

(1)

```
import sympy as sy
import numpy as np
import scipy.stats as st
```

```
import scipy as sp
```

(a) 正态分布 $f_n(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$

(b) 自由度为1的正态分布

```
T = sp.special.gamma
```

```
x = sy.symbols('x')
```

```
v = 1
```

```
p2 = x**(0.5*v-1) * sy.exp(-0.5*x) / (T(0.5*v)**(0.5*v))
```

```
p2
```

$0.29899792464014333e^{-0.5x}$

$x^{0.5}$

(c) 自由度为2的正态分布

(d) 柯西分布

```
T = sp.special.gamma
```

```
x = sy.symbols('x')
```

$f(x;0,1) = \frac{1}{\pi(1+x^2)}$

```
v = 2
```

```
p3 = x**(0.5*v-1) * sy.exp(-0.5*x) / (T(0.5*v)**(0.5*v))
```

```
p3
```

$0.5e^{-0.5x}$

(e)

自由度为1的正态分布

```
T = sp.special.gamma
```

```
pi = sy.pi
```

```
x = sy.symbols('x')
```

```
v = 2
```

```
p5 = (1+x**2/v)**(-v/2) * T(v/2) / (T(v/2)**(v/2) * sy.sqrt(pi*v))
```

```
p5
```

$0.443113462726379\sqrt{2}$

$\sqrt{\pi(\frac{x^2}{2}+1)}^{1.5}$

[2]

(b) $V=1$

$X2=1$

$d2 = \text{st.chi2.cdf}(X2, V)$

$d2$

0.6826894921370859

(c) $V=2$

$X2=1$

$d2 = \text{st.chi2.cdf}(X2, V)$

$d2$

0.2924693402873665

(e) $V=1$

$t=1$

$d5 = \text{st.t.cdf}(t, V)$

$d5$

0.7500000000000002

[3]

(a) $M=65$

$\sigma=5$

$n=25$

$XBar=64$

$\mu_x=\mu$

$\sigma_x = \sigma / \sqrt{5} \cdot \text{sqrt}(n)$

$\text{prob} = \text{st.norm.cdf}(XBar, \mu_x, \sigma_x)$

prob

0.0427903522728147

(b) $M=65$

$s=5$

$n=25$

$V=n-1$

$XBar=64$

$t = (XBar - \mu) / (s / \sqrt{n} \cdot \sqrt{V})$

$\text{prob} = \text{st.t.cdf}(t, V)$

prob

0.5429006151236145

(c) $d=.05$

$X = \text{st.t.ppf}(d, V)$

X

-1.7108820799094282

(d)

$X2 = \text{st.t.ppf}(0.95, V)$

$X1 = \text{st.t.ppf}(0.05, V)$

$(X1, X2)$

(-1.7108820799094282,

1.7108820799094282)