플라스틱의 3가지 유형을 시험한 결과

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **플라스틱 유형 / 습도** | **30%** | **50%** | **70%** | **90%** |
| a | 39.0 | 33.1 | 33.8 | 33.0 |
| b | 36.9 | 27.2 | 29.7 | 28.5 |
| c | 27.4 | 29.2 | 26.7 | 30.9 |

In [30]:

*#* 연습문제 *3 p371, node (7)*

*#* 접차된 레고*(*플라스틱*)* 조각들을 떼어놓는데 필요한 힘을 결정하기 위하여 연구가 이루어졌을 때*,* 네 가지의 습도를 사용하여

**from** scipy **import** stats

**from** math **import** sqrt

data **=** [[39.0, 33.1, 33.8, 33.0],

[36.9, 27.2, 29.7, 28.5],

[27.4, 29.2, 26.7, 30.9]]

n\_rows **=** len(data) n\_cols **=** len(data[0]) n\_total **=** n\_rows **\*** n\_cols

grand\_mean **=** sum([sum(row) **for** row **in** data]) **/** n\_total

ss\_humidity **=** sum([((sum(data[i]) **/** n\_cols) **-** grand\_mean) **\*\*** 2 **for** i **in** range(n\_rows)]) **\*** n\_cols

ss\_plastic\_type **=** sum([((sum([data[i][j] **for** i **in** range(n\_rows)]) **/** n\_rows) **-** grand\_mean) **\*\*** 2 **for** j **in** range(n\_cols)]) **\*** n\_rows ss\_total **=** sum([(data[i][j] **-** grand\_mean) **\*\*** 2 **for** i **in** range(n\_rows) **for** j **in** range(n\_cols)])

ss\_error **=** ss\_total **-** ss\_humidity **-** ss\_plastic\_type df\_humidity **=** n\_rows **-** 1

df\_plastic\_type **=** n\_cols **-** 1

df\_error **=** df\_humidity **\*** df\_plastic\_type df\_total **=** n\_total **-** 1

ms\_humidity **=** ss\_humidity **/** df\_humidity ms\_plastic\_type **=** ss\_plastic\_type **/** df\_plastic\_type ms\_error **=** ss\_error **/** df\_error

f\_humidity **=** ms\_humidity **/** ms\_error f\_plastic\_type **=** ms\_plastic\_type **/** ms\_error

p\_humidity **=** stats**.**f**.**sf(f\_humidity, df\_humidity, df\_error) p\_plastic\_type **=** stats**.**f**.**sf(f\_plastic\_type, df\_plastic\_type, df\_error)

print('요인\t\t제곱합\t\t자유도\t\t평균제곱\t\tF-통계량\t\tP-value') print('A\t\t{:.3f}\t\t{}\t\t{:.3f}\t\t{:.3f}\t\t{:.3f}'**.**format(ss\_humidity, df\_humidity, ms\_humidity, f\_humidity, p\_humidity)) print('B\t\t{:.3f}\t\t{}\t\t{:.3f}\t\t{:.3f}\t\t{:.3f}'**.**format(ss\_plastic\_type, df\_plastic\_type, ms\_plastic\_type, f\_plastic\_type, p\_plastic\_type)) print('오차\t\t{:.3f}\t\t{}\t\t{:.3f}'**.**format(ss\_error, df\_error, ms\_error))

print('총합\t\t{:.3f}\t\t{}'**.**format(ss\_total, df\_total))

요인 제곱합 자유도 평균제곱 F-통계량 P-value

A 79.272 2 39.636 4.692 0.059

B 41.217 3 13.739 1.626 0.280

오차 50.688 6 8.448

총합 171.177 11

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