```
$Single.Stage.Equal.Alpha.Allocation.Design
$Single.Stage.Equal.Alpha.Allocation.Design$design.parameters
$Single.Stage.Equal.Alpha.Allocation.Design$design.parameters$cumulative.sample.sizes.and.c
alendar.time.per.stage
  Stage  C1  C2  A1  A2 Analysis.Time.In.Years
1     1 250 250 250 250                      5

$Single.Stage.Equal.Alpha.Allocation.Design$design.parameters$alpha.allocation
  Stage Subpop.1 Subpop.2
1     1    0.025    0.025

$Single.Stage.Equal.Alpha.Allocation.Design$design.parameters$futility.boundaries
  Stage Subpop.1 Subpop.2
1     1       NA       NA


$Single.Stage.Equal.Alpha.Allocation.Design$design.performance
$Single.Stage.Equal.Alpha.Allocation.Design$design.performance$Power
  Scenario Power.H01 Power.H02 Prob.Reject.All.False.Null.Hypotheses
1        1    0.8648    0.8583                                0.7615
2        2    0.8047        NA                                0.8047
3        3        NA    0.7971                                0.7971
4        4        NA        NA                                    NA

$Single.Stage.Equal.Alpha.Allocation.Design$design.performance$Type.1.Error
  Scenario Type.I.Error.H01 Type.I.Error.H02 Familywise.Type.I.Error
1        1               NA               NA                     NA
2        2               NA           0.0458                 0.0458
3        3           0.0455               NA                 0.0455
4        4           0.0241           0.0273                 0.0492

$Single.Stage.Equal.Alpha.Allocation.Design$design.performance$Expected.Sample.Size
                            Scenario expected.sample.size
1                                  1                1000
2                                  2                1000
3                                  3                1000
4                                  4                1000
5 Weighted.Combination.Over.Scenarios                1000

$Single.Stage.Equal.Alpha.Allocation.Design$design.performance$Expected.Duration
                            Scenario expected.duration
1                                  1                 4
2                                  2                 4
3                                  3                 4
4                                  4                 4
5 Weighted.Combination.Over.Scenarios                 4

$Single.Stage.Equal.Alpha.Allocation.Design$design.performance$Distribution.of.sample.size.
and.duration.per.scenario
  scenario C1 C2 A1 A2 sample.size duration frequency proportion
1        1  1  1  1  1        1000        4     10000          1
2        2  1  1  1  1        1000        4     10000          1
3        3  1  1  1  1        1000        4     10000          1
4        4  1  1  1  1        1000        4     10000          1
```

```
$Single.Stage.Optimized.Alpha.Allocation.Design
$Single.Stage.Optimized.Alpha.Allocation.Design$design.parameters
$Single.Stage.Optimized.Alpha.Allocation.Design$design.parameters$cumulative.sample.sizes.a
nd.calendar.time.per.stage
  Stage  C1  C2  A1  A2 Analysis.Time.In.Years
1     1 250 250 250 250                     5

$Single.Stage.Optimized.Alpha.Allocation.Design$design.parameters$alpha.allocation
  Stage Subpop.1 Subpop.2
1     1    0.025    0.025

$Single.Stage.Optimized.Alpha.Allocation.Design$design.parameters$futility.boundaries
  Stage Subpop.1 Subpop.2
1     1       NA       NA


$Single.Stage.Optimized.Alpha.Allocation.Design$design.performance
$Single.Stage.Optimized.Alpha.Allocation.Design$design.performance$Power
  Scenario Power.H01 Power.H02 Prob.Reject.All.False.Null.Hypotheses
1        1    0.8605    0.8635                                0.7623
2        2    0.8000        NA                                0.8000
3        3        NA    0.8013                                0.8013
4        4        NA        NA                                    NA

$Single.Stage.Optimized.Alpha.Allocation.Design$design.performance$Type.1.Error
  Scenario Type.I.Error.H01 Type.I.Error.H02 Familywise.Type.I.Error
1        1               NA               NA                      NA
2        2               NA           0.0464                  0.0464
3        3           0.0450               NA                  0.0450
4        4           0.0236           0.0247                  0.0465

$Single.Stage.Optimized.Alpha.Allocation.Design$design.performance$Expected.Sample.Size
