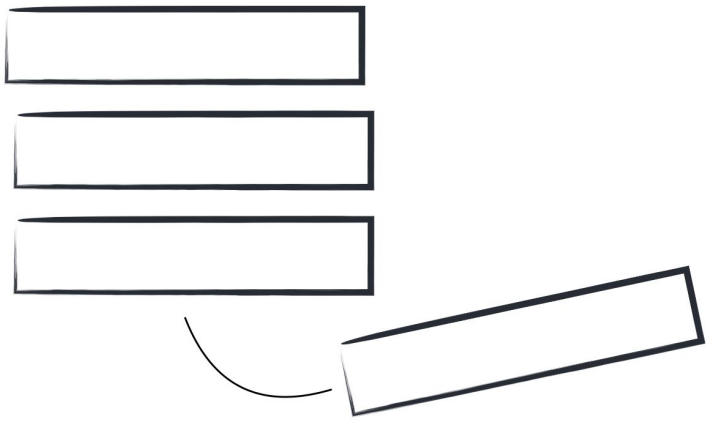
```
for i in range(0, 10):  # full term is 120
```

df

	payment	interest	principal	balance
0	80318	17750	62568	8.45743e+06
1	80318	17619.7	62698.3	8.39473e+06
2	80318	17489	62828.9	8.3319e+06
3	80318	17358.1	62959.8	8.26894e+06
4	80318	17227	63091	8.20585e+06
5	80318	17095.5	63222.4	8.14263e+06
6	80318	16963.8	63354.1	8.07928e+06
7	80318	16831.8	63486.1	8.01579e+06
8	80318	16699.6	63618.4	7.95217e+06
9	80318	16567	63750.9	7.88842e+06
10	NaN	NaN	NaN	NaN
11	NaN	NaN	NaN	NaN
12	NaN	NaN	NaN	NaN
13	NaN	NaN	NaN	NaN
14	NaN	NaN	NaN	NaN

```
%%timeit
better_way()
```

```
>>> 42.7 ms ± 6.38 ms per loop
>>> (mean ± std. dev. of 7 runs, 10 loops each)
```



169 ms per loop

42.7 ms per loop

```
def am(loan, rate, term):

    payment = round(-np.pmt(rate/12, term, loan), 2)
    balance = loan

    index = range(0, term)
    columns = ['payment', 'interest', 'principal', 'balance']
    df = pd.DataFrame(index=index, columns=columns)

    for i in range(0, term):
        interest = round(rate/12 * balance, 2)
        principal = payment - interest
        balance = balance - principal

        df.iloc[i]['payment'] = payment
        df.iloc[i]['interest'] = interest
        df.iloc[i]['principal'] = principal
        df.iloc[i]['balance'] = balance

    return df
```

8,520,000.00 COP

14 months

5.75%

20 months

3.99%

8 months

8.99%

8,520,000.00 COP

14 months

5.75%

20 months

3.99%

8 months

8.99%

```
loan = 8520000.00
am(loan, 0.0575, 14)
am(loan, 0.0399, 20)
am(loan, 0.0889,  8)
```

8,520,000.00 COP

14 months

5.75%

20 months

3.99%

8 months

8.99%

```
loan = 8520000.00
am(loan, 0.0575, 14)['interest']
am(loan, 0.0399, 20)['interest']
am(loan, 0.0889,  8)['interest']
```

8,520,000.00 COP

14 months

5.75%

20 months

3.99%

8 months

8.99%

```
loan = 8520000.00
am(loan, 0.0575, 14)['interest'].sum()
am(loan, 0.0399, 20)['interest'].sum()
am(loan, 0.0889,  8)['interest'].sum()
```

8,520,000.00 COP

14 months	20 months	8 months
5.75%	3.99%	8.99%

```
loan = 8520000.00
am(loan, 0.0575, 14)['interest'].sum()  309358.50
am(loan, 0.0399, 20)['interest'].sum()  300581.00
am(loan, 0.0889,  8)['interest'].sum()  286481.24
```

8,520,000.00 COP

Banco de Bogotá

Banco AV Villas

14 months

5.75%

20 months

3.99%

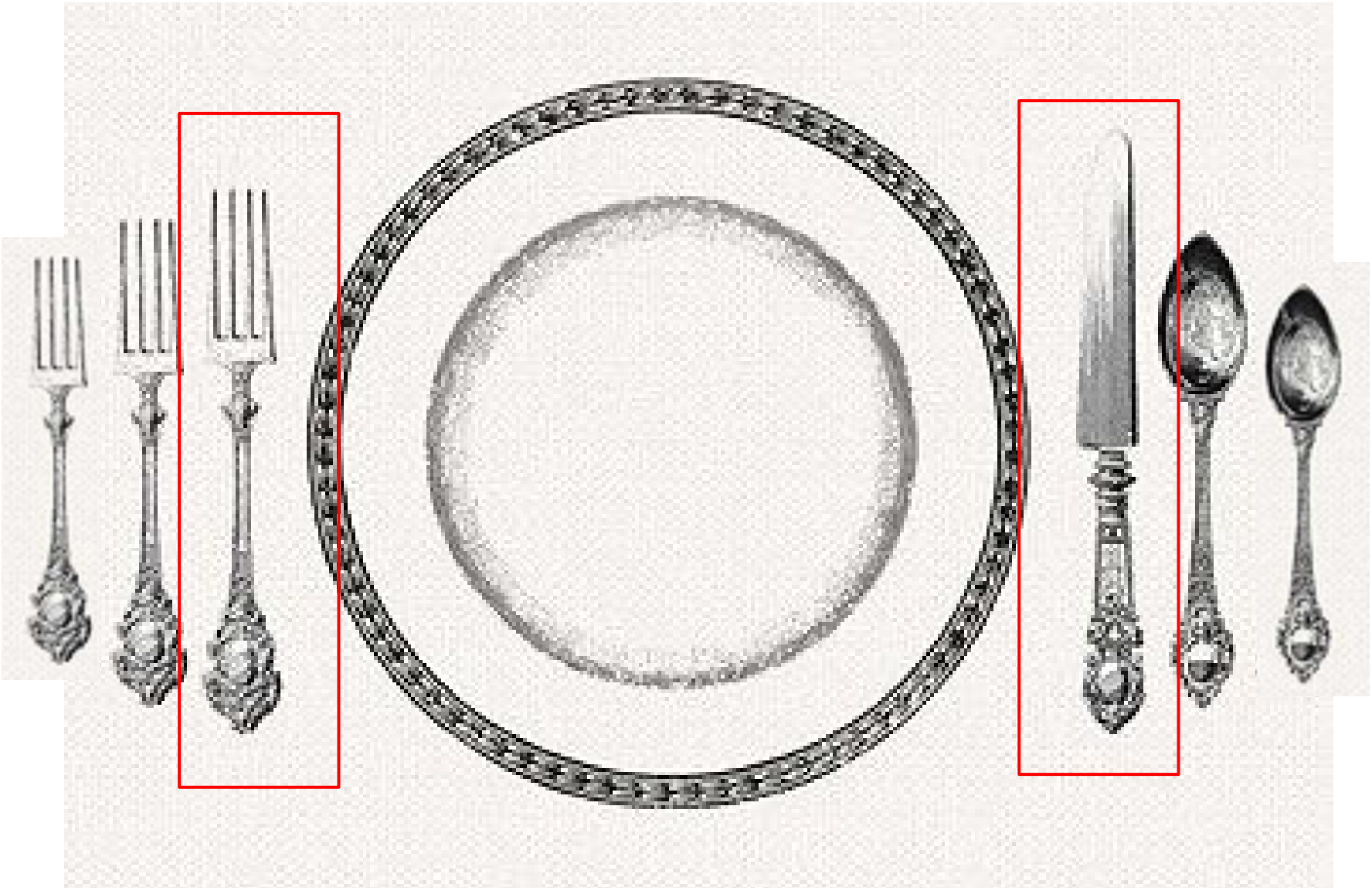
8 months

8.99%

```
loan = 8520000.00
am(loan, 0.0575, 14)['interest'].sum()  309358.50
am(loan, 0.0399, 20)['interest'].sum()  300581.00
am(loan, 0.0889,  8)['interest'].sum()  286481.24
```


irr
borrow
budget
balance


DOGE/
MOON
DOGE
NASA
Bancolombia
"TO THE MOON"



	A	B	C	D	E	F	G	H
1								
2		Bank	1000					
3								
4		Months	4			4		
5								
6			WINTER			SUMMER		
7			One Time	Monthly	Total	One Time	Monthly	Total
8								
9		FUNDING / INCOME						
10		Employment			0			0
11		Grants			0			0
12		Total FUNDING / INCOME	0	0	0	0	0	0
13								
14		EXPENSES						
15		Tuition			0			0
16		Books/Supplies			0			0
17		Rent		600	2400		600	2400
18		Cell Phone		65	260		65	260
19		Grocery		300	1200		300	1200
20		Transportation		110	440		110	440
21		Entertainment		300	1200		300	1200
22		Transfer to Savings			0			0
23		Other			0			0
24		SCENARIO PLANNING						
25		Trip			0			0
26					0			0
27		Total EXPENSES	0	1375	5500	0	1375	5500
28		NET			-5500			-5500
29		Projected End			-4500			-10000
30								

