

# 二元配置分散分析

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## 1 目的

二元配置分散分析を行う。

## 2 使用法

```
import sys
sys.path.append("statlib")
from xtest import twoway_ANOVA
twoway_ANOVA(x, a, b, verbose=True)
```

### 2.1 引数

x	測定値
a	要因 A を表す変数
b	要因 B を表す変数
verbose	必要最小限のプリント出力をする

### 2.2 戻り値の名前

"result"	結果をデータフレームにして返す
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## 3 使用例

### 3.1 繰り返し数が1の場合

```
import pandas as pd

a = [1, 1, 1, 1, 2, 2, 2, 2, 3, 3, 3, 3]
b = [1, 2, 3, 4, 1, 2, 3, 4, 1, 2, 3, 4]
x = [9, 17, 12, 16, 1, 21, 16, 11, 7, 19, 6, 9]
df = pd.DataFrame({"x": x, "a": a, "b": b})
```

```
import sys
sys.path.append("statlib")
from xtest import twoway_ANOVA

ans = twoway_ANOVA(df)
```

	SS	d.f.	MS	F value	p value
a	21.500000	2	10.750000	0.659284	0.551030
b	268.666667	3	89.555556	5.492334	0.037192
e	97.833333	6	16.305556	NaN	NaN
T	388.000000	11	35.272727	NaN	NaN

### 3.2 繰り返し数が周辺度数に比例する場合

```
import numpy as np

# case 2-1
x = [24.8, 23.9, 24.1, 28.8, 22.6, 28.0, 26.4, 27.4, 29.4, 30.0, 28.7,
     29.2, 25.0, 26.6, 27.9, 28.5, 27.1, 25.2, 27.9, 29.2, 26.7,
     25.0,
     29.9, 29.4, 27.5, 32.5, 29.5, 26.3, 28.2, 31.8, 30.2, 31.7,
     29.2,
     30.3, 30.9, 28.4, 29.8, 26.7, 30.7, 28.5, 26.5, 26.7, 31.7,
     27.2,
     25.5, 29.9, 27.3, 28.8, 28.5, 25.7, 28.7, 31.3, 29.4, 29.8,
     30.3,
     29.6, 31.7, 33.6, 32.0, 34.3]
a = np.ravel([np.repeat(range(4), 3) for i in range(5)])
b = np.repeat(range(5), 12)
df = pd.DataFrame({"x": x, "a": a, "b": b})

ans = twoway_ANOVA(df)
```

#### 母数モデル

	SS	d.f.	MS	F value	p value
a	51.397333	3	17.132444	4.937067	0.005204
b	106.287333	4	26.571833	7.657221	0.000111
a:b	52.852667	12	4.404389	1.269215	0.273893
e	138.806667	40	3.470167	NaN	NaN
T	349.344000	59	5.921085	NaN	NaN

#### 変量モデル

	SS	d.f.	MS	F value	p value
a	51.397333	3	17.132444	3.889857	0.037391

```

b    106.287333    4  26.571833  6.033035  0.006719
a:b   52.852667   12  4.404389  1.269215  0.273893
e    138.806667   40  3.470167    NaN    NaN
T    349.344000   59  5.921085    NaN    NaN

```

```

# case 2-2
d = np.array([ 1, 1, 7.0, 1, 1, 5.7,
              1, 2, 4.6, 1, 2, 5.6,
              1, 3, 7.0, 1, 3, 7.4,
              1, 3, 6.6, 1, 4, 7.3,
              1, 4, 6.3, 1, 4, 7.8,
              1, 5, 5.3, 1, 5, 4.7,
              2, 1, 5.8, 2, 1, 8.9,
              2, 2, 10.0, 2, 2, 7.1,
              2, 3, 6.5, 2, 3, 9.8,
              2, 3, 5.0, 2, 4, 9.7,
              2, 4, 6.4, 2, 4, 9.9,
              2, 5, 7.8, 2, 5, 5.4,
              3, 1, 8.1, 3, 1, 6.1, 3, 1, 10.2, 3, 1, 6.9,
              3, 2, 5.2, 3, 2, 5.7, 3, 2, 11.8, 3, 2, 6.1,
              3, 3, 10.4, 3, 3, 5.6, 3, 3, 9.4, 3, 3, 5.9, 3, 3, 12.1, 3, 3,
              5.7,
              3, 4, 5.3, 3, 4, 9.7, 3, 4, 5.5, 3, 4, 10.2, 3, 4, 13.8, 3, 4,
              7.0,
              3, 5, 11.1, 3, 5, 4.2, 3, 5, 7.1, 3, 5, 5])
d = d.reshape((48, 3))
df = pd.DataFrame(d[:,[2,0,1]], columns=["x", "a", "b"])

ans = twoway_ANOVA(df)

```

#### 母数モデル

	SS	d.f.	MS	F value	p value
a	20.796875	2	10.398437	1.758991	0.187983
b	19.536458	4	4.884115	0.826193	0.518037
a:b	7.848958	8	0.981120	0.165965	0.994003
e	195.082500	33	5.911591	NaN	NaN
T	243.264792	47	5.175847	NaN	NaN

#### 変量モデル

	SS	d.f.	MS	F value	p value
a	20.796875	2	10.398437	10.598540	0.005636
b	19.536458	4	4.884115	4.978102	0.026004
a:b	7.848958	8	0.981120	0.165965	0.994003
e	195.082500	33	5.911591	NaN	NaN
T	243.264792	47	5.175847	NaN	NaN

### 3.3 一般の場合

前述のどれでもない場合。

```
# case 3
a = [1, 1, 1, 1, 2, 2, 2, 2, 2]
b = [1, 1, 2, 2, 1, 1, 2, 2, 2]
x = [17, 16, 25, 22, 18, 26, 34, 30, 34, 30]
df = pd.DataFrame({"x": x, "a": a, "b": b})

ans = twoway_ANOVA(df)
```

	SS	d.f.	MS	F value	p value
a	121.440476	1	121.440476	13.747978	0.009995
b	177.190476	1	177.190476	20.059299	0.004198
a:b	5.142857	1	5.142857	0.582210	0.474369
e	53.000000	6	8.833333	NaN	NaN
T	415.600000	9	46.177778	NaN	NaN

このプログラムでは Type II の平方和を使っているので、(結果表示中の順番は異なっても) 要因の指定順序によって結果が異なることはない。

```
df = pd.DataFrame({"x": x, "b": b, "a": a})

ans = twoway_ANOVA(df)
```

	SS	d.f.	MS	F value	p value
b	177.190476	1	177.190476	20.059299	0.004198
a	121.440476	1	121.440476	13.747978	0.009995
b:a	5.142857	1	5.142857	0.582210	0.474369
e	53.000000	6	8.833333	NaN	NaN
T	415.600000	9	46.177778	NaN	NaN