```
$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     1 292 438 292 438                   3.65

$Single.Stage.Equal.Alpha.Allocation.Design$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    0.8649    0.9401                                0.8241
2        2    0.7987        NA                                0.7987
3        3        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           0.0477                 0.0477
3        3           0.0256           0.0279                 0.0511

$Single.Stage.Equal.Alpha.Allocation.Design$design.performance$Expected.Sample.Size
                            Scenario expected.sample.size
1                                   1                1460
2                                   2                1460
3                                   3                1460
4 Weighted.Combination.Over.Scenarios                1460

$Single.Stage.Equal.Alpha.Allocation.Design$design.performance$Expected.Duration
                            Scenario expected.duration
1                                   1             3.65
2                                   2             3.65
3                                   3             3.65
4 Weighted.Combination.Over.Scenarios             3.65

$Single.Stage.Equal.Alpha.Allocation.Design$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        1460     3.65     10000          1
2        2  1  1  1  1        1460     3.65     10000          1
3        3  1  1  1  1        1460     3.65     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     1 283 424 283 424                   3.54

$Single.Stage.Optimized.Alpha.Allocation.Design$design.parameters$alpha.allocation
  Stage Subpop.1 Subpop.2
1     1   0.0309   0.0191

$Single.Stage.Optimized.Alpha.Allocation.Design$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     0.931                                0.8143
2        2    0.8137        NA                                0.8137
3        3        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          0.0470                 0.0470
3        3           0.0309          0.0209                 0.0506

$Single.Stage.Optimized.Alpha.Allocation.Design$design.performance$Expected.Sample.Size
                            Scenario expected.sample.size
1                                  1                1414
2                                  2                1414
3                                  3                1414
4 Weighted.Combination.Over.Scenarios                1414

$Single.Stage.Optimized.Alpha.Allocation.Design$design.performance$Expected.Duration
                            Scenario expected.duration
1                                  1             3.54
2                                  2             3.54
3                                  3             3.54
4 Weighted.Combination.Over.Scenarios             3.54

$Single.Stage.Optimized.Alpha.Allocation.Design$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        1414    3.535     10000          1
2        2  1  1  1  1        1414    3.535     10000          1
3        3  1  1  1  1        1414    3.535     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  33  49  33  49                 0.4125
2     2 330 495 330 495                 4.1250
```

```
$Two.Stage.Group.Sequential.Design$design.parameters$alpha.allocation
  Stage Subpop.1 Subpop.2
1     1   0.0189   0.0065
2     2   0.0181   0.0066

$Two.Stage.Group.Sequential.Design$design.parameters$futility.boundaries
  Stage Subpop.1 Subpop.2
1     1  -4.8112  -3.2498
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    0.8717    0.9447                                0.8424
2        2    0.8324        NA                                0.8324
3        3        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           0.0412                 0.0412
3        3            0.041           0.0149                 0.0536

$Two.Stage.Group.Sequential.Design$design.performance$Expected.Sample.Size
                            Scenario expected.sample.size
1                                  1                1636
2                                  2                1648
3                                  3                1650
4 Weighted.Combination.Over.Scenarios                1645

$Two.Stage.Group.Sequential.Design$design.performance$Expected.Duration
                            Scenario expected.duration
1                                  1             4.09
2                                  2             4.12
3                                  3             4.13
4 Weighted.Combination.Over.Scenarios             4.12

$Two.Stage.Group.Sequential.Design$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         164 0.412500        93     0.0093
2         1  1  2  1  2        1056 4.129167        NA         NA
3         1  2  1  2  1         758 4.125000        NA         NA
4         1  2  2  2  2        1650 4.129167      9907     0.9907
