Admissible Multinomial Trial - IUT design Example

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Multinomial Trial Design with Different Output Options

In the following example, we provide four design methods for multinomial trial: Minimax (minimize the maximum sample size), Optimal (minimize the expected sample size), Admissible (minimize the Bayesian risk) and Maxpower (maximize the exact power level).

```
source(file="powfun_IUT.r")
source(file="searchfun_IUT_adm.r")
library(clinfun)
```

Single-stage

It should be noted that single-stage design only allows Minimax and Maxpower output methods.

```
# Minimax
IUT.design(method = "s1", s2.rej = 18, t2.rej = 12, n = 80, s2.rej.delta = 1,
    t2.rej.delta = 1, n.delta = 1, p0.s = 0.15, p0.t = 0.25, p1.s = 0.3, p1.t = 0.1,
    output = "minimax")
```

```
##   p0.s p0.t p1.s p1.t s.rej t.rej  N  Error Power
## 2 0.15 0.25  0.3  0.1    18    11 79 0.0430 0.857
## 3 0.15 0.25  0.3  0.1    19    11 79 0.0228 0.825
## 5 0.15 0.25  0.3  0.1    18    12 79 0.0430 0.896
## 6 0.15 0.25  0.3  0.1    19    12 79 0.0254 0.862
## 8 0.15 0.25  0.3  0.1    18    13 79 0.0477 0.919
## 9 0.15 0.25  0.3  0.1    19    13 79 0.0477 0.882
##    user  system elapsed
##    0.49    0.02    0.50
```

```
# Maxpower
IUT.design(method = "s1", s2.rej = 18, t2.rej = 12, n = 80, s2.rej.delta = 1,
    t2.rej.delta = 1, n.delta = 1, p0.s = 0.15, p0.t = 0.25, p1.s = 0.3, p1.t = 0.1,
    output = "maxpower")
```

```
##    p0.s p0.t p1.s p1.t s.rej t.rej  N Error Power
## 17 0.15 0.25  0.3  0.1    18    13 80 0.048 0.924
##    user  system elapsed
##    0.56    0.00    0.57
```

Two-stage

```r
# Minimax
IUT.design(method = "s2.sf", s1.rej = 10, t1.rej = 3, s1.acc = 8, t1.acc = 5,
    s2.rej = 18, t2.rej = 12, n1 = 41, n2 = 41, s1.rej.delta = 1, t1.rej.delta = 1,
    s2.rej.delta = 1, t2.rej.delta = 1, p0.s = 0.15, p0.t = 0.25, p1.s = 0.3,
    p1.t = 0.1, output = "minimax")
```

```
##    p0.s p0.t p1.s p1.t s1.rej t1.rej s1.acc t1.acc s2.rej t2.rej N1 N2
## 27 0.15 0.25  0.3  0.1     11      4      8      5     19     11 41 41
## 54 0.15 0.25  0.3  0.1     11      4      8      5     19     12 41 41
## 81 0.15 0.25  0.3  0.1     11      4      8      5     19     13 41 41
##     Error Power   PET   EN
## 27 0.0476 0.853 0.996 41.2
## 54 0.0476 0.869 0.996 41.2
## 81 0.0476 0.875 0.996 41.2
##    user  system elapsed
##   65.09    0.01   65.57
```

```r
# Optimal
IUT.design(method = "s2.sf", s1.rej = 10, t1.rej = 3, s1.acc = 8, t1.acc = 5,
    s2.rej = 18, t2.rej = 12, n1 = 41, n2 = 41, s1.rej.delta = 1, t1.rej.delta = 1,
    s2.rej.delta = 1, t2.rej.delta = 1, p0.s = 0.15, p0.t = 0.25, p1.s = 0.3,
    p1.t = 0.1, output = "optimal")
```

```
##    p0.s p0.t p1.s p1.t s1.rej t1.rej s1.acc t1.acc s2.rej t2.rej N1 N2
## 27 0.15 0.25  0.3  0.1     11      4      8      5     19     11 41 41
## 54 0.15 0.25  0.3  0.1     11      4      8      5     19     12 41 41
## 81 0.15 0.25  0.3  0.1     11      4      8      5     19     13 41 41
##     Error Power   PET   EN
## 27 0.0476 0.853 0.996 41.2
## 54 0.0476 0.869 0.996 41.2
## 81 0.0476 0.875 0.996 41.2
##    user  system elapsed
##   65.13    0.02   65.52
```

```r
# Admissible
IUT.design(method = "s2.sf", s1.rej = 10, t1.rej = 3, s1.acc = 8, t1.acc = 5,
    s2.rej = 18, t2.rej = 12, n1 = 41, n2 = 41, s1.rej.delta = 1, t1.rej.delta = 1,
    s2.rej.delta = 1, t2.rej.delta = 1, p0.s = 0.15, p0.t = 0.25, p1.s = 0.3,
    p1.t = 0.1, output = "admissible")
```

```
##    p0.s p0.t p1.s p1.t s1.rej t1.rej s1.acc t1.acc s2.rej t2.rej N1 N2
## 27 0.15 0.25  0.3  0.1     11      4      8      5     19     11 41 41
##     Error Power   PET   EN
## 27 0.0476 0.853 0.996 41.2
##    user  system elapsed
##   65.45    0.01   65.78
```

```r
# Maxpower
IUT.design(method = "s2.sf", s1.rej = 10, t1.rej = 3, s1.acc = 8, t1.acc = 5,
    s2.rej = 18, t2.rej = 12, n1 = 41, n2 = 41, s1.rej.delta = 1, t1.rej.delta = 1,
    s2.rej.delta = 1, t2.rej.delta = 1, p0.s = 0.15, p0.t = 0.25, p1.s = 0.3,
    p1.t = 0.1, output = "maxpower")
```

```
##    p0.s p0.t p1.s p1.t s1.rej t1.rej s1.acc t1.acc s2.rej t2.rej N1 N2
## 81 0.15 0.25  0.3  0.1     11      4      8      5     19     13 41 41
##     Error Power   PET   EN
## 81 0.0476 0.875 0.996 41.2
##    user  system elapsed
##   65.08    0.00   65.30
```