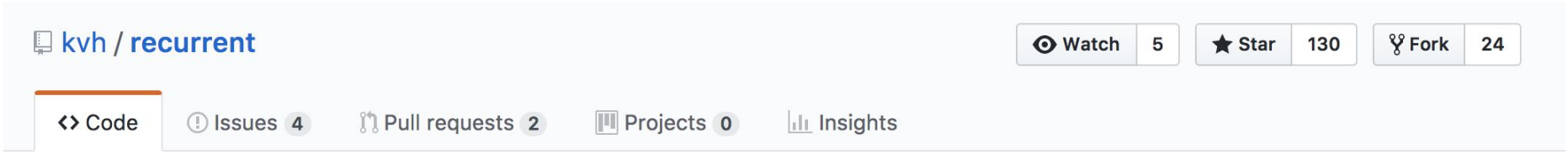
```r
library(tidyverse)

# start
today <- Sys.Date()

# inputs
bank     <- 1000   # starting balance
salary   <- 1000   # per biweek
rent     <- 900    # per month
phone    <- 50     # per month
grocery  <- 70     # per week
fun      <- 80     # per weekend
fitness  <- 100    # per month
savings  <- 100    # per week
```

```r
# build cashflow
cf <- calendar %>%
    mutate(bank = ifelse(date == today, bank, 0)) %>%
    mutate(income = ifelse(weekday == "Friday" & weekn %% 2 == 1, salary, 0)) %>%
    mutate(rent = ifelse(day == "01", -rent, 0)) %>%
    mutate(phone = ifelse(day == "25", -phone, 0)) %>%
    mutate(grocery = ifelse(weekday == "Sunday", -grocery, 0)) %>%
    mutate(fun = ifelse(weekday == "Friday" | weekday == "Saturday", -(fun/2), 0)) %>%
    mutate(savings = ifelse(weekday == "Monday", -savings, 0)) %>%
    mutate(fitness = ifelse(day == "05", -fitness, 0))

# calculate totals
bank <- cf %>%
    select(-month, -day, -weekday, -weekend, -weekn) %>%
    gather(key, value, -date) %>%
    group_by(date) %>%
    summarise(total = sum(value)) %>%
    mutate(balance = cumsum(total))
```

```r
library(tidyverse)

# start
today <- Sys.Date()

# inputs
bank     <- 1000   # starting balance
salary   <- 1000   # per biweek
rent     <- 900    # per month
phone    <- 50     # per month
grocery  <- 70     # per week
fun      <- 80     # per weekend
fitness  <- 100    # per month
savings  <- 100    # per week
```

```r
# build cashflow
cf <- calendar %>%
    mutate(bank = ifelse(date == today, bank, 0)) %>%
    mutate(income = ifelse(weekday == "Friday" & weekn %% 2 == 1, salary, 0)) %>%
    mutate(rent = ifelse(day == "01", -rent, 0)) %>%
    mutate(phone = ifelse(day == "25", -phone, 0)) %>%
    mutate(grocery = ifelse(weekday == "Sunday", -grocery, 0)) %>%
    mutate(fun = ifelse(weekday == "Friday" | weekday == "Saturday", -(fun/2), 0)) %>%
    mutate(savings = ifelse(weekday == "Monday", -savings, 0)) %>%
    mutate(fitness = ifelse(day == "05", -fitness, 0))

# calculate totals
bank <- cf %>%
    select(-month, -day, -weekday, -weekend, -weekn) %>%
    gather(key, value, -date) %>%
    group_by(date) %>%
    summarise(total = sum(value)) %>%
    mutate(balance = cumsum(total))
```

```
every other day
every 16th of the month
first thursday of every month
third and fourth friday of each month
weekly on wednesdays and fridays
every day starting next tuesday until feb
every week on sunday starting tomorrow until November
tomorrow
```




```
r = RecurringEvent()
r.parse('every other day')
r.parse('every 16th of the month')
r.parse('first thursday of every month')
r.parse('third and fourth friday of each month')
r.parse('weekly on wednesdays and fridays')
r.parse('every day starting next tuesday until feb')
r.parse('every week on sunday starting tomorrow until November')
r.parse('tomorrow')
```

```
from recurrent import RecurringEvent
```

```
r = RecurringEvent()
r.parse('every other day')
r.parse('every 16th of the month')
r.parse('first thursday of every month')
r.parse('third and fourth friday of each month')
r.parse('weekly on wednesdays and fridays')
r.parse('every day starting next tuesday until feb')
r.parse('every week on sunday starting tomorrow until November')
r.parse('tomorrow')
```

```
'RRULE:INTERVAL=2;FREQ=DAILY'
r.parse('every 16th of the month')
r.parse('first thursday of every month')
r.parse('third and fourth friday of each month')
r.parse('weekly on wednesdays and fridays')
r.parse('every day starting next tuesday until feb')
r.parse('every week on sunday starting tomorrow until November')
r.parse('tomorrow')
```

```
'RRULE:INTERVAL=2;FREQ=DAILY'
'RRULE:BYMONTHDAY=16;INTERVAL=1;FREQ=MONTHLY'
r.parse('first thursday of every month')
r.parse('third and fourth friday of each month')
r.parse('weekly on wednesdays and fridays')
r.parse('every day starting next tuesday until feb')
r.parse('every week on sunday starting tomorrow until November')
r.parse('tomorrow')
```

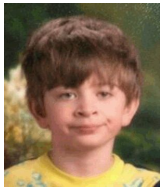
```
'RRULE:INTERVAL=2;FREQ=DAILY'
'RRULE:BYMONTHDAY=16;INTERVAL=1;FREQ=MONTHLY'
'RRULE:BYDAY=1TH;INTERVAL=1;FREQ=MONTHLY'
r.parse('third and fourth friday of each month')
r.parse('weekly on wednesdays and fridays')
r.parse('every day starting next tuesday until feb')
r.parse('every week on sunday starting tomorrow until November')
r.parse('tomorrow')
```

```
'RRULE:INTERVAL=2;FREQ=DAILY'
'RRULE:BYMONTHDAY=16;INTERVAL=1;FREQ=MONTHLY'
'RRULE:BYDAY=1TH;INTERVAL=1;FREQ=MONTHLY'
'RRULE:BYDAY=3FR,4FR;INTERVAL=1;FREQ=MONTHLY'
r.parse('weekly on wednesdays and fridays')
r.parse('every day starting next tuesday until feb')
r.parse('every week on sunday starting tomorrow until November')
r.parse('tomorrow')
```

```
'RRULE:INTERVAL=2;FREQ=DAILY'
'RRULE:BYMONTHDAY=16;INTERVAL=1;FREQ=MONTHLY'
'RRULE:BYDAY=1TH;INTERVAL=1;FREQ=MONTHLY'
'RRULE:BYDAY=3FR,4FR;INTERVAL=1;FREQ=MONTHLY'
'RRULE:BYDAY=WE,FR;INTERVAL=1;FREQ=WEEKLY'
'DTSTART:20180213\nRRULE:INTERVAL=1;FREQ=DAILY;UNTIL=20190201'
'DTSTART:20180206\nRRULE:BYDAY=SU;INTERVAL=1;FREQ=WEEKLY;UNTIL=20181101'
r.parse('tomorrow')
```

```
'RRULE:INTERVAL=2;FREQ=DAILY'
'RRULE:BYMONTHDAY=16;INTERVAL=1;FREQ=MONTHLY'
'RRULE:BYDAY=1TH;INTERVAL=1;FREQ=MONTHLY'
'RRULE:BYDAY=3FR,4FR;INTERVAL=1;FREQ=MONTHLY'
'RRULE:BYDAY=WE,FR;INTERVAL=1;FREQ=WEEKLY'
'DTSTART:20180213\nRRULE:INTERVAL=1;FREQ=DAILY;UNTIL=20190201'
'DTSTART:20180206\nRRULE:BYDAY=SU;INTERVAL=1;FREQ=WEEKLY;UNTIL=20181101'
datetime.datetime(2018, 2, 6, 9, 0)
```

```
'RRULE:INTERVAL=2;FREQ=DAILY'
'RRULE:BYMONTHDAY=16;INTERVAL=1;FREQ=MONTHLY'
'RRULE:BYDAY=1TH;INTERVAL=1;FREQ=MONTHLY'
'RRULE:BYDAY=3FR,4FR;INTERVAL=1;FREQ=MONTHLY'
'RRULE:BYDAY=WE,FR;INTERVAL=1;FREQ=WEEKLY'
'DTSTART:20180213\nRRULE:INTERVAL=1;FREQ=DAILY;UNTIL=20190201'
'DTSTART:20180206\nRRULE:BYDAY=SU;INTERVAL=1;FREQ=WEEKLY;UNTIL=20181101'
datetime.datetime(2018, 2, 6, 9, 0)
```



```
r = RecurringEvent()
r.parse('every 3 weeks starting 2018-05-01 until 2018-09-30')
```

```
r = RecurringEvent()
r.parse('every 3 weeks starting 2018-05-01 until 2018-09-30')
```

```
>>> ‘DTSTART:20180501\nRRULE:INTERVAL=3;FREQ=WEEKLY;UNTIL=20180930'
```

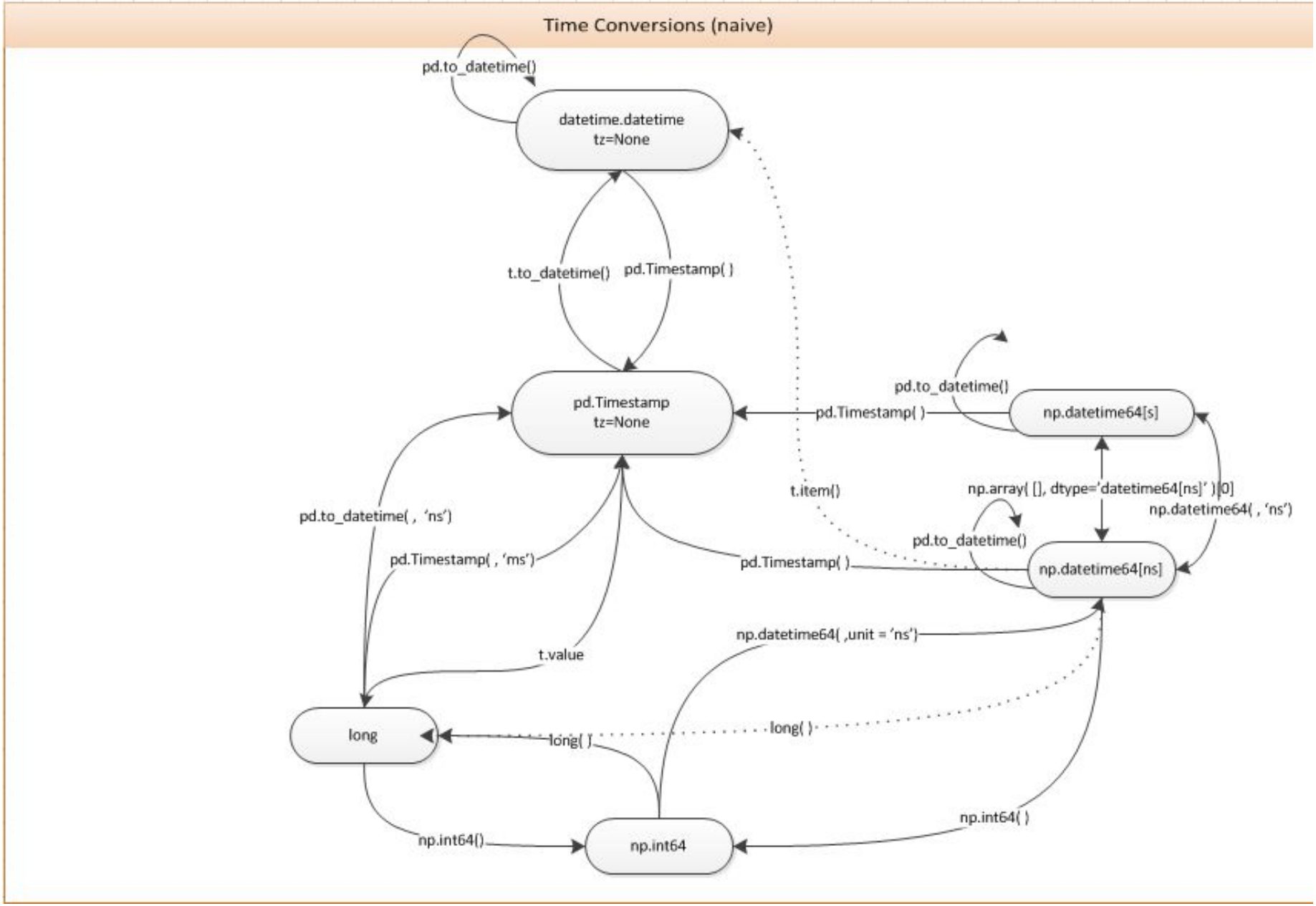
```
r = RecurringEvent()
r.parse('every 3 weeks starting 2018-05-01 until 2018-09-30')
>>> ‘DTSTART:20180501\nRRULE:INTERVAL=3;FREQ=WEEKLY;UNTIL=20180930'
```

```
rr = rrule.rrulestr(r.get_RFC_rrule())
rr.after(datetime.datetime.now())
>>> datetime.datetime(2018, 5, 1, 0, 0)
rr.count()
>>> 8
rr.before(datetime.datetime(2018, 7, 1))
>>> datetime.datetime(2018, 6, 12, 0, 0)
```

