```
$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     1 272 408 272 408                 3.405

$Single.Stage.Optimized.Alpha.Allocation.Design$design.parameters$alpha.allocation
  Stage Subpop.1 Subpop.2
1     1   0.0343   0.0157

$Single.Stage.Optimized.Alpha.Allocation.Design$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    0.8463    0.9172                                0.7928
2        2    0.8063        NA                                0.8063
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          0.0424                 0.0424
3        3          0.0376          0.0164                 0.0517

$Single.Stage.Optimized.Alpha.Allocation.Design$design.performance$Expected.Sample.Size
                            Scenario expected.sample.size
1                                  1                1360
2                                  2                1360
3                                  3                1360
4 Weighted.Combination.Over.Scenarios                1360

$Single.Stage.Optimized.Alpha.Allocation.Design$design.performance$Expected.Duration
                            Scenario expected.duration
1                                  1              3.4
2                                  2              3.4
3                                  3              3.4
4 Weighted.Combination.Over.Scenarios              3.4

$Single.Stage.Optimized.Alpha.Allocation.Design$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        1360      3.4     10000          1
2        2  1  1  1  1        1360      3.4     10000          1
3        3  1  1  1  1        1360      3.4     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     1 248 373 248 373                3.1095
2     2 276 414 276 414                3.4550
```

```
$Two.Stage.Group.Sequential.Design$design.parameters$alpha.allocation
  Stage Subpop.1 Subpop.2
1     1   0.0199   0.0096
2     2   0.0140   0.0066

$Two.Stage.Group.Sequential.Design$design.parameters$futility.boundaries
  Stage Subpop.1 Subpop.2
1     1   0.1361  -1.5897
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    0.8415    0.9248                                0.7951
2        2    0.8058        NA                                0.8058
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           0.0462                 0.0462
3        3           0.0333           0.0169                 0.0485

$Two.Stage.Group.Sequential.Design$design.performance$Expected.Sample.Size
                             Scenario expected.sample.size
1                                   1                1308
2                                   2                1374
3                                   3                1375
4 Weighted.Combination.Over.Scenarios                1352

$Two.Stage.Group.Sequential.Design$design.performance$Expected.Duration
                             Scenario expected.duration
1                                   1             3.27
2                                   2             3.44
3                                   3             3.45
4 Weighted.Combination.Over.Scenarios             3.39

$Two.Stage.Group.Sequential.Design$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        1242 3.108333      5244     0.5244
2         1  1  2  1  2        1324 3.450000        NA         NA
3         1  2  1  2  1        1298 3.458333        NA         NA
4         1  2  2  2  2        1380 3.458333      4756     0.4756
5         2  1  1  1  1        1242 3.108333       454     0.0454
6         2  1  2  1  2        1324 3.450000        NA         NA
7         2  2  1  2  1        1298 3.458333        NA         NA
8         2  2  2  2  2        1380 3.458333      9546     0.9546
9         3  1  1  1  1        1242 3.108333       365     0.0365
10        3  1  2  1  2        1324 3.450000        NA         NA
11        3  2  1  2  1        1298 3.458333        NA         NA
12        3  2  2  2  2        1380 3.458333      9635     0.9635
```

```
$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     1 156 234 156 234                 1.9525
2     2 312 468 312 468                 3.9050

$Two.Stage.Equal.Alpha.Allocation.Design$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    0.8784    0.9463                                0.8449
2        2    0.7932        NA                                0.7932
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          0.0428                 0.0428
3        3          0.0254          0.0244                 0.0478

$Two.Stage.Equal.Alpha.Allocation.Design$design.performance$Expected.Sample.Size
                            Scenario expected.sample.size
1                                  1                1163
2                                  2                1422
3                                  3                1549
4 Weighted.Combination.Over.Scenarios                1380

$Two.Stage.Equal.Alpha.Allocation.Design$design.performance$Expected.Duration
                            Scenario expected.duration
1                                  1             3.43
2                                  2             3.89
3                                  3             3.90
4 Weighted.Combination.Over.Scenarios             3.74

$Two.Stage.Equal.Alpha.Allocation.Design$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         780     1.95      2422     0.2422
2         1  1  2  1  2        1248     3.90      1847     0.1847
3         1  2  1  2  1        1092     3.90      3221     0.3221
4         1  2  2  2  2        1560     3.90      2510     0.2510
5         2  1  1  1  1         780     1.95        53     0.0053
6         2  1  2  1  2        1248     3.90      4196     0.4196
7         2  2  1  2  1        1092     3.90        72     0.0072
```

```
8         2  2  2  2  2        1560     3.90      5679     0.5679
9         3  1  1  1  1         780     1.95        NA         NA
10        3  1  2  1  2        1248     3.90       135     0.0135
11        3  2  1  2  1        1092     3.90       140     0.0140
12        3  2  2  2  2        1560     3.90      9725     0.9725



$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     1 247 370 247 370                 3.0915
2     2 274 412 274 412                 3.4350

$Two.Stage.Optimized.Alpha.Allocation.Design$design.parameters$alpha.allocation
  Stage Subpop.1 Subpop.2
1     1   0.0206   0.0057
2     2   0.0194   0.0043

$Two.Stage.Optimized.Alpha.Allocation.Design$design.parameters$futility.boundaries
  Stage Subpop.1 Subpop.2
1     1  -4.7845   0.8247
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    0.8505     0.913                                0.7993
2        2    0.8318        NA                                0.8318
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           0.0423                  0.0423
3        3           0.0371           0.0096                  0.0452

$Two.Stage.Optimized.Alpha.Allocation.Design$design.performance$Expected.Sample.Size
                            Scenario expected.sample.size
1                                  1                1276
2                                  2                1267
3                                  3                1303
4 Weighted.Combination.Over.Scenarios                1282

$Two.Stage.Optimized.Alpha.Allocation.Design$design.performance$Expected.Duration
                            Scenario expected.duration
1                                  1             3.27
2                                  2             3.24
3                                  3             3.42
4 Weighted.Combination.Over.Scenarios             3.31

$Two.Stage.Optimized.Alpha.Allocation.Design$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	1234	3.0875	4829	0.4829
2	1	1	2	1	2	1318	3.4375	2208	0.2208
3	1	2	1	2	1	1288	3.4250	2103	0.2103
4	1	2	2	2	2	1372	3.4375	860	0.0860
5	2	1	1	1	1	1234	3.0875	5668	0.5668
6	2	1	2	1	2	1318	3.4375	1387	0.1387
7	2	2	1	2	1	1288	3.4250	2352	0.2352
8	2	2	2	2	2	1372	3.4375	593	0.0593
9	3	1	1	1	1	1234	3.0875	150	0.0150
10	3	1	2	1	2	1318	3.4375	40	0.0040
11	3	2	1	2	1	1288	3.4250	7920	0.7920
12	3	2	2	2	2	1372	3.4375	1890	0.1890

Minimum power difference (obtained - desired) for each Design

Design	*Scenario*	*Minimum difference in power (obtained - desired)*
Single.Stage.Equal.Alpha.Allocation.Design	2	-.0013
Single.Stage.Optimized.Alpha.Allocation.Design	1	-.0072
Two.Stage.Group.Sequential.Design	1	-.0049
Two.Stage.Equal.Alpha.Allocation.Design	2	-.0068
Two.Stage.Optimized.Alpha.Allocation.Design	1	-.0007