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## 課題解答例

### Gaussian(正規分布)へのフィット

正規分布で知られる, ガウス関数

$$f(x) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(\frac{-(x - \mu)^2}{2\sigma^2}\right)$$

フィットをやってみましょう.

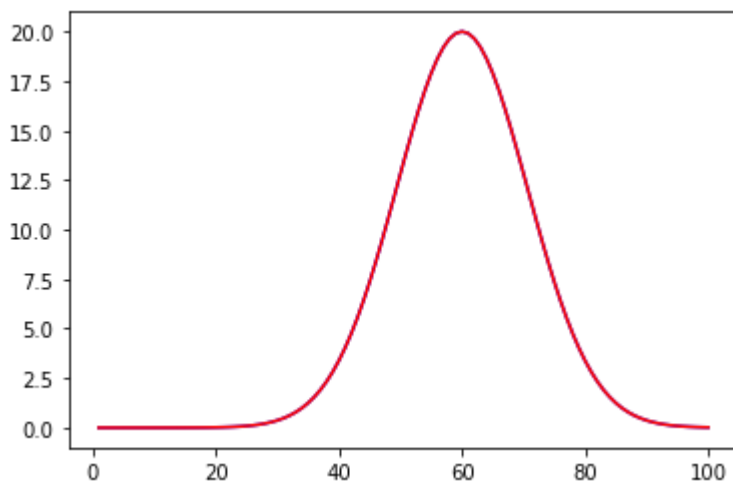
例えば, 平均値( $\mu$ )が60点, 偏差値( $\sigma$ )が15点として, ピークの人数が20人としましょう.

```
In [3]: import numpy as np
import matplotlib.pyplot as plt
from scipy.optimize import curve_fit

def func(x, a1, a2, a3):
    return a1*np.exp(-(x-a2)**2/a3**2)

ndata = 100
xdata = np.linspace(1, ndata, ndata)
y = func(xdata, 20, 60, 15)
ydata = y
plt.plot(xdata, ydata, 'b-', label='data')

popt, pcov = curve_fit(func, xdata, ydata)
plt.plot(xdata, func(xdata, *popt), 'r-', label='fit')
plt.show()
```



```
In [4]: from pprint import pprint
import scipy.linalg as linalg
```

```

def dfda1(x,a1,a2,a3):
    return np.exp(-(x - a2) ** 2 / a3 ** 2 / 2)
def dfda2(x,a1,a2,a3):
    return a1 * (x - a2) / a3 ** 2 * np.exp(-(x - a2) ** 2 / a3 ** 2 / 2)
def dfda3(x,a1,a2,a3):
    return a1 * (x - a2) ** 2 / a3 ** 3 * np.exp(-(x - a2) ** 2 / a3 ** 2 / 2)

```

```

In [16]: nparam = 3
         guess1 = [10,50,10]