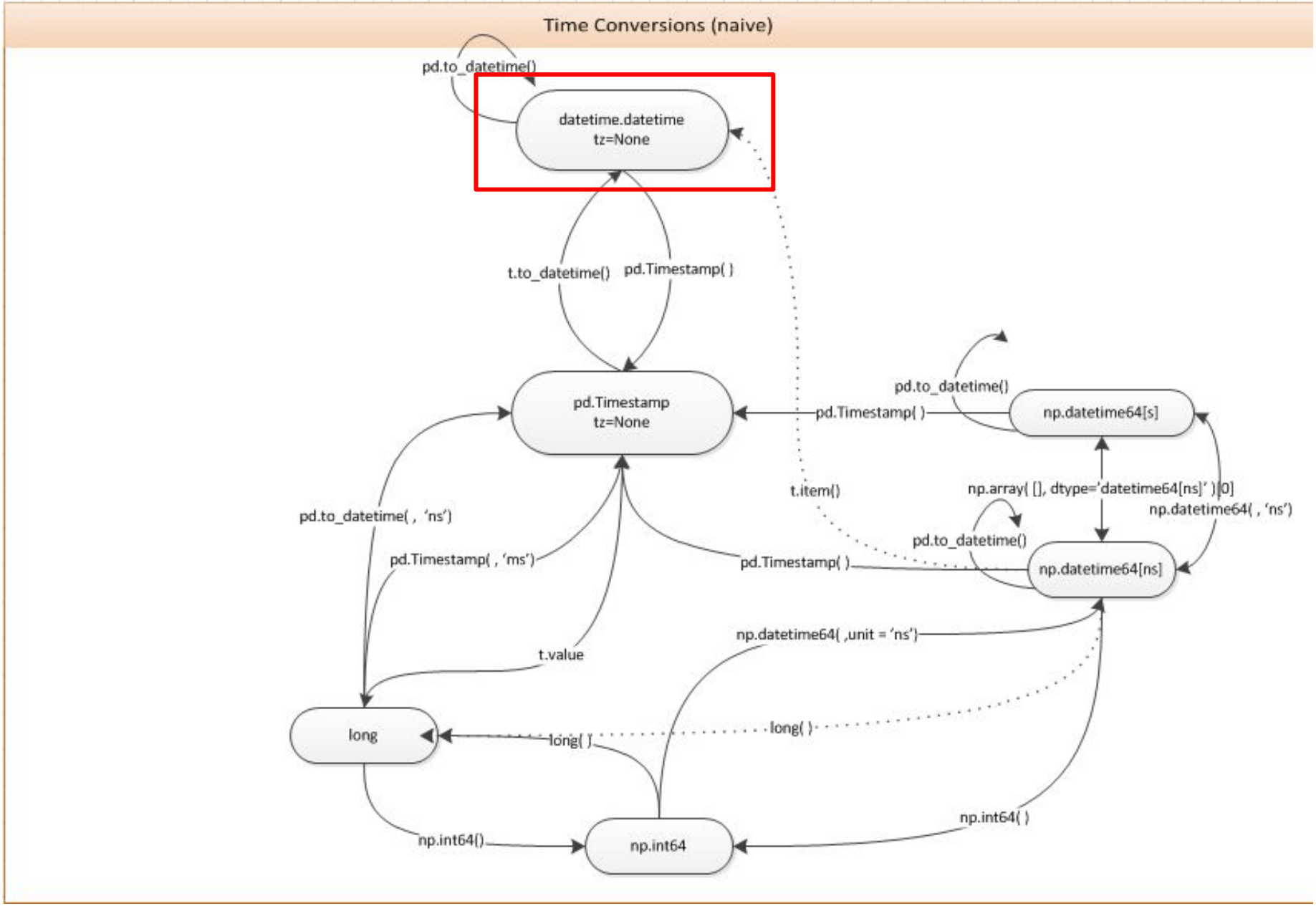
```
r = RecurringEvent()
r.parse('every 3 weeks starting 2018-05-01 until 2018-09-30')
rr = rrule.rrulestr(r.get_RFC_rrule())
rr.between(datetime.date.today(), datetime.date(2018, 9, 1))
```

```
r = RecurringEvent()
r.parse('every 3 weeks starting 2018-05-01 until 2018-09-30')
rr = rrule.rrulestr(r.get_RFC_rrule())
rr.between(datetime.date.today(), datetime.date(2018, 9, 1))
```

```
---------------------------------------------------------------------
TypeError                         Traceback (most recent call last)
<ipython-input-46-77d7d68d1920> in <module>()
--> 1 rr.between(datetime.date.today(), datetime.date(2018, 9, 1))

TypeError: can't compare datetime.datetime to datetime.date
```



https://stackoverflow.com/questions/13703720/converting-between-datetime-timestamp-and-datetime64/21916253#21916253



https://stackoverflow.com/questions/13703720/converting-between-datetime-timestamp-and-datetime64/21916253#21916253

```
r = RecurringEvent()
r.parse('every 3 weeks starting 2018-05-01 until 2018-09-30')
rr = rrule.rrulestr(r.get_RFC_rrule())
rr.between(datetime.datetime.now(), datetime.datetime(2018, 9, 1))
```

```
r = RecurringEvent()
r.parse('every 3 weeks starting 2018-05-01 until 2018-09-30')
rr = rrule.rrulestr(r.get_RFC_rrule())
rr.between(datetime.datetime.now(), datetime.datetime(2018, 9, 1))
```

```
[datetime.datetime(2018, 5, 1, 0, 0),
 datetime.datetime(2018, 5, 22, 0, 0),
 datetime.datetime(2018, 6, 12, 0, 0),
 datetime.datetime(2018, 7, 3, 0, 0),
 datetime.datetime(2018, 7, 24, 0, 0),
 datetime.datetime(2018, 8, 14, 0, 0)]
```

```
r = RecurringEvent()
r.parse('every 3 weeks starting 2018-05-01 until 2018-09-30')
rr = rrule.rrulestr(r.get_RFC_rrule())
rr.between(datetime.datetime.now(), datetime.datetime(2018, 9, 1))
```

```
[datetime.datetime(2018, 5, 1, 0, 0),
 datetime.datetime(2018, 5, 22, 0, 0),
 datetime.datetime(2018, 6, 12, 0, 0),
 datetime.datetime(2018, 7, 3, 0, 0),
 datetime.datetime(2018, 7, 24, 0, 0),
 datetime.datetime(2018, 8, 14, 0, 0)]
```

```
things = {
    'mining_income': {
        'amount': 100,
        'frequency': 'every monday starting in March'
    }
}
```

```
things = {
    'mining_income': {
        'amount': 100,
        'frequency': 'every monday starting in March'
    }
}
amount = things['mining_income']['amount']
rr = get_rrule_or_datetime(things['mining_income']['frequency'])
dates = rr.between(TODAY, END)
dates = [normalize_datetime(d) for d in dates]
dates[:10]
```

```
[datetime.datetime(2018, 3, 5, 0, 0),
 datetime.datetime(2018, 3, 12, 0, 0),
 datetime.datetime(2018, 3, 19, 0, 0),
 datetime.datetime(2018, 3, 26, 0, 0),
 datetime.datetime(2018, 4, 2, 0, 0),
 datetime.datetime(2018, 4, 9, 0, 0),
 datetime.datetime(2018, 4, 16, 0, 0),
 datetime.datetime(2018, 4, 23, 0, 0),
 datetime.datetime(2018, 4, 30, 0, 0),
 datetime.datetime(2018, 5, 7, 0, 0)]
```

```
def get_rrule_or_datetime(frequency):
    try:
        r = RecurringEvent()
        f = r.parse(frequency)
        return rrule.rrulestr(r.get_RFC_rrule())
    except ValueError:  # r.parse() returned a datetime.datetime
        return f
    except AttributeError:  # frequency is a datetime.date
        return datetime.datetime.combine(frequency, datetime.time())


def normalize_datetime(dt):
    return datetime.datetime.combine(dt, datetime.time())
```

```
TODAY = normalize_datetime(datetime.datetime.now())
END = TODAY + datetime.timedelta(days=365)

df = pd.DataFrame({
    'date': pd.date_range(
        start=TODAY,
        end=END,
        normalize=True,
        freq='D')
})
```

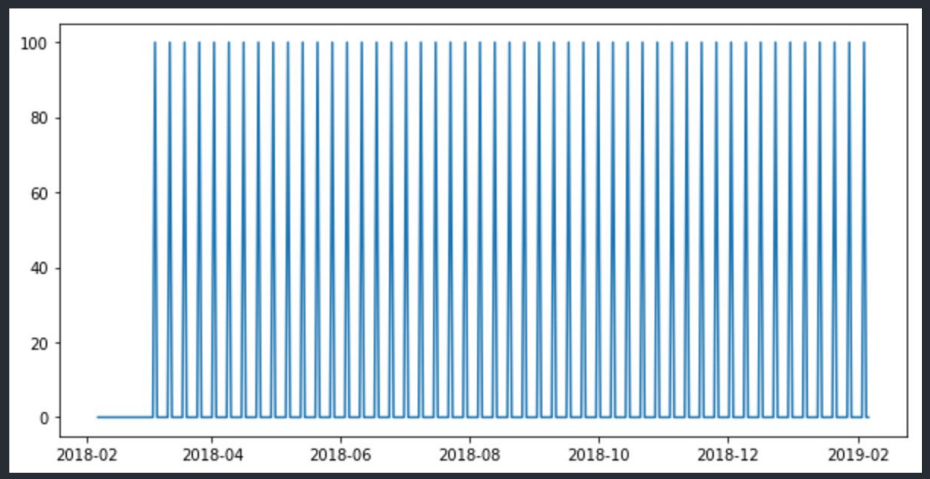
```
df
```

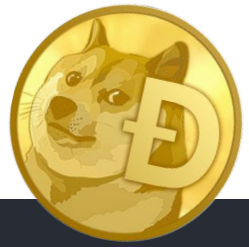
	date
0	2018-02-05
1	2018-02-06
2	2018-02-07
3	2018-02-08
4	2018-02-09
5	2018-02-10
6	2018-02-11
7	2018-02-12

```
datetime.datetime(2018, 3, 19, 0, 0),
datetime.datetime(2018, 3, 26, 0, 0),
datetime.datetime(2018, 4, 2, 0, 0),
datetime.datetime(2018, 4, 9, 0, 0),
datetime.datetime(2018, 4, 16, 0, 0),
datetime.datetime(2018, 4, 23, 0, 0),
datetime.datetime(2018, 4, 30, 0, 0),
datetime.datetime(2018, 5, 7, 0, 0)]
```

```
df = df.merge(
    pd.DataFrame({'date': dates, 'mining_income': amount}),
    how='left').fillna(0)

plt.figure(figsize=(10, 5))
plt.plot(df.date, df.mining_income)
```

```
df = df.merge(
    pd.DataFrame({'date': dates, 'mining_income': amount}),
    how='left').fillna(0)

plt.figure(figsize=(10, 5))
plt.plot(df.date, df.mining_income)
```