                            Scenario expected.sample.size
1                                  1                1000
2                                  2                1000
3                                  3                1000
4                                  4                1000
5 Weighted.Combination.Over.Scenarios                1000

$Single.Stage.Optimized.Alpha.Allocation.Design$design.performance$Expected.Duration
                            Scenario expected.duration
1                                  1                 4
2                                  2                 4
3                                  3                 4
4                                  4                 4
5 Weighted.Combination.Over.Scenarios                 4

$Single.Stage.Optimized.Alpha.Allocation.Design$design.performance$Distribution.of.sample.s
ize.and.duration.per.scenario
  scenario C1 C2 A1 A2 sample.size duration frequency proportion
1        1  1  1  1  1        1000        4     10000          1
2        2  1  1  1  1        1000        4     10000          1
3        3  1  1  1  1        1000        4     10000          1
4        4  1  1  1  1        1000        4     10000          1
```

```
$Two.Stage.Group.Sequential.Design
$Two.Stage.Group.Sequential.Design$design.parameters
$Two.Stage.Group.Sequential.Design$design.parameters$cumulative.sample.sizes.and.calendar.t
ime.per.stage
  Stage  C1  C2  A1  A2 Analysis.Time.In.Years
1     1 187 187 187 187                      3
2     2 250 250 250 250                      5

$Two.Stage.Group.Sequential.Design$design.parameters$alpha.allocation
  Stage Subpop.1 Subpop.2
1     1   0.0125   0.0125
2     2   0.0125   0.0125

$Two.Stage.Group.Sequential.Design$design.parameters$futility.boundaries
  Stage Subpop.1 Subpop.2
1     1       -3       -3
2     2       NA       NA


$Two.Stage.Group.Sequential.Design$design.performance
$Two.Stage.Group.Sequential.Design$design.performance$Power
  Scenario Power.H01 Power.H02 Prob.Reject.All.False.Null.Hypotheses
1        1    0.8398    0.8442                                0.7407
2        2    0.7757        NA                                0.7757
3        3        NA    0.7638                                0.7638
4        4        NA        NA                                    NA

$Two.Stage.Group.Sequential.Design$design.performance$Type.1.Error
  Scenario Type.I.Error.H01 Type.I.Error.H02 Familywise.Type.I.Error
1        1               NA               NA                     NA
2        2               NA           0.0441                 0.0441
3        3           0.0430               NA                 0.0430
4        4           0.0258           0.0266                 0.0504

$Two.Stage.Group.Sequential.Design$design.performance$Expected.Sample.Size
                            Scenario expected.sample.size
1                                  1                  961
2                                  2                  999
3                                  3                  999
4                                  4                 1000
5 Weighted.Combination.Over.Scenarios                  990

$Two.Stage.Group.Sequential.Design$design.performance$Expected.Duration
                            Scenario expected.duration
1                                  1             3.84
2                                  2             3.99
3                                  3             4.00
4                                  4             4.00
5 Weighted.Combination.Over.Scenarios             3.96

$Two.Stage.Group.Sequential.Design$design.performance$Distribution.of.sample.size.and.durat
ion.per.scenario
   scenario C1 C2 A1 A2 sample.size duration frequency proportion
1         1  1  1  1  1         748    2.992      1544     0.1544
```

```
2         1  1  2  1  2         874    4.000        NA         NA
3         1  2  1  2  1         874    4.000        NA         NA
4         1  2  2  2  2        1000    4.000      8456     0.8456
5         2  1  1  1  1         748    2.992        59     0.0059
6         2  1  2  1  2         874    4.000        NA         NA
7         2  2  1  2  1         874    4.000        NA         NA
8         2  2  2  2  2        1000    4.000      9941     0.9941
9         3  1  1  1  1         748    2.992        48     0.0048
