Ввод [1]:
```
from PIL import ImageGrab
from IPython.display import display, Image
def ins(ratio=1.0):
    im_data = ImageGrab.grabclipboard()
    new_size = tuple([int(i*ratio) for i in im_data.size])
    thumb = im_data.resize(new_size)
    fn = "temp.PNG"
    thumb.save(fn)
    img = Image(filename=fn)
    display(img)
```

Ввод [2]:
```
import numpy as np
from itertools import *
from more_itertools import *
from sympy import *
from scipy.stats import *
#from scipy.special import *
import math
from scipy import integrate
```

Ввод [3]:
```
import locale as loc
loc.setlocale(loc.LC_ALL, 'ru')
init_printing(use_unicode=True,use_latex=True)
from IPython.display import display, Math, Latex
```

Ввод [4]:
```
import matplotlib.pyplot as plt
import matplotlib.ticker as ticker
from matplotlib import rcParams
##########################
import locale
locale.setlocale(locale.LC_NUMERIC, 'russian')
plt.rcParams['axes.formatter.use_locale'] = True
#########
#########
plt.rcParams['font.size'] = 36
plt.rcParams["font.family"] = "Times New Roman"
plt.rcParams['mathtext.fontset'] = 'cm'
###################
```

Ввод [105]:
```
ins(1)
```

Пример

Функция плотности вероятности случайной величины X имеет вид

$$f_X(x) = \begin{cases} 0, & \text{если} \quad x < 6; \\ \frac{C}{x^2}, & \text{если} \quad x \geqslant 6. \end{cases}$$

Найдите константу C и вероятность $\mathbb{P}(X < 7)$, а также покажите статистическую устойчивость вероятности.

Ввод [5]:
```
def f(x):
    if (6<=x<=np.infty):
        return 1/x**2
    return 0
```

Ввод [6]:
```
C = 1/integrate.quad(f, -np.infty, np.infty)[0]
C
```

Out[6]: 6.00000000008646

Ввод [7]:
```
class distr(rv_continuous):
    def _pdf(self, t):
        return C*f(t)
```