budget.py | inputs.yaml

```yaml
bank:
    frequency: today
    amount: 2000.20
salary:
    frequency: every 2 weeks on Friday starting 2018
    amount: 1000
mining_income:
    frequency: every week on Tuesday starting 2018-03-01
    amount: 125.00
loan:
    frequency: every 12th of the month starting March until 2018-12-31
    amount: -345.80
rent:
    frequency: every month
    amount: -1090
utilities:
    frequency: first monday of every month
    amount: -110
food:
    frequency: every day
    amount: -10
fun:
    frequency: every week on Friday and Saturday
    amount: -40
```

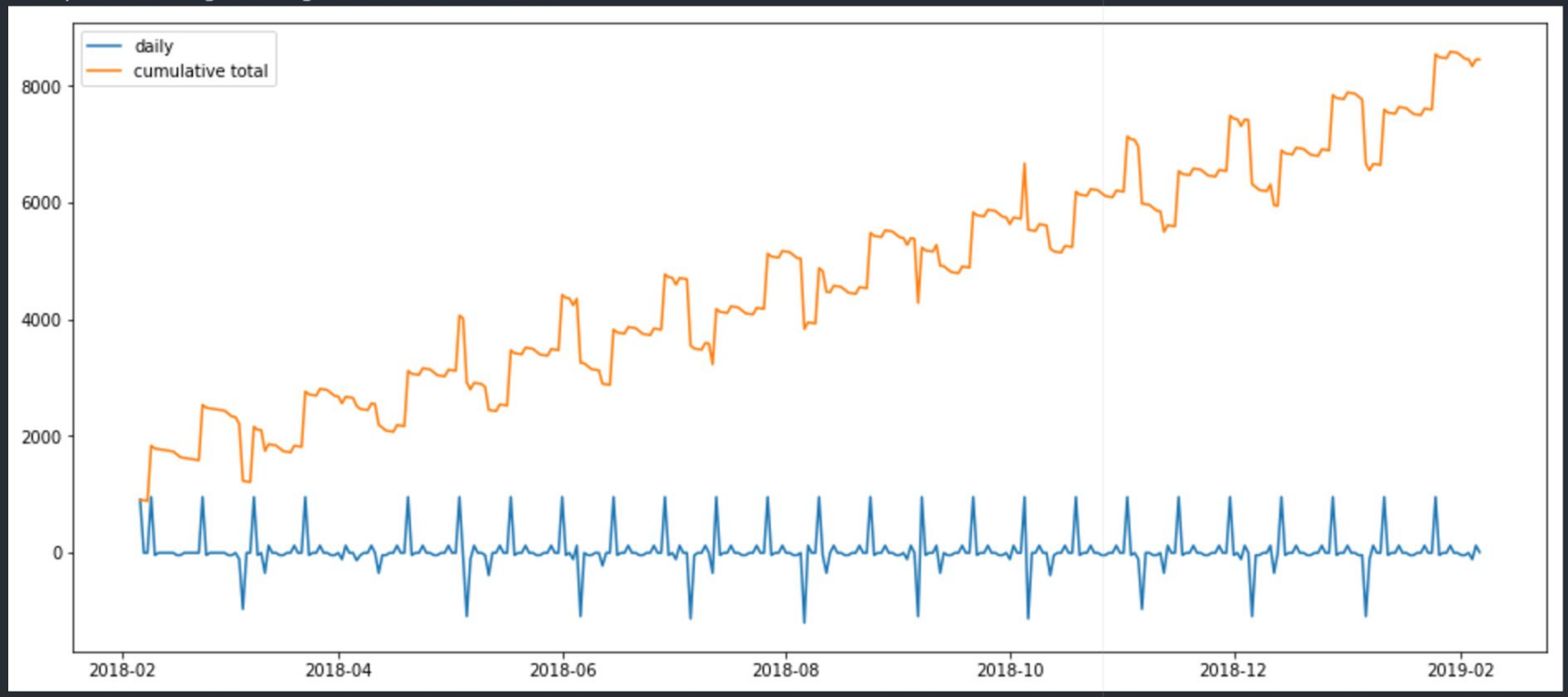
```
with open('data/inputs.yaml', 'r') as f:
    inputs = yaml.load(f)

for k, v in inputs.items():
    frequency = v.get('frequency')
    amount = v.get('amount')
    rr = get_rrule_or_datetime(frequency)
    if type(rr) is datetime.datetime:
        date = normalize_datetime(rr)
        dfi = pd.DataFrame({'date': [date], k: [amount]})
    else:
        dates = rr.between(TODAY, END)
        dates = [normalize_datetime(d) for d in dates]
        dfi = pd.DataFrame({'date': dates, k: amount})
    df = df.merge(dfi, how='left').fillna(0)
```

	date	mining_income	bank	salary	loan	rent	utilities	food	fun	vacation
0	2018-02-06	0.0	2000.2	0.0	0.0	-1090.0	0.0	-10.0	0.0	0.0
1	2018-02-07	0.0	0.0	0.0	0.0	0.0	0.0	-10.0	0.0	0.0
2	2018-02-08	0.0	0.0	0.0	0.0	0.0	0.0	-10.0	0.0	0.0
3	2018-02-09	0.0	0.0	1000.0	0.0	0.0	0.0	-10.0	-40.0	0.0
4	2018-02-10	0.0	0.0	0.0	0.0	0.0	0.0	-10.0	-40.0	0.0
5	2018-02-11	0.0	0.0	0.0	0.0	0.0	0.0	-10.0	0.0	0.0
6	2018-02-12	0.0	0.0	0.0	0.0	0.0	0.0	-10.0	0.0	0.0
7	2018-02-13	0.0	0.0	0.0	0.0	0.0	0.0	-10.0	0.0	0.0
8	2018-02-14	0.0	0.0	0.0	0.0	0.0	0.0	-10.0	0.0	0.0
9	2018-02-15	0.0	0.0	0.0	0.0	0.0	0.0	-10.0	0.0	0.0
10	2018-02-16	0.0	0.0	0.0	0.0	0.0	0.0	-10.0	-40.0	0.0

```
df['total'] = df.drop('date', axis=1).sum(axis=1)
df['cumulative_total'] = df['total'].cumsum()

plt.figure(figsize=(16, 7))
plt.plot(df.date, df.total, label='daily')
plt.plot(df.date, df.cumulative_total, label='cumulative total')
plt.legend()
```

```
df['total'] = df.drop('date', axis=1).sum(axis=1)
df['cumulative_total'] = df['total'].cumsum()

plt.figure(figsize=(16, 7))
plt.plot(df.date, df.total, label='daily')
plt.plot(df.date, df.cumulative_total, label='cumulative total')
plt.legend()
```

```
<matplotlib.legend.Legend at 0x10881e2b0>
```




I NEED A VACATION.

budget.py | inputs.yaml

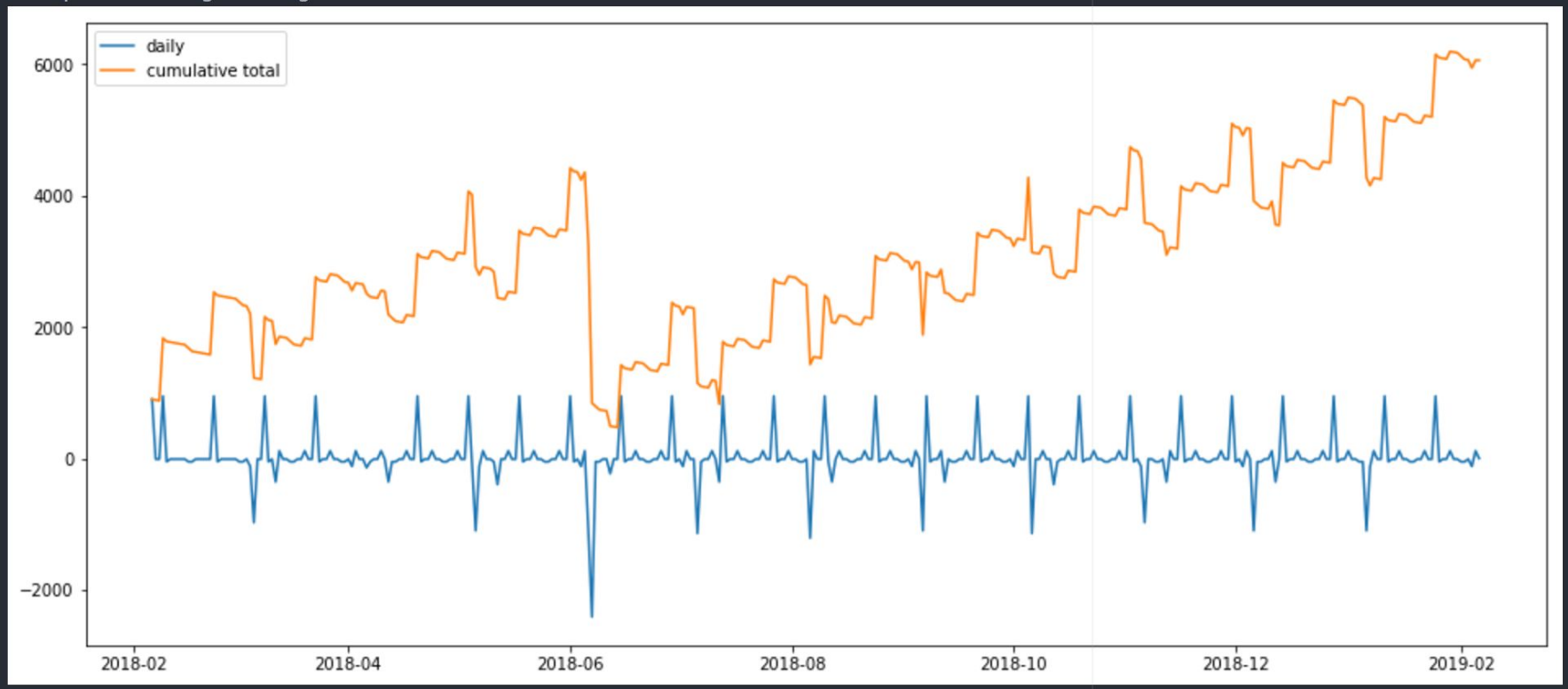
```yaml
bank:
    frequency: today
    amount: 2000.20
salary:
    frequency: every 2 weeks on Friday starting 2018
    amount: 1000
mining_income:
    frequency: every week on Tuesday starting 2018-03-01
    amount: 125.00
loan:
    frequency: every 12th of the month starting March until 2018-12-31
    amount: -345.80
rent:
    frequency: every month
    amount: -1090
utilities:
    frequency: first monday of every month
    amount: -110
food:
    frequency: every day
    amount: -10
fun:
    frequency: every week on Friday and Saturday
    amount: -40
vacation:
    frequency: 2018-06-07
    amount: -2400