10        3  1  2  1  2         874    4.000        NA         NA
11        3  2  1  2  1         874    4.000        NA         NA
12        3  2  2  2  2        1000    4.000      9952     0.9952
13        4  1  1  1  1         748    2.992         1     0.0001
14        4  1  2  1  2         874    4.000        NA         NA
15        4  2  1  2  1         874    4.000        NA         NA
16        4  2  2  2  2        1000    4.000      9999     0.9999



$Two.Stage.Equal.Alpha.Allocation.Design
$Two.Stage.Equal.Alpha.Allocation.Design$design.parameters
$Two.Stage.Equal.Alpha.Allocation.Design$design.parameters$cumulative.sample.sizes.and.cale
ndar.time.per.stage
  Stage  C1  C2  A1  A2 Analysis.Time.In.Years
1     1 187 187 187 187                      3
2     2 250 250 250 250                      5

$Two.Stage.Equal.Alpha.Allocation.Design$design.parameters$alpha.allocation
  Stage Subpop.1 Subpop.2
1     1   0.0125   0.0125
2     2   0.0125   0.0125

$Two.Stage.Equal.Alpha.Allocation.Design$design.parameters$futility.boundaries
  Stage Subpop.1 Subpop.2
1     1       -3       -3
2     2       NA       NA


$Two.Stage.Equal.Alpha.Allocation.Design$design.performance
$Two.Stage.Equal.Alpha.Allocation.Design$design.performance$Power
  Scenario Power.H01 Power.H02 Prob.Reject.All.False.Null.Hypotheses
1        1    0.8416    0.8441                                 0.7425
2        2    0.7686        NA                                 0.7686
3        3        NA    0.7705                                 0.7705
4        4        NA        NA                                     NA

$Two.Stage.Equal.Alpha.Allocation.Design$design.performance$Type.1.Error
  Scenario Type.I.Error.H01 Type.I.Error.H02 Familywise.Type.I.Error
1        1               NA               NA                     NA
2        2               NA           0.0427                 0.0427
3        3           0.0448               NA                 0.0448
4        4           0.0253           0.0268                 0.0500

$Two.Stage.Equal.Alpha.Allocation.Design$design.performance$Expected.Sample.Size
                            Scenario expected.sample.size
1                                  1                  901
2                                  2                  949
```

```
3                                    3                 948
4                                    4                 996
5 Weighted.Combination.Over.Scenarios                  949

$Two.Stage.Equal.Alpha.Allocation.Design$design.performance$Expected.Duration
                              Scenario expected.duration
1                                    1             3.85
2                                    2             4.00
3                                    3             3.99
4                                    4             4.00
5 Weighted.Combination.Over.Scenarios              3.96

$Two.Stage.Equal.Alpha.Allocation.Design$design.performance$Distribution.of.sample.size.and
.duration.per.scenario
   scenario C1 C2 A1 A2 sample.size duration frequency proportion
1         1  1  1  1  1         748    2.992      1528     0.1528
2         1  1  2  1  2         874    4.000      2382     0.2382
3         1  2  1  2  1         874    4.000      2397     0.2397
4         1  2  2  2  2        1000    4.000      3693     0.3693
5         2  1  1  1  1         748    2.992        42     0.0042
6         2  1  2  1  2         874    4.000      3878     0.3878
7         2  2  1  2  1         874    4.000        83     0.0083
8         2  2  2  2  2        1000    4.000      5997     0.5997
9         3  1  1  1  1         748    2.992        53     0.0053
10        3  1  2  1  2         874    4.000        79     0.0079
11        3  2  1  2  1         874    4.000      3925     0.3925
12        3  2  2  2  2        1000    4.000      5943     0.5943
13        4  1  1  1  1         748    2.992         2     0.0002
14        4  1  2  1  2         874    4.000       141     0.0141
15        4  2  1  2  1         874    4.000       142     0.0142
16        4  2  2  2  2        1000    4.000      9715     0.9715



$Two.Stage.Optimized.Alpha.Allocation.Design
$Two.Stage.Optimized.Alpha.Allocation.Design$design.parameters
$Two.Stage.Optimized.Alpha.Allocation.Design$design.parameters$cumulative.sample.sizes.and.