Ввод [8]:
```
X=distr()
```

Ввод [9]:
```
integrate.quad(X.pdf, -np.infty, np.infty)[0]
```

Out[9]: 1.0

Ввод [10]:
```
X.cdf(7)
```

Out[10]: 0.142857142859202

Ввод [11]:
```
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```

Out[11]: 0.142857142857143

Ввод [13]:
```
N=200
sample=X.rvs(size=N)
sample
```

Out[13]:
```
array([ 26.28086467,  25.02263474,   7.12511386, 232.82001202,
        10.07599309,  42.82653707,  44.62509497,  13.25692657,
        14.29116096,   9.62262877,   7.92781665,   6.12396437,
        41.06323532,  10.59876134,  25.35338547, 164.63113322,
        77.28468971,  18.06997811,  14.06491505,  19.43301792,
         6.92333163,   8.13492457,  42.06125089,  31.83867818,
        28.19994447,  12.51989666,   8.68684657, 161.45920043,
        22.33331107, 233.67631153,  10.53257733,  27.1511855 ,
        11.03785774,   6.05013204,  25.72104371,  50.4958637 ,
        15.00641875,  11.56506301,   6.24575504,  23.54862529,
         9.19157435,   6.25424722,   6.65693502,  13.28333148,
         9.74824379,  10.16562213,  15.76349907,  58.98475475,
         9.9052993 ,  26.56292806,  69.27460131, 131.34519176,
       317.6121401 ,  15.78464686,   6.85394492,  13.389073  ,
        41.87369681,  12.21675551,   9.70038149,   9.77739049,
       130.62835122,  15.68187878,  24.37620675,  27.83924017,
        15.62679689,  30.0135773 ,  44.00578926,   7.63050037,
        10.54203616,  11.43646189,  18.85644305,  13.86086244,
         8.85140377,  11.0524033 ,  11.60433999,  24.8893361 ,
        13.30047834,   8.41563196,   6.5094884 ,  45.73730366,
        13.43918572,  10.34693447,  29.82058153,   6.22479147,
        11.73384654,  11.35877012,   6.21479726,   8.440491  ,
        15.91937506, 278.14446394,  23.75780922,   7.32798627,
         9.33748343,  12.07292061,  18.84811715,  11.79583337,
         9.76683872, 281.32517709,   8.77682685,   6.42353255,
        13.61900684,  20.03639784,  27.34625327,  35.83179998,
        20.91939633,   7.62571056,   6.6309253 ,  27.51602815,
        10.96449406,   9.80470412,   6.93108341,  19.40938169,
        58.79534856,  13.2134847 ,   6.17552028,  10.57003639,
        11.55834237,  14.81567815,   7.67183279, 157.85413472,
        17.28916815,   9.50933106,  15.7705504 ,  42.0554162 ,
        13.63669202,  19.09632825,  81.25141113,  24.7913972 ,
        13.50745511,  26.84912739,  59.0900444 ,  11.52567971,
        12.66409588,  20.38840818,   9.67027222,  44.60495742,
         9.47874126, 445.73138553,  32.16711174,   7.83493112,
         6.13572626,  62.09544769,  10.00502639,  41.37890404,
        11.71364566, 118.07205491,  10.7832599 ,  12.23736432,
         6.54724999,  18.67151057,  22.07269761,   7.08680233,
        79.92235647,  23.78505305,   7.78002489,   6.0683152 ,
        24.09426143,   6.94854632,   6.07877805,  12.37774056,
         7.80921522,  57.92956573,   7.40138299,   9.23192092,
        48.92581694,  14.67714361,  66.95665264,   6.58964324,
         7.89725455,   9.74724871,   7.9164995 ,   7.06560909,
         6.27100062,   8.13134009,  15.84542173,   9.20934208,
        11.44846812,  62.65872857,  11.6003911 ,  10.26591341,
        12.62804461,   6.34729529,   6.71994875,  25.438578  ,
        53.8028209 ,   7.2253837 ,   6.80203376,  16.94465454,
         9.04223047,  23.02754038,  10.74423263,  16.76524298,
         6.36849073,  26.43137372,   6.8588692 ,  12.16560277,
         7.4440606 ,   7.47910305,  45.1523809 ,   6.14998108])
```

Ввод [14]:
```
NA=len(sample[sample<7])
pstat=NA/N
pstat
```

Out[14]: 0.135

Ввод [15]:
```
def Q(p):
    return 6/(1-p)
```

Ввод [16]:
```
Q(0.3)
```

Out[16]: 8.57142857142857

Ввод [17]:
```
X.ppf(0.3)
```

Out[17]: 8.57142858190795

Ввод [18]:
```
U=uniform()
```

Ввод [49]:
```
N=50000000
data=U.rvs(size=N)
data

```

Out[49]:
```
array([0.93091713, 0.56852783, 0.89603243, ..., 0.93083616, 0.22280178,
       0.90449515])
```

Ввод [50]:
```
sample=Q(data)
sample
```

Out[50]:
```
array([86.85221315, 13.90587937, 57.71030301, ..., 86.75053528,
        7.72003829, 62.82403193])
```

Ввод [51]:
```
NA=len(sample[sample<7])
pstat=NA/N
pstat
```

Out[51]: 0.14289902

Ввод [86]:
```
N=150
sample1=np.array([X.ppf(U.rvs()) for i in range(1,N+1)])
sample1
```

Out[86]:
```
array([ 98.27706641,  15.0828582 ,   7.54520048,   6.29605498,
         6.35925656, 100.8373738 ,   8.43557818,  36.75500468,
         6.58885907,   6.55209706,   6.05490565,   8.55146925,
         8.57816356,  19.50638128,   9.7155885 ,   6.15265271,
         7.22825189,  49.79490307,   7.93876372,  11.17310656,
        12.1304832 ,  12.2456853 ,   7.58956708,  20.34037319,
         6.04330591,  21.4951238 ,  11.87061529,  58.6795566 ,
         7.06489472,   9.51880254,  12.66452712,   6.35966201,
        15.76864837,  10.55529366,   6.95517714,   8.0543865 ,
         6.52746649,  13.95652033,  15.27805575,   7.98815667,
        18.61582535,   6.84700757,  17.93419318,   9.10094361,
        19.9367639 ,   8.11115448,  13.74027383, 109.9150712 ,
        13.0684475 , 129.98313612,  78.06793267,   6.78696695,
         6.97100315,  18.81936663,   6.61982454,  23.65642811,
        15.46979682,   6.87036768,  46.89162533,  15.68187878,
        45.32820109,  12.34145474,  26.67750494,   7.82324717,
        44.53259256,  10.85676939,   6.77406384,   7.10866909,
         6.31412929,   7.63933492,  55.54273115,   6.43719729,
        10.67163247,   9.32190039,  64.06515892,  22.31353935,
         6.90281038,  57.0642875 ,   7.83824067,  12.21170156,
        45.09792669,   9.95281601,   6.93481732,  18.85821545,
        11.80229934,   8.21496905,  13.5944184 ,  10.51116245,
         9.68682475,  13.94124805,   6.31048684,  37.26245586,
        21.94096183,  12.60735462,   8.02870793,  17.90237889,
        14.23171722,  22.09995673, 116.46799663,   7.37965316,
        10.34093939,  38.0277063 ,   8.89946953,  24.17113204,
         6.12178552,  13.81292797,   6.09009186,   6.79676355,
         6.07317225,   9.45827106,  12.30317572,  18.69075828,
         6.10945947,  19.16835381, 150.39692154,   7.28929938,
        42.40139846,  41.33957409,   8.55724419,   9.46568027,
        34.33832696,  10.25439664,  24.43866418, 456.66692617,
        11.64771106, 195.75122642,   8.25808696,   8.08770675,
         7.92763193,  41.94306454, 102.2115542 ,  13.97321381,
        87.67380694,   9.25342354,  10.121977  ,  11.28446832,
         7.83751375,   7.79510596,  25.88097119,  42.63806019,
        10.26691794,   8.05992596,   6.757891  ,  12.0594128 ,
        30.31625257,   9.81499572,  12.53950107,  32.42568924,
         7.70264132,  11.58350441])
```

Ввод [87]:
```
NA=len(sample1[sample1<7])
pstat1=NA/N
pstat1
```

Out[87]: 0.18

Ввод [44]:
```
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```

