Table of Contents


```
clear;
```

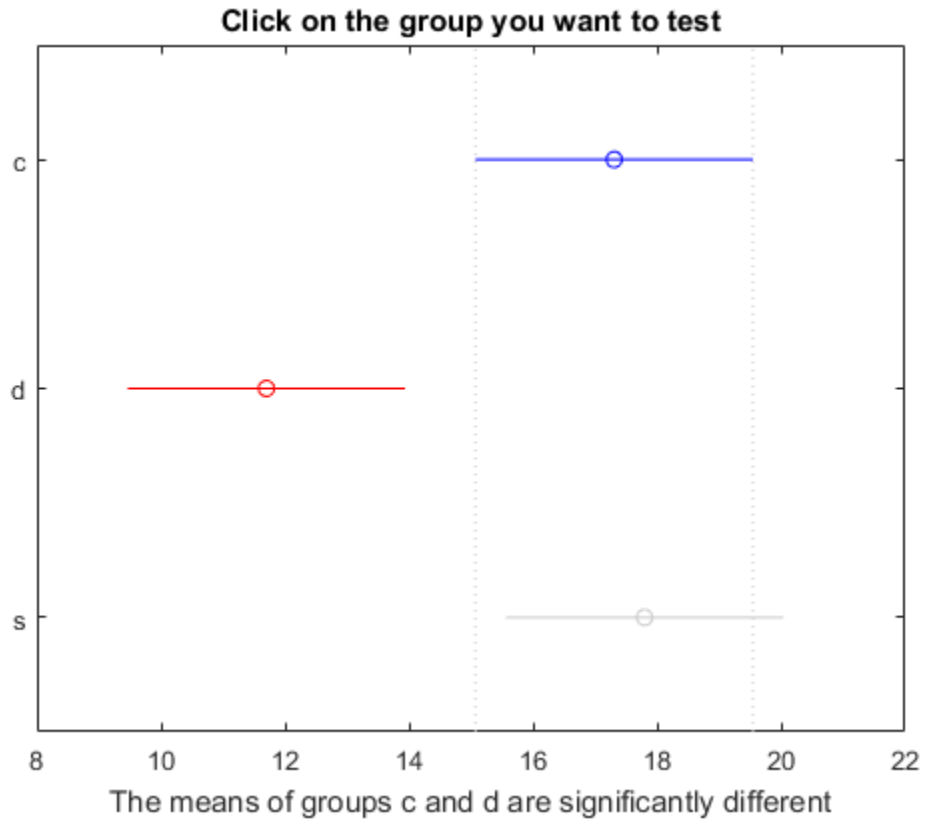
9.1-2

```
control = [17.9 12.2 14.9 13.8 26.1 15.4 20.3 16.9 20.8 14.8];
deficient = [ 7.0 6.9 13.3 11.1 11.0 16.5 12.7 12.4 17.1 9.0];
slow = [19.8 20.3 16.1 17.9 12.4 12.5 17.4 19.9 27.3 14.4];

data = [ control deficient slow ];
groups(1:10) = {'c'};
groups(11:20) = {'d'};
groups(21:30) = {'s'};

[p,table,stats] = anova1(data,groups)
multcompare(stats);
% yes, heights differ
```

```
p =
    0.0034
table =
    'Source'    'SS'          'df'    'MS'          'F'
 'Prob>F'
    'Groups'    [229.7407]    [ 2]    [114.8703]    [7.0587]
 [0.0034]
    'Error'     [439.3890]    [27]    [ 16.2737]          []
 []
    'Total'     [669.1297]    [29]            []          []
 []
stats =
    gnames: {3x1 cell}
         n: [10 10 10]
    source: 'anova1'
     means: [17.3100 11.7000 17.8000]
        df: 27
         s: 4.0341
```

ANOVA Table

Source	SS	df	MS	F	Prob>F
Groups	229.741	2	114.87	7.06	0.0034
Error	439.389	27	16.274		
Total	669.13	29			