calendar.time.per.stage
  Stage  C1  C2  A1  A2 Analysis.Time.In.Years
1     1 187 187 187 187                      3
2     2 250 250 250 250                      5

$Two.Stage.Optimized.Alpha.Allocation.Design$design.parameters$alpha.allocation
  Stage Subpop.1 Subpop.2
1     1   0.0125   0.0125
2     2   0.0125   0.0125

$Two.Stage.Optimized.Alpha.Allocation.Design$design.parameters$futility.boundaries
  Stage Subpop.1 Subpop.2
1     1       -3       -3
2     2       NA       NA


$Two.Stage.Optimized.Alpha.Allocation.Design$design.performance
$Two.Stage.Optimized.Alpha.Allocation.Design$design.performance$Power
  Scenario Power.HO1 Power.HO2 Prob.Reject.All.False.Null.Hypotheses
```

```
1        1    0.8482    0.8487                                0.7502
2        2    0.7661        NA                                0.7661
3        3        NA    0.7667                                0.7667
4        4        NA        NA                                    NA

$Two.Stage.Optimized.Alpha.Allocation.Design$design.performance$Type.1.Error
  Scenario Type.I.Error.H01 Type.I.Error.H02 Familywise.Type.I.Error
1        1               NA               NA                      NA
2        2               NA           0.0460                  0.0460
3        3           0.0397               NA                  0.0397
4        4           0.0252           0.0273                  0.0501

$Two.Stage.Optimized.Alpha.Allocation.Design$design.performance$Expected.Sample.Size
                            Scenario expected.sample.size
1                                  1                 900
2                                  2                 949
3                                  3                 950
4                                  4                 997
5 Weighted.Combination.Over.Scenarios                949

$Two.Stage.Optimized.Alpha.Allocation.Design$design.performance$Expected.Duration
                            Scenario expected.duration
1                                  1              3.84
2                                  2              4.00
3                                  3              4.00
4                                  4              4.00
5 Weighted.Combination.Over.Scenarios              3.96

$Two.Stage.Optimized.Alpha.Allocation.Design$design.performance$Distribution.of.sample.size
.and.duration.per.scenario
   scenario C1 C2 A1 A2 sample.size duration frequency proportion
1         1  1  1  1  1         748    2.992      1573     0.1573
2         1  1  2  1  2         874    4.000      2340     0.2340
3         1  2  1  2  1         874    4.000      2431     0.2431
4         1  2  2  2  2        1000    4.000      3656     0.3656
5         2  1  1  1  1         748    2.992        49     0.0049
6         2  1  2  1  2         874    4.000      3891     0.3891
7         2  2  1  2  1         874    4.000        94     0.0094
8         2  2  2  2  2        1000    4.000      5966     0.5966
9         3  1  1  1  1         748    2.992        47     0.0047
10        3  1  2  1  2         874    4.000        64     0.0064
11        3  2  1  2  1         874    4.000      3841     0.3841
12        3  2  2  2  2        1000    4.000      6048     0.6048
13        4  1  1  1  1         748    2.992         3     0.0003
14        4  1  2  1  2         874    4.000       127     0.0127
15        4  2  1  2  1         874    4.000       136     0.0136
16        4  2  2  2  2        1000    4.000      9734     0.9734
```

Minimum power difference (obtained - desired) for each Design

Design	*Scenario*	*Minimum difference in power (obtained - desired)*
Single.Stage.Equal.Alpha.Allocation.Design	1	-0.0385
Single.Stage.Optimized.Alpha.Allocation.Design	1	-0.0377
Two.Stage.Group.Sequential.Design	1	-0.0593
Two.Stage.Equal.Alpha.Allocation.Design	1	-0.0575
Two.Stage.Optimized.Alpha.Allocation.Design	1	-0.0498