5         2  1  1  1  1         164 0.412500        12     0.0012
6         2  1  2  1  2        1056 4.129167        NA         NA
7         2  2  1  2  1         758 4.125000        NA         NA
8         2  2  2  2  2        1650 4.129167      9988     0.9988
9         3  1  1  1  1         164 0.412500         2     0.0002
10        3  1  2  1  2        1056 4.129167        NA         NA
11        3  2  1  2  1         758 4.125000        NA         NA
12        3  2  2  2  2        1650 4.129167      9998     0.9998
```

```
$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     1 146 219 146 219                 1.8275
2     2 292 438 292 438                 3.6550

$Two.Stage.Equal.Alpha.Allocation.Design$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    0.8517    0.9314                                0.8091
2        2    0.7658        NA                                0.7658
3        3        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          0.0439                 0.0439
3        3          0.0232          0.0247                 0.0467

$Two.Stage.Equal.Alpha.Allocation.Design$design.performance$Expected.Sample.Size
                            Scenario expected.sample.size
1                                  1                1113
2                                  2                1338
3                                  3                1450
4 Weighted.Combination.Over.Scenarios                1302

$Two.Stage.Equal.Alpha.Allocation.Design$design.performance$Expected.Duration
                            Scenario expected.duration
1                                  1             3.27
2                                  2             3.64
3                                  3             3.65
4 Weighted.Combination.Over.Scenarios             3.52

$Two.Stage.Equal.Alpha.Allocation.Design$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         730    1.825      2093     0.2093
2         1  1  2  1  2        1168    3.650      1870     0.1870
3         1  2  1  2  1        1022    3.650      3188     0.3188
4         1  2  2  2  2        1460    3.650      2849     0.2849
5         2  1  1  1  1         730    1.825        55     0.0055
6         2  1  2  1  2        1168    3.650      3887     0.3887
7         2  2  1  2  1        1022    3.650        92     0.0092
```

```
8         2  2  2  2  2        1460    3.650      5966     0.5966
9         3  1  1  1  1         730    1.825         2     0.0002
10        3  1  2  1  2        1168    3.650       126     0.0126
11        3  2  1  2  1        1022    3.650       136     0.0136
12        3  2  2  2  2        1460    3.650      9736     0.9736



$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     1 146 219 146 219                 1.8275
2     2 292 438 292 438                 3.6550

$Two.Stage.Optimized.Alpha.Allocation.Design$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.H01 Power.H02 Prob.Reject.All.False.Null.Hypotheses
1        1    0.8621    0.9292                                0.8184
2        2    0.7687        NA                                0.7687
3        3        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           0.0448                 0.0448
3        3           0.0246           0.0255                 0.0486

$Two.Stage.Optimized.Alpha.Allocation.Design$design.performance$Expected.Sample.Size
                            Scenario expected.sample.size
1                                  1                1111
2                                  2                1337
3                                  3                1450
4 Weighted.Combination.Over.Scenarios                1301

$Two.Stage.Optimized.Alpha.Allocation.Design$design.performance$Expected.Duration
                            Scenario expected.duration
1                                  1             3.26
2                                  2             3.64
3                                  3             3.65
4 Weighted.Combination.Over.Scenarios             3.52

$Two.Stage.Optimized.Alpha.Allocation.Design$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	730	1.825	2128	0.2128
2	1	1	2	1	2	1168	3.650	1784	0.1784
3	1	2	1	2	1	1022	3.650	3224	0.3224
4	1	2	2	2	2	1460	3.650	2864	0.2864
5	2	1	1	1	1	730	1.825	60	0.0060
6	2	1	2	1	2	1168	3.650	3934	0.3934
7	2	2	1	2	1	1022	3.650	90	0.0090
8	2	2	2	2	2	1460	3.650	5916	0.5916
9	3	1	1	1	1	730	1.825	1	0.0001
10	3	1	2	1	2	1168	3.650	127	0.0127
11	3	2	1	2	1	1022	3.650	139	0.0139
12	3	2	2	2	2	1460	3.650	9733	0.9733

Minimum power difference (obtained - desired) for each Design

Design	*Scenario*	*Minimum difference in power (obtained - desired)*
Single.Stage.Equal.Alpha.Allocation.Design	2	-0.0013
Single.Stage.Optimized.Alpha.Allocation.Design	2	0.0137
Two.Stage.Group.Sequential.Design	2	0.0324
Two.Stage.Equal.Alpha.Allocation.Design	2	-0.0342
Two.Stage.Optimized.Alpha.Allocation.Design	2	-0.0313