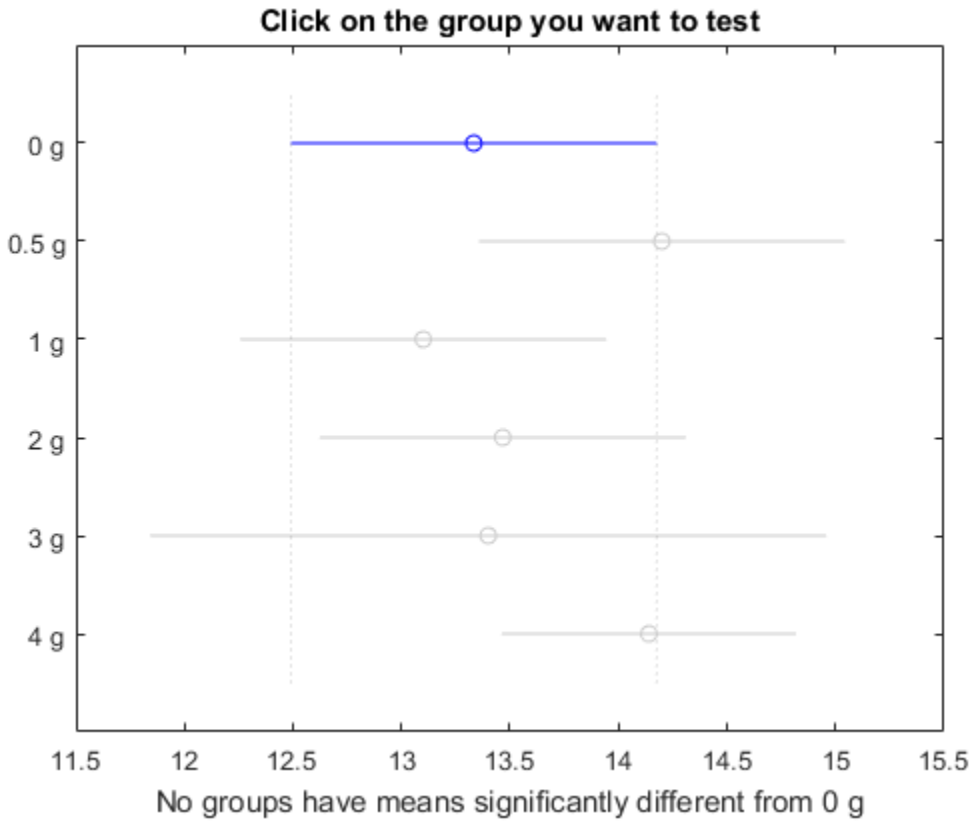
9.1-4

```
clear;
g0 = [12.7 14.1 13.2];
g05 = [13.5 14.5 14.6];
g1 = [12.7 13.4 13.2];
g2 =[12.7 13.6 14.1];
g3 = [13.4 13.5 14.3];
g4 = [14.5 13.5 14.9];

data = [g0,g05,g1,g2,g3,g4];
groups(1:3) = {'0 g'};
groups(4:6) = {'0.5 g'};
groups(7:9) = {'1 g'};
groups(10:12) = {'2 g'};
groups(13:15) = {'3 g'};
groups(14:18) = {'4 g'};

[p,table,stats] = anova1(data,groups)
multcompare(stats);
% no differences
```

```
p =
    0.1843
table =
    'Source'    'SS'        'df'    'MS'        'F'         'Prob>F'
    'Groups'    [3.4524]    [ 5]    [0.6905]    [1.8150]    [0.1843]
    'Error'     [4.5653]    [12]    [0.3804]          []          []
    'Total'     [8.0178]    [17]          []          []          []
stats =
    gnames: {6x1 cell}
         n: [3 3 3 3 1 5]
    source: 'anova1'
     means: [13.3333 14.2000 13.1000 13.4667 13.4000 14.1400]
        df: 12
         s: 0.6168
```

ANOVA Table

Source	SS	df	MS	F	Prob>F
Groups	3.45244	5	0.69049	1.81	0.1843
Error	4.56533	12	0.38044		
Total	8.01778	17			