Two-stage early terminate with futility only

```
# Minimax
suppressWarnings(IUT.design(method = "s2.f", s1.acc = 7, t1.acc = 5, s2.rej = 17,
    t2.rej = 13, n1 = 41, n2 = 41, s1.acc.delta = 1, t1.acc.delta = 1, s2.rej.delta = 1,
    t2.rej.delta = 1, p0.s = 0.15, p0.t = 0.25, p1.s = 0.3, p1.t = 0.1, output = "minimax"))
```

```
## Error in IUT.design(method = "s2.f", s1.acc = 7, t1.acc = 5, s2.rej = 17, :   No feasible solution fo
##  Increase maximum sample size.  Current nmax value = 82.
```

```
# Optimal
suppressWarnings(IUT.design(method = "s2.f", s1.acc = 7, t1.acc = 5, s2.rej = 17,
    t2.rej = 13, n1 = 41, n2 = 41, s1.acc.delta = 1, t1.acc.delta = 1, s2.rej.delta = 1,
    t2.rej.delta = 1, p0.s = 0.15, p0.t = 0.25, p1.s = 0.3, p1.t = 0.1, output = "optimal"))
```

```
## Error in IUT.design(method = "s2.f", s1.acc = 7, t1.acc = 5, s2.rej = 17, :   No feasible solution fo
##  Increase maximum sample size.  Current nmax value = 82.
```

```
# Admissible
suppressWarnings(IUT.design(method = "s2.f", s1.acc = 7, t1.acc = 5, s2.rej = 17,
    t2.rej = 13, n1 = 41, n2 = 41, s1.acc.delta = 1, t1.acc.delta = 1, s2.rej.delta = 1,
    t2.rej.delta = 1, p0.s = 0.15, p0.t = 0.25, p1.s = 0.3, p1.t = 0.1, output = "admissible"))
```

```
## Error in IUT.design(method = "s2.f", s1.acc = 7, t1.acc = 5, s2.rej = 17, :   No feasible solution fo
##  Increase maximum sample size.  Current nmax value = 82.
```

```
# Maxpower
suppressWarnings(IUT.design(method = "s2.f", s1.acc = 7, t1.acc = 5, s2.rej = 17,
    t2.rej = 13, n1 = 41, n2 = 41, s1.acc.delta = 1, t1.acc.delta = 1, s2.rej.delta = 1,
    t2.rej.delta = 1, p0.s = 0.15, p0.t = 0.25, p1.s = 0.3, p1.t = 0.1, output = "maxpower"))
```

```
## Error in IUT.design(method = "s2.f", s1.acc = 7, t1.acc = 5, s2.rej = 17, :   No feasible solution fo
##  Increase maximum sample size.  Current nmax value = 82.
```