```

budget.py | inputs.yaml

```yaml
bank:
    frequency: today
    amount: 2000.20
salary:
    frequency: every 2 weeks on Friday starting 2018
    amount: 1000
mining_income:
    frequency: every week on Tuesday starting 2018-03-01
    amount: 125.00
loan:
    frequency: every 12th of the month starting March until 2018-12-31
    amount: -345.80
rent:
    frequency: every month
    amount: -1090
utilities:
    frequency: first monday of every month
    amount: -110
food:
    frequency: every day
    amount: -10
fun:
    frequency: every week on Friday and Saturday
    amount: -40
vacation:
    frequency: 2018-06-07
    amount: -2400
```

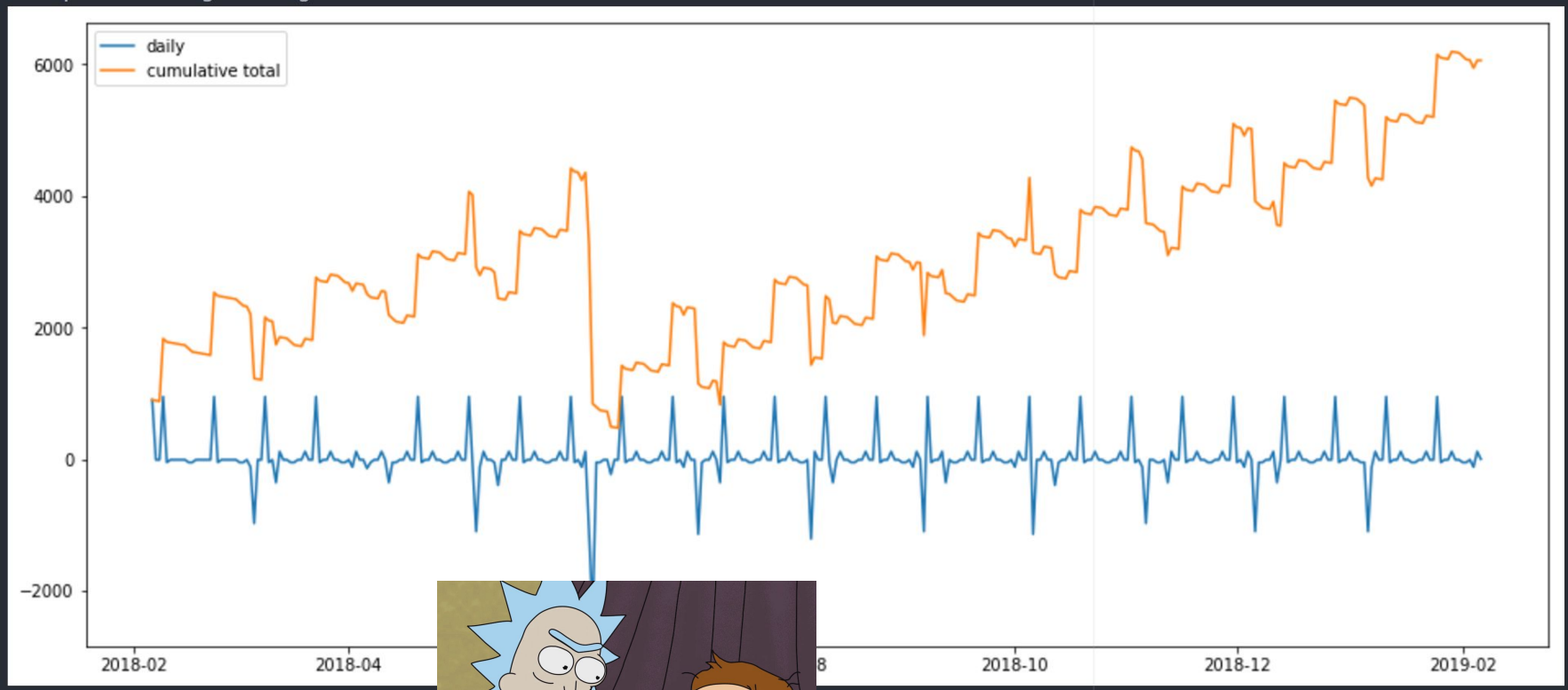
```
df['total'] = df.drop('date', axis=1).sum(axis=1)
df['cumulative_total'] = df['total'].cumsum()

plt.figure(figsize=(16, 7))
plt.plot(df.date, df.total, label='daily')
plt.plot(df.date, df.cumulative_total, label='cumulative total')
```

```
<matplotlib.legend.Legend at 0x108bed8d0>
```



```
df['total'] = df.drop('date', axis=1).sum(axis=1)
df['cumulative_total'] = df['total'].cumsum()

plt.figure(figsize=(16, 7))
plt.plot(df.date, df.total, label='daily')
plt.plot(df.date, df.cumulative_total, label='cumulative total')
```

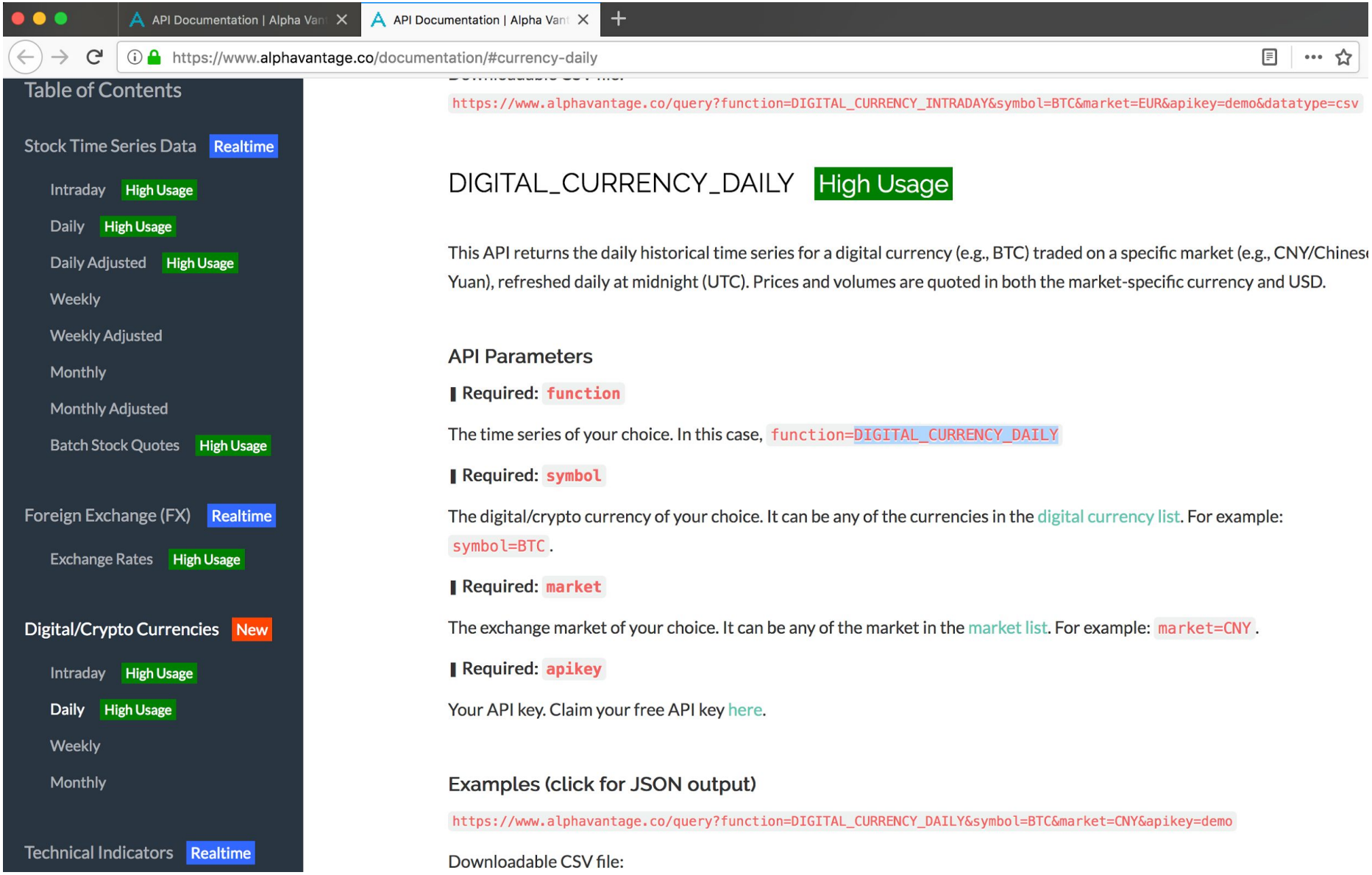
```
<matplotlib.legend.Legend at 0x108bed8d0>
```




irr
borrow
budget
balance


coins
shiba
You need to diversify your


ethereum


API Documentation | Alpha Van
API Documentation | Alpha Van
https://www.alphavantage.co/documentation/#currency-daily
Table of Contents
Stock Time Series Data Realtime
Intraday High Usage
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Foreign Exchange (FX) Realtime
Exchange Rates High Usage
Digital/Crypto Currencies New
Intraday High Usage
Daily High Usage
Weekly
Monthly
Technical Indicators Realtime
https://www.alphavantage.co/query?function=DIGITAL_CURRENCY_INTRADAY&symbol=BTC&market=EUR&apikey=demo&datatype=csv
DIGITAL_CURRENCY_DAILY High Usage
This API returns the daily historical time series for a digital currency (e.g., BTC) traded on a specific market (e.g., CNY/Chines
Yuan), refreshed daily at midnight (UTC). Prices and volumes are quoted in both the market-specific currency and USD.
API Parameters
Required: function
The time series of your choice. In this case, function=DIGITAL_CURRENCY_DAILY
Required: symbol
The digital/crypto currency of your choice. It can be any of the currencies in the digital currency list. For example: symbol=BTC.
Required: market
The exchange market of your choice. It can be any of the market in the market list. For example: market=CNY.
Required: apikey
Your API key. Claim your free API key here.
Examples (click for JSON output)
https://www.alphavantage.co/query?function=DIGITAL_CURRENCY_DAILY&symbol=BTC&market=CNY&apikey=demo
Downloadable CSV file:

```
URL = 'https://www.alphavantage.co/query?'
payload = {
    'function': 'DIGITAL_CURRENCY_DAILY',
    'symbol': ticker,
    'market': market,
    'apikey': API_KEY
}
r = requests.get(URL, params=payload)
```

```
p = pd.DataFrame(r.json()['Time Series (Digital Currency Daily)'])
```