```

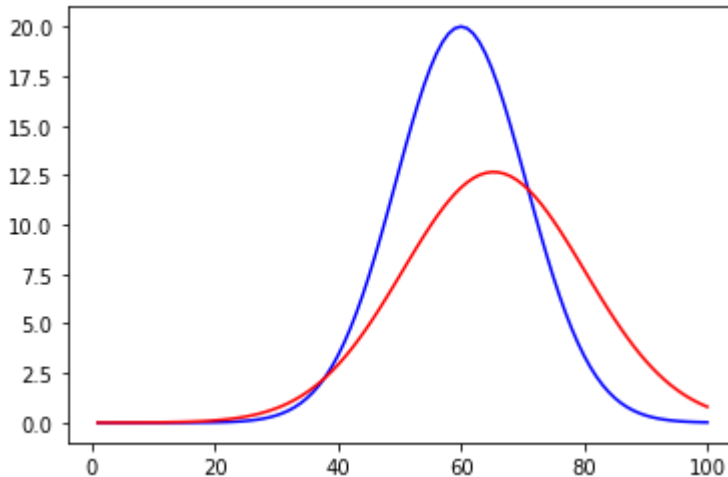
```

In [17]: df=np.zeros([ndata])
         for i in range(0,ndata):
             dy = ydata[i]-func(xdata[i], *guess1)
             df[i]=dy
             #pprint(df)
         Jac=np.zeros([ndata,nparam])
         for i in range(0,ndata):
             Jac[i,0] = dfda1(xdata[i], *guess1)
             Jac[i,1] = dfda2(xdata[i], *guess1)
             Jac[i,2] = dfda3(xdata[i], *guess1)
             # pprint(Jac)
         iJac = linalg.inv(np.dot(np.transpose(Jac),Jac))
         # print(iJac)
         Jdf = np.dot(np.transpose(Jac),df)
         # pprint(Jdf)
         guess1 = guess1 + np.dot(iJac, Jdf)
         pprint(guess1)
         plt.plot(xdata, ydata, 'b-', label='data')

         #popt, pcov = curve_fit(func, xdata, ydata)
         plt.plot(xdata, func(xdata, *guess1), 'r-', label='fit')
         plt.show()

```

```
array([12.65890851, 65.30826287, 20.88231001])
```



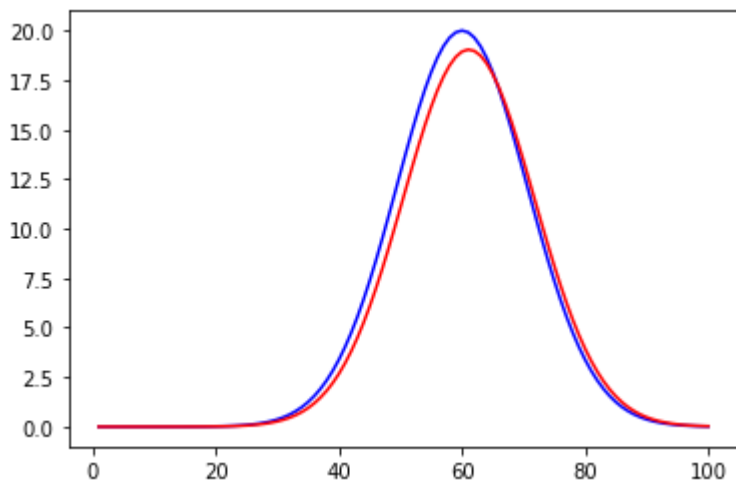
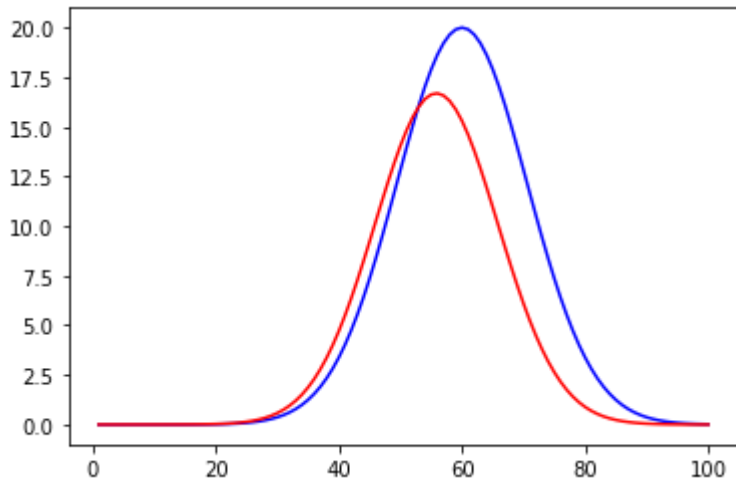
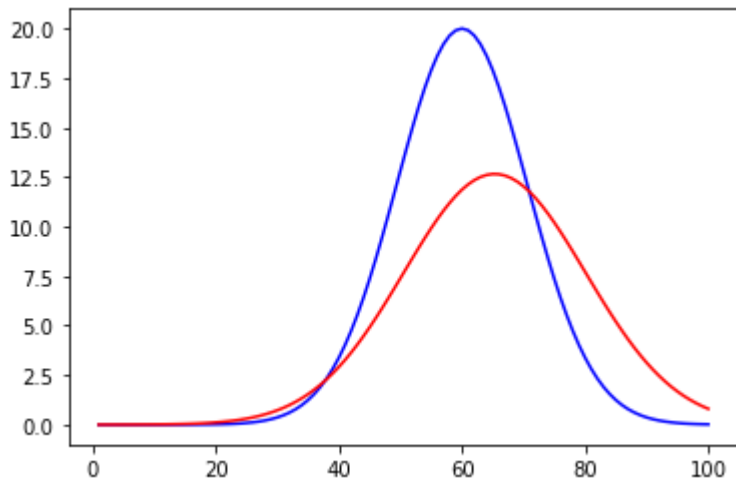
これを4回ぐらい繰り返す。