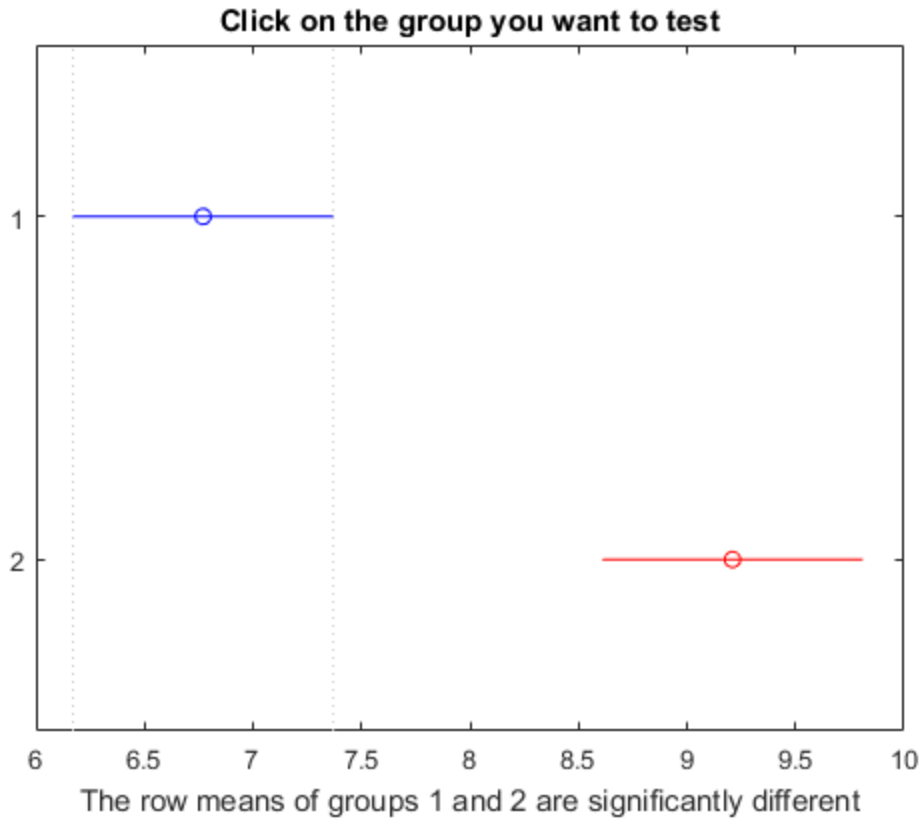


1. The treatment populations must be normal. 2. The treatment populations must all have the same variance

9.3-6

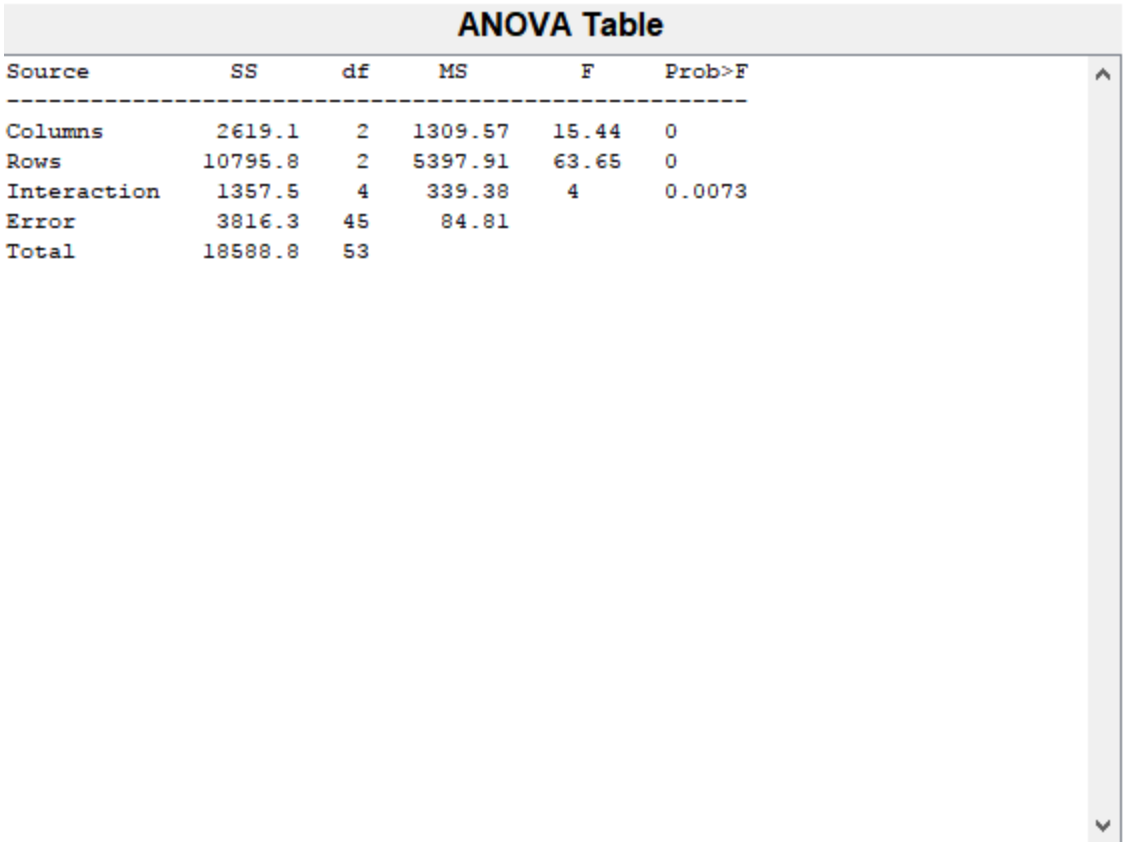
```
SA =[6.4 5.8 5.1 8.4 7.0 8.4 8.5 7.5 7.0 7.9]';
SB =[4.7 4.7 3.8 5.3 10.6 4.5 8.2 10.8 5.1 5.7]';
IA =[11.0 8.9 9.3 9.2 7.9 9.7 9.0 12.5 6.7 9.8]';
IB =[8.9 7.0 10.7 10.3 6.2 12.2 7.0 9.5 8.7 9.7]';

data = [SA SB; IA IB];
[p_vals, table,stats] = anova2(data, 10)
multcompare(stats,'estimate','column');
multcompare(stats,'estimate','row');

% Yes, it is possible, P=0.687
% Yes, there's a difference, p=0.00002
% Yes, no difference, p=0.3014
```

```
p_vals =
    0.3014    0.0002    0.6873
table =
  Columns 1 through 5
    'Source'         'SS'          'df'    'MS'         'F'
    'Columns'        [  3.8440]    [ 1]    [ 3.8440]    [ 1.0992]
    'Rows'           [ 59.5360]    [ 1]    [59.5360]    [17.0238]
    'Interaction'    [  0.5760]    [ 1]    [ 0.5760]    [ 0.1647]
    'Error'          [125.9000]    [36]    [ 3.4972]           []
    'Total'          [189.8560]    [39]           []           []
  Column 6
    'Prob>F'
    [    0.3014]
    [2.0838e-04]
    [    0.6873]
                []
                []
stats =
      source: 'anova2'
     sigmasq: 3.4972
    colmeans: [8.3000 7.6800]
        coln: 20
    rowmeans: [6.7700 9.2100]
        rown: 20
       inter: 1
        pval: 0.6873
          df: 36
Note: Your model includes an interaction term.  A test of main effects
 can be
difficult to interpret when the model includes interactions.
Note: Your model includes an interaction term.  A test of main effects
 can be
difficult to interpret when the model includes interactions.
```