	2014-04-05	2014-04-06	2014-04-07	2014-04-08	2014-04-09	2014-04-10
1a. open (USD)	0.00057000	0.00054050	0.00059005	0.00058950	0.00056749	0.00056000
1b. open (USD)	0.00057000	0.00054050	0.00059005	0.00058950	0.00056749	0.00056000
2a. high (USD)	0.00057000	0.00059005	0.00059005	0.00058950	0.00057000	0.00056000
2b. high (USD)	0.00057000	0.00059005	0.00059005	0.00058950	0.00057000	0.00056000
3a. low (USD)	0.00054050	0.00054050	0.00049999	0.00049999	0.00051990	0.00035000
3b. low (USD)	0.00054050	0.00054050	0.00049999	0.00049999	0.00051990	0.00035000
4a. close (USD)	0.00054050	0.00059005	0.00058950	0.00056749	0.00056000	0.00042000
4b. close	0.00054050	0.00059005	0.00058950	0.00056749	0.00056000	0.00042000

```
p = p.T['4a. close (USD)']
```

```
2014-04-05    0.00054050
2014-04-06    0.00059005
2014-04-07    0.00058950
2014-04-08    0.00056749
2014-04-09    0.00056000
2014-04-10    0.00042000
2014-04-11    0.00050000
2014-04-12    0.00054700
2014-04-13    0.00045000
2014-04-14    0.00050000
2014-04-15    0.00056000
2014-04-16    0.00076001
2014-04-17    0.00070000
2014-04-18    0.00065000
2014-04-19    0.00070000
2014-04-20    0.00068000
2014-04-21    0.00068000
2014-04-22    0.00070000
2014-04-23    0.00062610
2014-04-24    0.00065994
```

```
def get_crypto_price(ticker, market='USD', latest=False):
    URL = 'https://www.alphavantage.co/query?'
    payload = {
        'function': 'DIGITAL_CURRENCY_DAILY',
        'symbol': ticker,
        'market': market,
        'apikey': API_KEY
    }
    r = requests.get(URL, params=payload)
    p = pd.DataFrame(
              r.json()['Time Series (Digital Currency Daily)’])
             .T[‘4a. close (USD)']
    df = pd.DataFrame({ticker: p.apply(float)})
    df.index = pd.to_datetime(df.index)
    if latest:
        return df.tail(1)
    return df
```

```
get_crypto_price('DOGE')
```

2018-01-21	0.007927
2018-01-22	0.007487
2018-01-23	0.007322
2018-01-24	0.007532
2018-01-25	0.007927
2018-01-26	0.007532
2018-01-27	0.007605
2018-01-28	0.007679
2018-01-29	0.007315
2018-01-30	0.006712
2018-01-31	0.006358
2018-02-01	0.005312
2018-02-02	0.004712
2018-02-03	0.005540
2018-02-04	0.004850

```
def get_historical(tickers, start_date, end_date):
    df = pd.DataFrame(
          index=pd.date_range(start_date, end_date, freq='D'))
    for t in tickers:
        df = pd.concat([
            df,
            get_crypto_price(t)],
            axis=1,
            join_axes=[df.index]
        )
    df = df.fillna(method='ffill').dropna()
    return df
```

```
get_historical(
    ['DOGE', 'BTC', 'ZEC', 'ETH'],
    start_date='2017-01-01',
    end_date='2018-01-07'
)
```

	DOGE	BTC	ZEC	ETH
2017-01-01	0.000219	987.300889	48.843009	8.036445
2017-01-02	0.000214	1012.091632	49.448097	8.232979
2017-01-03	0.000211	1025.543263	49.718332	9.531110
2017-01-04	0.000226	1131.522402	55.007820	11.002355
2017-01-05	0.000226	996.678230	49.104636	10.152173
2017-01-06	0.000220	890.624920	46.212815	10.058127
2017-01-07	0.000220	897.776868	46.995530	9.618651
2017-01-08	0.000235	904.204206	45.813221	10.098427
2017-01-09	0.000215	897.388621	45.971429	10.182773
2017-01-10	0.000211	899.967565	45.340895	10.513418
2017-01-11	0.000216	775.512824	40.213864	9.797002
2017-01-12	0.000209	801.154042	43.221347	9.724204

```
class Rebalance:

    def __init__(self, targets, deposit):

    def _instantiate_portfolio(self):

    def update_prices(self, prices):

    def get_order(self):

    def process_order(self):

    def deposit(self, amount):

    def withdraw(self, amount):
```

```
class Rebalance:

    def __init__(self, targets, deposit):

    def _instantiate_portfolio(self):

    def update_prices(self, prices):

    def get_order(self):

    def process_order(self):

    def deposit(self, amount):
```

```
class Rebalance:

    def __init__(self, targets, deposit):

    def _instantiate_portfolio(self):

    def update_prices(self, prices):

    def get_order(self):

    def process_order(self):
```

```
def __init__(self, targets, deposit):
     self.targets = targets
     self.tickers = list(targets.keys())
     self.cash = deposit
     self.stock_value = 0
     self.total_value = self.cash + self.stock_value
     self.portfolio = self._instantiate_portfolio()
```

```
def _instantiate_portfolio(self):
    df = pd.DataFrame(
        index=self.tickers,
        columns=['date', 'price', 'target',
        ‘allocation', 'shares', 'market_value']
    )
    df.shares = 0
    df.market_value = 0
    df.allocation = 0
    df.update(
        pd.DataFrame
            .from_dict(self.targets, orient='index')
            .rename(columns={0:'target'})
    )
    return df
```

```
targets = {
    'DOGE': 0.40,
    'BTC': 0.20,
    'ETH': 0.20,
    'ZEC': 0.20,
}

shiba_rebalancer = Rebalance(targets, 10000)
```

```
targets = {
    'DOGE': 0.40,
    'BTC': 0.20,
    'ETH': 0.20,
    'ZEC': 0.20,
}

shiba_rebalancer = Rebalance(targets, 10000)
shiba_rebalancer.cash
shiba_rebalancer.portfolio
```

	date	price	target	allocation	shares	market_value
DOGE	NaN	NaN	0.4	0	0	0
BTC	NaN	NaN	0.2	0	0	0
ETH	NaN	NaN	0.2	0	0	0
ZEC	NaN	NaN	0.2	0	0	0

```
shiba_rebalancer.stock_value
```

```
class Rebalance:

    def __init__(self, targets, deposit):

    def _instantiate_portfolio(self):

    def update_prices(self, prices):

    def get_order(self):

    def process_order(self):
```

```
def update_prices(self, prices):
     self.portfolio.update(
         pd.DataFrame({
             'price': prices}
         )
     )
     self.portfolio.date = prices.name
     self.portfolio.market_value = (
         self.portfolio.shares * self.portfolio.price)
     self.stock_value = self.portfolio.market_value.sum()
     self.total_value = self.stock_value + self.cash
```

```
tickers = list(targets.keys())
historical_prices = get_historical(
    tickers, '2017-01-01', '2018-01-07')
prices = historical_prices.loc['2017-01-01']
```

```
DOGE      0.000219
BTC     987.300889
ETH       8.036445
ZEC      48.843009
Name: 2017-01-01 00:00:00, dtype: float64
```

```python
prices = pd.Series({
    'DOGE': 0.000219,
    'BTC': 987.300889,
    'ETH': 8.036445,
    'ZEC': 48.843009
})
prices.name = '2017-01-01'
```

```
BTC     987.300889
DOGE      0.000219
ETH       8.036445
ZEC      48.843009
Name: 2017-01-01, dtype: float64
```

```
shiba_rebalancer = Rebalance(targets, 10000)
prices = historical_prices.loc['2017-01-01']
shiba_rebalancer.update_prices(prices)
```

	date	price	target	allocation	shares	market_value
DOGE	NaN	NaN	0.4	0	0	0
BTC	NaN	NaN	0.2	0	0	0
ETH	NaN	NaN	0.2	0	0	0
ZEC	NaN	NaN	0.2	0	0	0

```
shiba_rebalancer = Rebalance(targets, 10000)
prices = historical_prices.loc['2017-01-01']
shiba_rebalancer.update_prices(prices)
```

```
shiba_rebalancer.portfolio
```

	date	price	target	allocation	shares	market_value
DOGE	2017-01-01	0.00021949	0.4	0	0	0
BTC	2017-01-01	987.301	0.2	0	0	0
ETH	2017-01-01	8.03644	0.2	0	0	0
ZEC	2017-01-01	48.843	0.2	0	0	0

```
class Rebalance:

    def __init__(self, targets, deposit):

    def _instantiate_portfolio(self):

    def update_prices(self, prices):

    def get_order(self):

    def process_order(self):
```

```
def get_order(self):
     self.order = (
         (self.total_value * self.portfolio.target
         / self.portfolio.price)
         - self.portfolio.shares
     ).apply(lambda x: safe_round_down(x, 4))
     print(self.order)
```

```
shiba_rebalancer.cash 10000
shiba_rebalancer.total_value 10000.0
shiba_rebalancer.get_order()
```

```
DOGE    1.822406e+07
BTC     2.025700e+00
ETH     2.488662e+02
ZEC     4.094750e+01
dtype: float64
```

```
class Rebalance:

    def __init__(self, targets, deposit):

    def _instantiate_portfolio(self):

    def update_prices(self, prices):

    def get_order(self):

    def process_order(self):
```

```
def process_order(self):
    self.cash -= np.round(np.sum(self.order * self.portfolio.price), 2)
    self.portfolio.shares += self.order
    self.portfolio.market_value = self.portfolio.shares *
        self.portfolio.price
    self.portfolio.allocation = self.portfolio.market_value /
        self.total_value
    self.stock_value = self.portfolio.market_value.sum()
    self.total_value = self.cash + self.stock_value
    print('Success!')
```

```
def process_order(self):
    self.cash -= np.round(np.sum(self.order * self.portfolio.price), 2)
    self.portfolio.shares += self.order
    self.portfolio.market_value = self.portfolio.shares *
        self.portfolio.price
    self.portfolio.allocation = self.portfolio.market_value /
        self.total_value
    self.stock_value = self.portfolio.market_value.sum()
    self.total_value = self.cash + self.stock_value
    print('Success!')
```

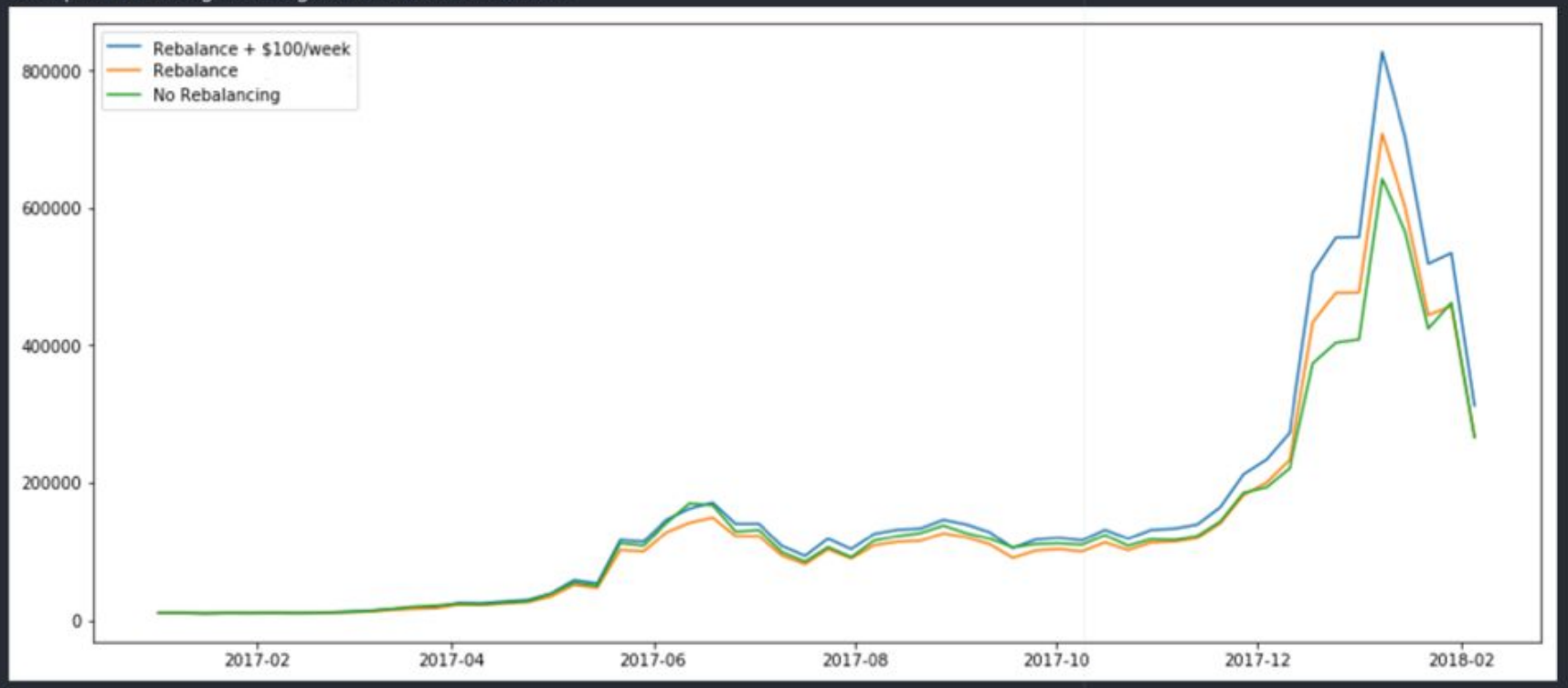
```
shiba_rebalancer.process_order() Success!
shiba_rebalancer.cash 0.030000000000654836
```

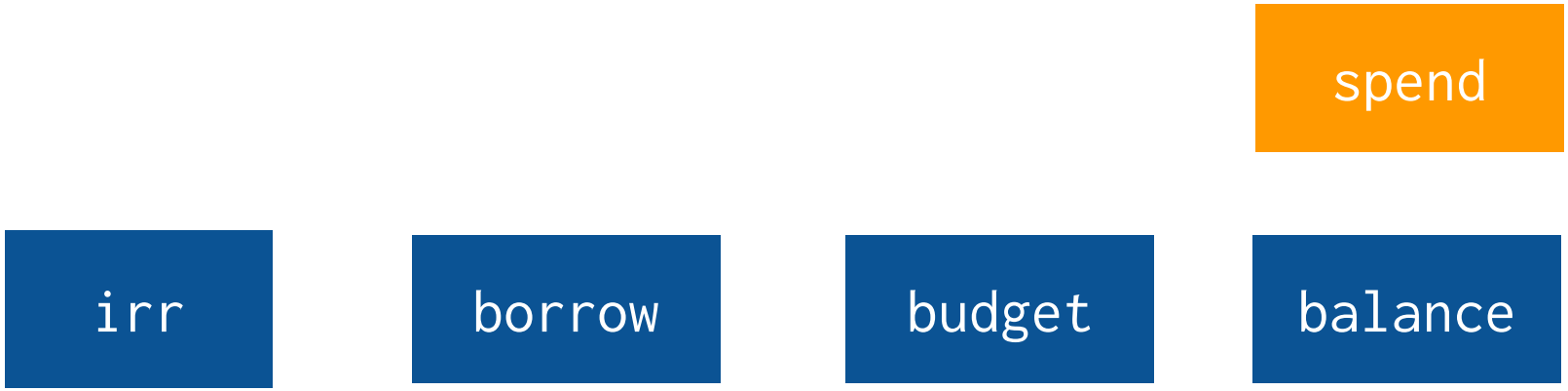
```
shiba_rebalancer = Rebalance(targets, 10000)
dates = pd.date_range(
   ‘2017-01-01', '2018-02-06', freq='W-MON').tolist()
tracker = pd.DataFrame()
for d in dates:
    prices = historical_prices.loc[d]
    shiba_rebalancer.update_prices(prices)
    shiba_rebalancer.get_order()
    shiba_rebalancer.process_order()
    tracker = tracker.append(
        pd.DataFrame({
            'date': [d],
            'total_value': [shiba_rebalancer.total_value]
        })
    )
```

```
shiba_rebalancer.portfolio
```

	date	price	target	allocation	shares	market_value
DOGE	2018-02-05	0.0038217	0.4	0.4	2.796411e+07	106870
BTC	2018-02-05	6920.4	0.2	0.200003	7.721500e+00	53435.9
ETH	2018-02-05	693.38	0.2	0.2	7.706490e+01	53435.3
ZEC	2018-02-05	304.109	0.2	0.2	1.757109e+02	53435.2

```
<matplotlib.legend.Legend at 0x1187a3278>
```



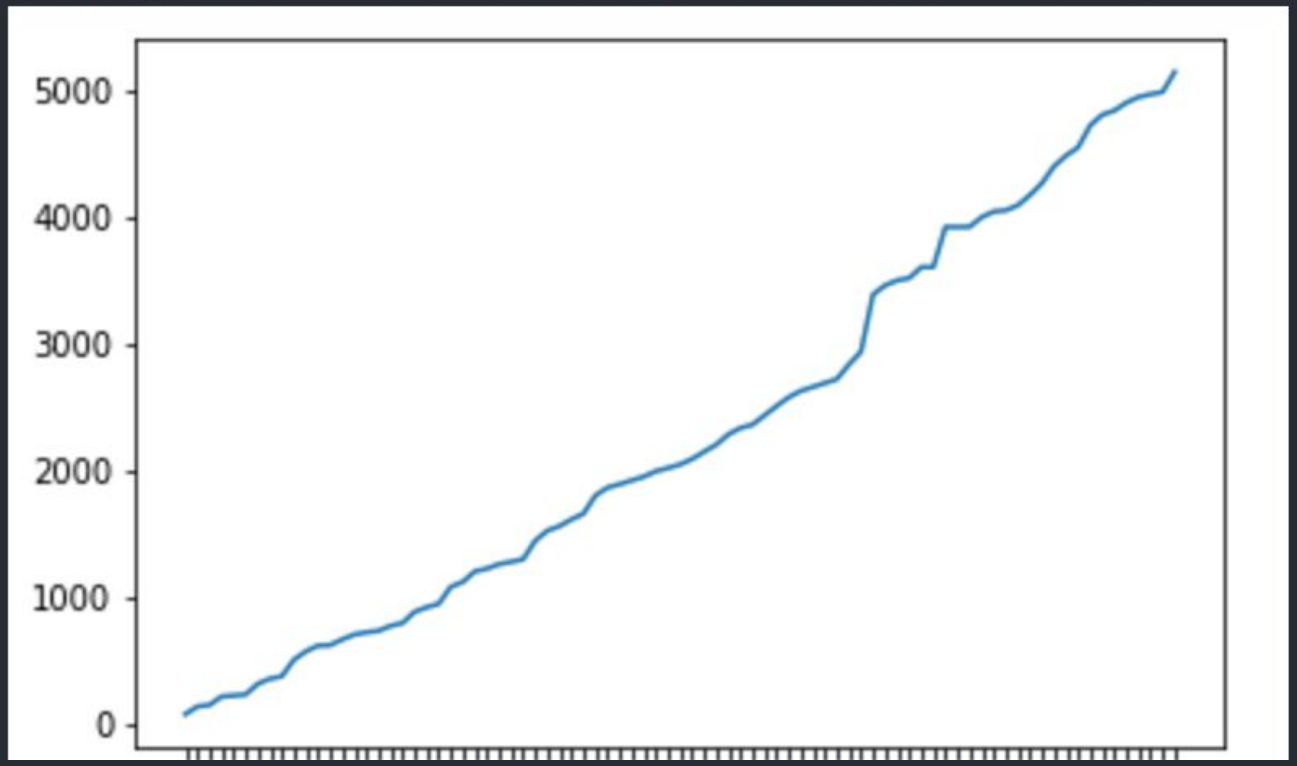

spend
irr
borrow
budget
balance

```
purchases = pd.read_csv('data/purchases.csv')
purchases['cumsum'] = purchases['amount'].cumsum()
```

	date	amount	cumsum
0	2012-07-25	82.55	82.55
1	2012-12-10	61.01	143.56
2	2013-02-19	11.54	155.10
3	2013-02-24	66.67	221.77
4	2013-04-20	7.99	229.76
5	2013-04-25	7.99	237.75
6	2013-07-08	84.59	322.34
7	2013-08-23	39.53	361.87
8	2013-10-14	19.65	381.52
9	2013-11-04	130.48	512.00
10	2013-12-12	66.45	578.45
11	2013-12-25	45.19	623.64
12	2014-01-12	3.45	627.09
13	2014-01-13	45.13	672.22
14	2014-02-10	38.32	710.54
15	2014-09-03	18.27	728.81

```
plt.plot(purchases['date'], purchases['cumsum'])
```

```
[<matplotlib.lines.Line2D at 0x111f6dac8>]
```



https://research.fb.com/prophet-forecasting-at-scale/

```
purchases = purchases[['date', 'cumsum']]
purchases.columns = ['ds', 'y']

m = Prophet()
m.fit(purchases)
```

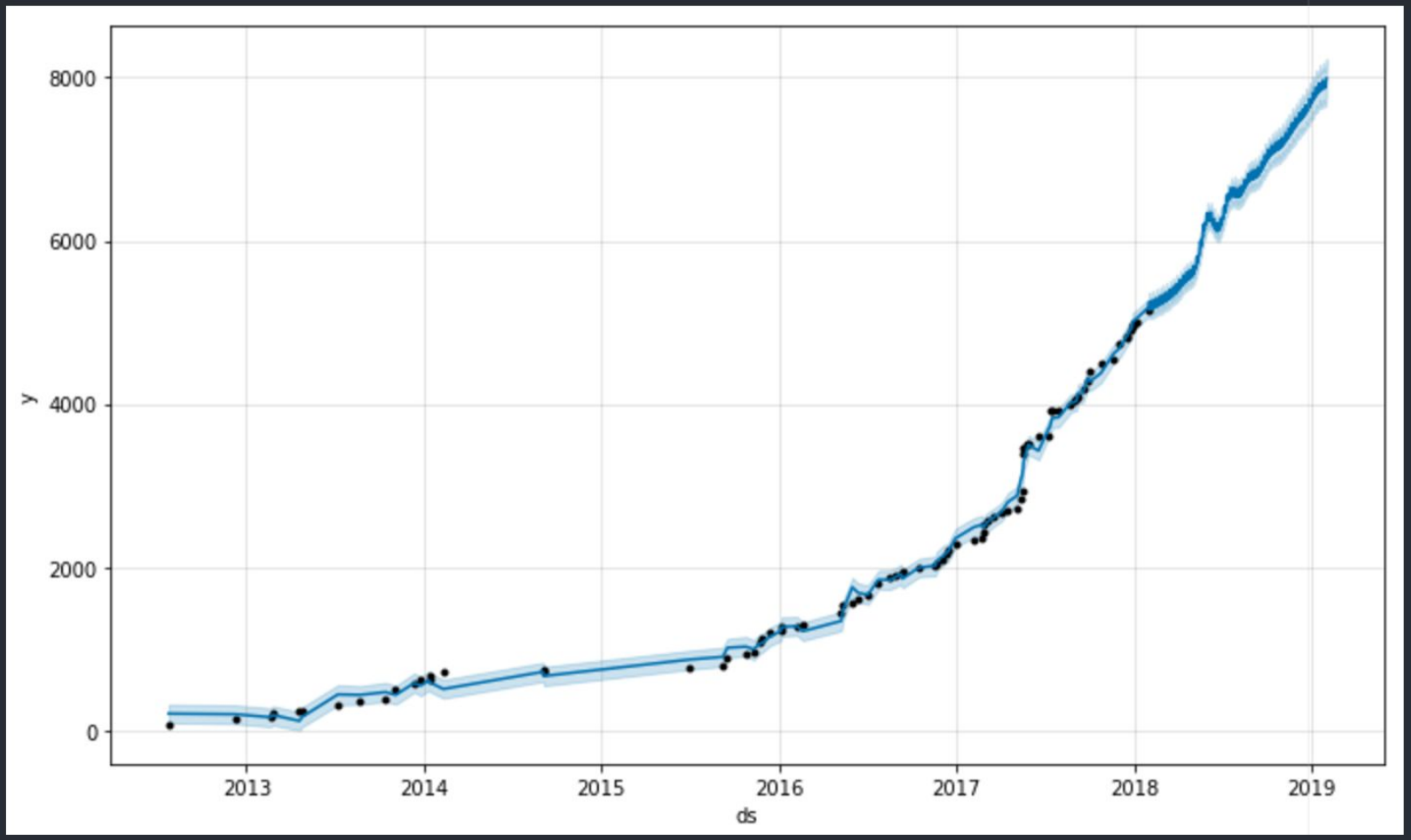
```
future = m.make_future_dataframe(periods=365)
```

428	2019-01-12
429	2019-01-13
430	2019-01-14
431	2019-01-15
432	2019-01-16
433	2019-01-17
434	2019-01-18
435	2019-01-19
436	2019-01-20
437	2019-01-21
438	2019-01-22

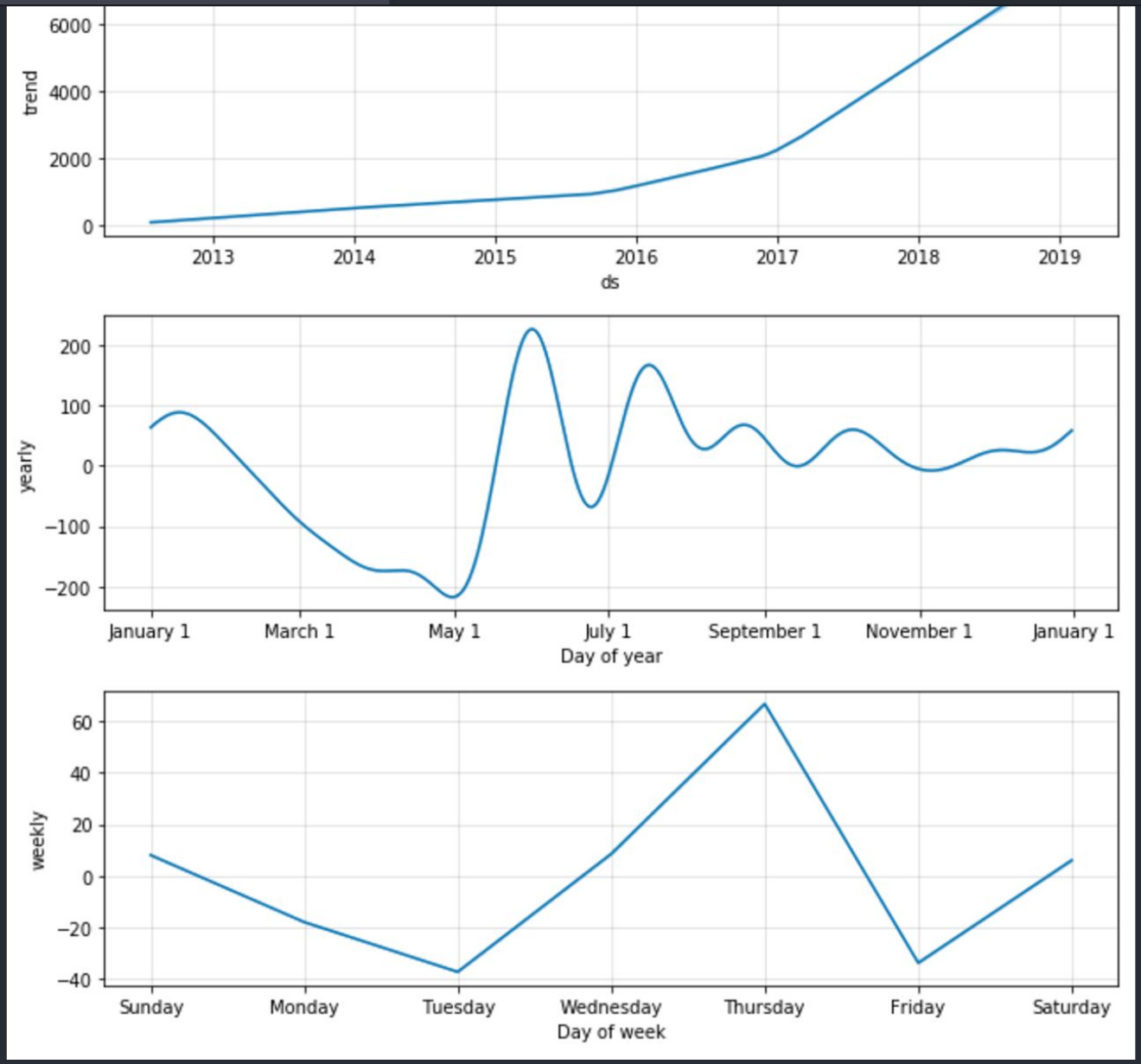
```
forecast = m.predict(future)
forecast[['ds', 'yhat', 'yhat_lower', 'yhat_upper']].tail()
```

	ds	yhat	yhat_lower	yhat_upper
443	2019-01-27	7914.330291	7696.667218	8142.043675
444	2019-01-28	7891.583392	7665.045665	8119.289513
445	2019-01-29	7875.415396	7640.784566	8084.660286
446	2019-01-30	7924.375719	7704.501595	8146.556386
447	2019-01-31	7985.795633	7752.413435	8225.873105

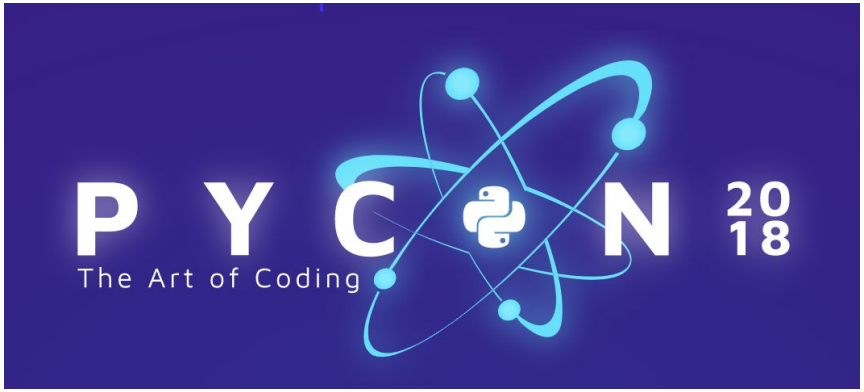
```
m.plot(forecast)
```



```
m.plot_components(forecast)
```




To Cash Flow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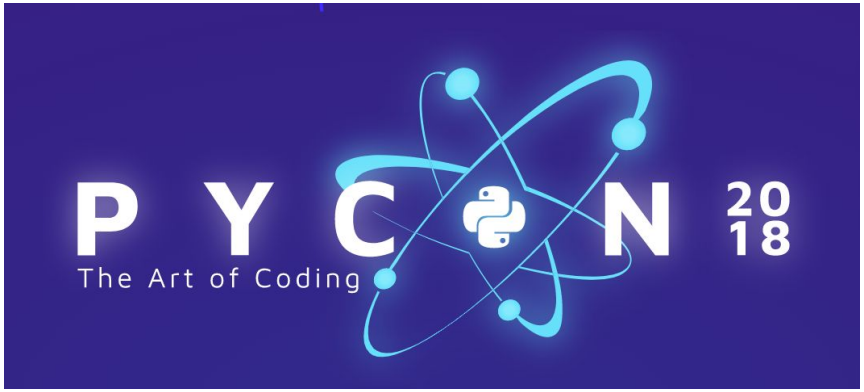

pandas
numpy
scipy
matplotlib
requests
recurrent
dateutil
pyyaml
prophet
dotenv

Save dat money

https://www.youtube.com/watch?v=yvHYWD29ZNY

maxhumber