Out[44]: 0.142857142857143

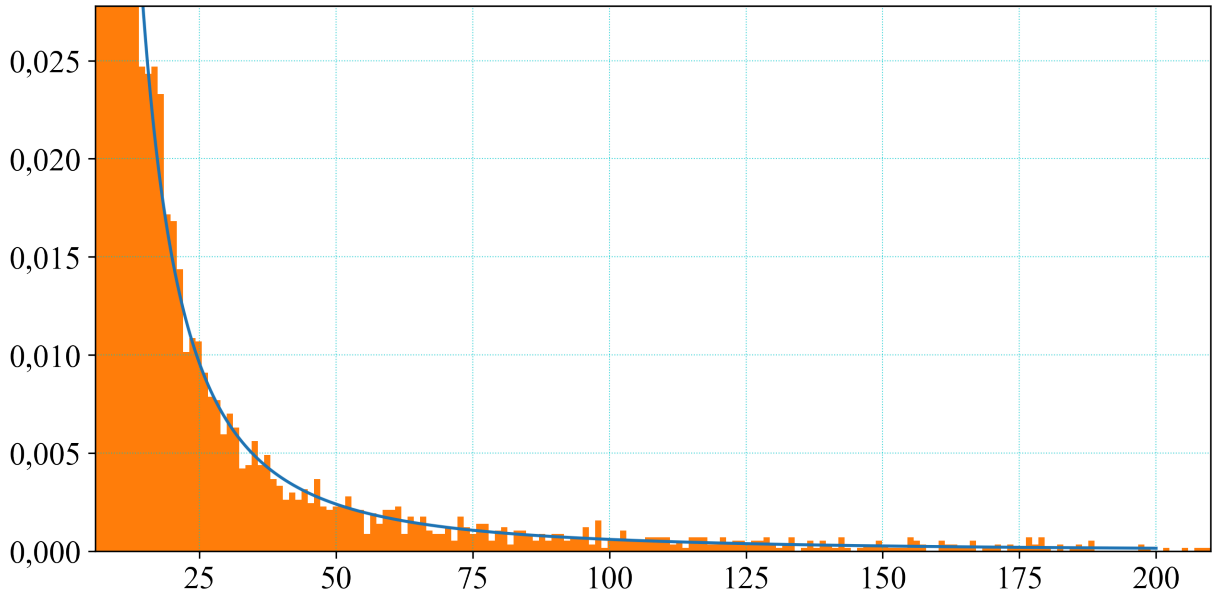
Ввод [88]:
```
x=np.linspace(6,200,10000)
y=np.array([X.pdf(t) for t in x])
```

Ввод [89]:
```
np.vectorize(X.pdf)
```

Out[89]:
```
<numpy.vectorize at 0x213bb030f10>
```

Ввод [90]:
```
x=np.linspace(6,200,10000)
y=np.vectorize(X.pdf)(x)
```

Ввод [209]:
```
rcParams['figure.figsize'] = (30, 20)
rcParams['figure.dpi'] = 300
import matplotlib.pyplot as plt
fig,ax =plt.subplots(figsize=(10, 5))
plt.tick_params(labelsize = 16)
plt.grid(color='DarkTurquoise', alpha=0.75, linestyle=':', linewidth=0.5)
ax.xaxis.set_major_locator(ticker.MaxNLocator(10))
#ax.xaxis.set_minor_locator(ticker.MaxNLocator(15))
###############
plt.plot(x,y)
plt.ylim(0,1/36)
plt.xlim(6,210)
plt.hist(sample,density=True,bins=23000)
plt.show()
```



Ввод [210]:
```
a=9
b=12
loc=a
scale=b-a
X=uniform(loc,scale)
Y=uniform(loc,scale)
```

Ввод [215]:
```
N=10000000
sampleX=X.rvs(size=N)
sampleY=Y.rvs(size=N)
Ans=(30*(sampleX-sampleY)**2).mean()
Ans
```

Out[215]: 45.0193122441194

Ввод [ ]:
```
```