9.3-9

```
S80T5 =[5 6 5 5 4 3]';
S80T10 =[8 8 8 8 8 8]';
S80T15 =[11 10 9 9 10 9]';
S150T5 =[9 11 9 8 10 9]';
S150T10 =[14 14 15 13 17 18]';
S150T15 =[16 15 26 24 24 25]';
S220T5 =[34 33 19 21 18 20]';
S220T10 =[60 59 29 31 28 31]';
S220T15 =[65 64 31 33 75 80]';

data = [S80T5 S80T10 S80T15;S150T5 S150T10 S150T15;S220T5 S220T10
 S220T15];
[p_vals, table,stats] = anova2(data, 6);

% No, it is not possible, P=0.007
% No, no model
% No, no model
```



ANOVA Table

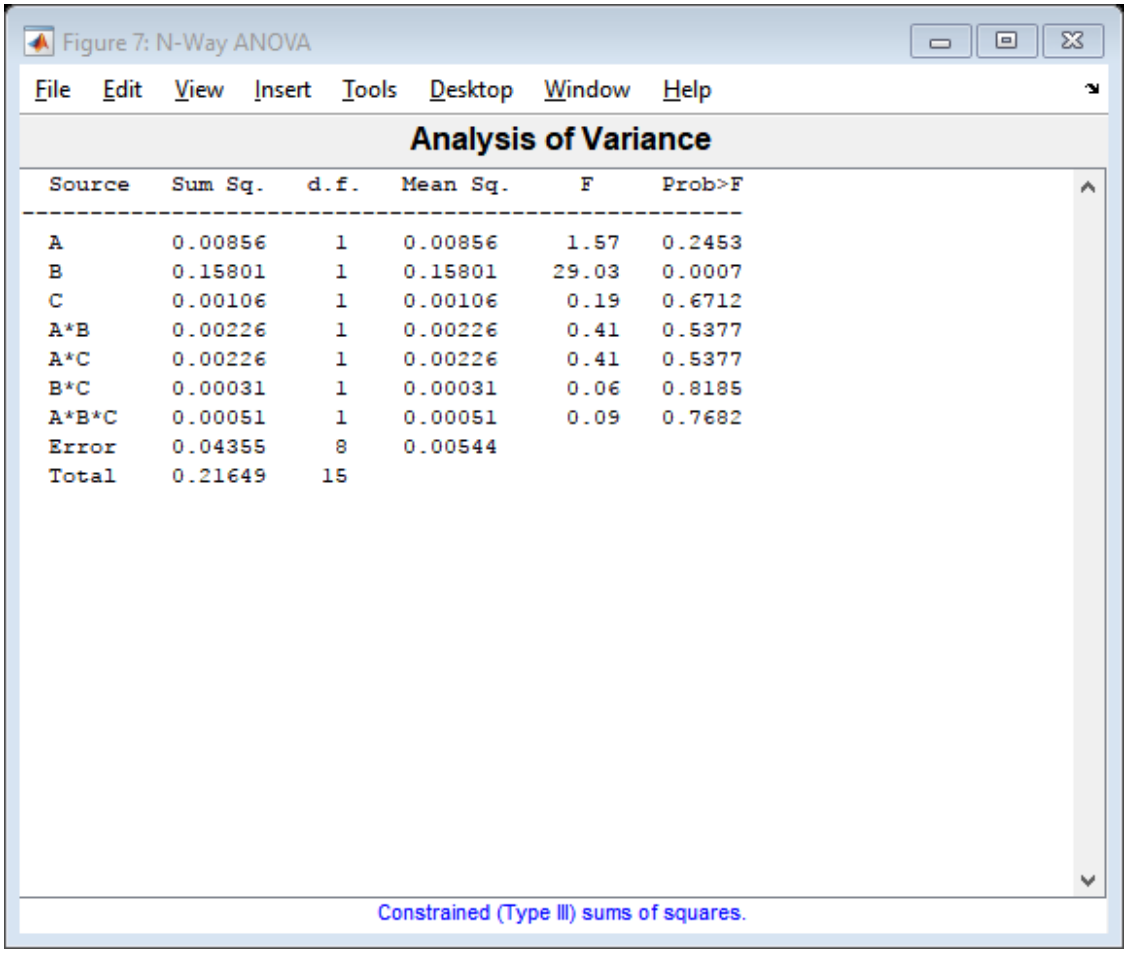
Source	SS	df	MS	F	Prob>F
Columns	2619.1	2	1309.57	15.44	0
Rows	10795.8	2	5397.91	63.65	0
Interaction	1357.5	4	339.38	4	0.0073
Error	3816.3	45	84.81		
Total	18588.8	53			

Because the design is not balanced, the analysis becomes harder, and we do not know how to do the calculations.

9.5-4

```
data = [0.55, 0.49...
        0.60, 0.42...
        0.37, 0.28...
        0.30, 0.28...
        0.54, 0.54...
        0.54, 0.47...
        0.44, 0.33...
        0.36, 0.20];

f=ff2n(3+1);
A=f(:,3)';
B=f(:,2)';
C=f(:,1)';

[p,table] = anovan(data,{A,B,C},'model','full','varnames',
{'A','B','C'})

% Yes, it is appropiate (no interactions)
% B has an effect

p =
```

```
    0.2453
    0.0007
    0.6712
    0.5377
    0.5377
    0.8185
    0.7682
table =
  Columns 1 through 5
    'Source'    'Sum Sq.'       'd.f.'    'Singular?'    'Mean Sq.'
    'A'         [    0.0086]    [   1]    [        0]    [    0.0086]
    'B'         [    0.1580]    [   1]    [        0]    [    0.1580]
    'C'         [    0.0011]    [   1]    [        0]    [    0.0011]
    'A*B'       [    0.0023]    [   1]    [        0]    [    0.0023]
    'A*C'       [    0.0023]    [   1]    [        0]    [    0.0023]
    'B*C'       [3.0625e-04]    [   1]    [        0]    [3.0625e-04]
    'A*B*C'     [5.0625e-04]    [   1]    [        0]    [5.0625e-04]
    'Error'     [    0.0436]    [   8]    [        0]    [    0.0054]
    'Total'     [    0.2165]    [  15]    [        0]              []
  Columns 6 through 7
    'F'          'Prob>F'
    [ 1.5718]    [    0.2453]
    [29.0253]    [6.5572e-04]
    [ 0.1940]    [    0.6712]
    [ 0.4145]    [    0.5377]
    [ 0.4145]    [    0.5377]
    [ 0.0563]    [    0.8185]
    [ 0.0930]    [    0.7682]
           []              []
           []              []
```



9.5-5

```
data = [68.0 77.5 98.0 98.0 74.0 77.0 97.0 98.0];
f = fliplr(ff2n(3));
f(f==0)=-1;
f(:,4)=f(:,1).*f(:,2);
f(:,5)=f(:,1).*f(:,3);
f(:,6)=f(:,2).*f(:,3);
f(:,7)=f(:,1).*f(:,2).*f(:,3);

effect = data*f/4

% No, design is unreplicated
% No, B has the greatest effect
```

```
effect =
    3.3750   23.6250    1.1250   -2.8750   -1.3750   -1.6250    1.8750
```

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