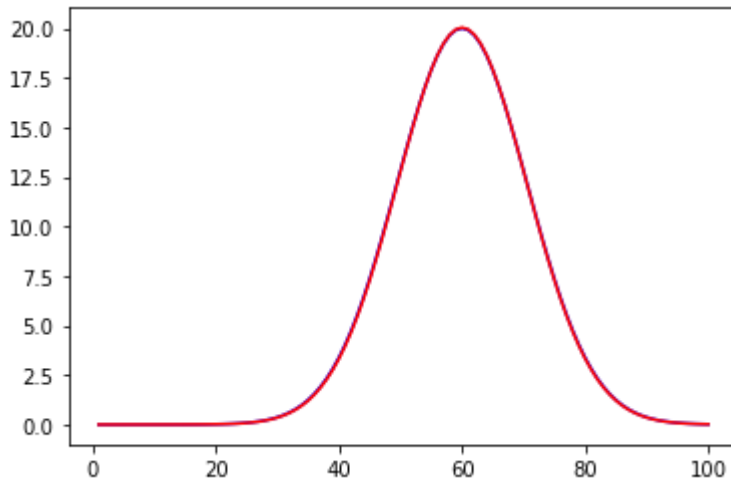
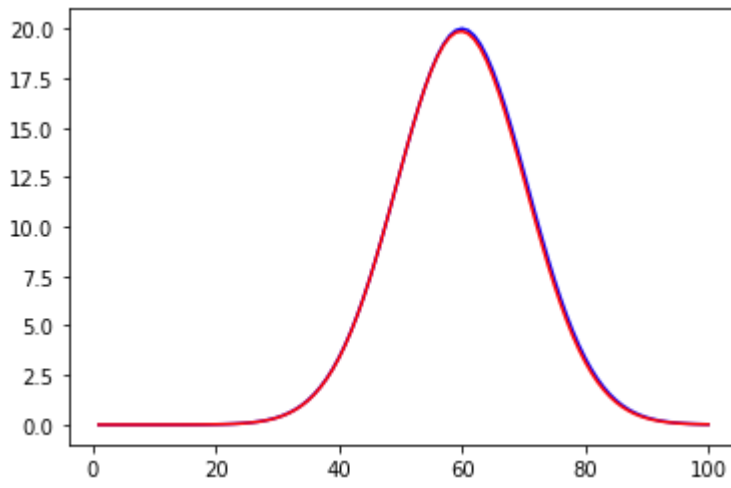
```

guess1 = [10,50,10]
array([16.69058876, 55.85037666, 14.09363923])
array([19.03931932, 61.10281187, 15.0516337 ])
array([19.86610657, 59.84145965, 14.87841873])
array([20.0354474 , 60.01550602, 14.92040764])

```

下のプロットとはずれているかも. . . .





In [ ]: