Package ‘bfbin2arm’

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Title Bayes Factor Design for Two-Arm Binomial Trials

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Description Design and analysis of one- and two-stage two-arm binomial clinical phase II trials using Bayes factors. Implements Bayes factors for point-null and directional hypotheses, predictive densities under different hypotheses, and power and sample size calibration.

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`BFminus0` *Bayes factor BF-0: H- vs H0*

Description

Bayes factor BF-0: H- vs H0

Usage

```
BFminus0(BFminus1, BF01)
```

Arguments

`BFminus1`	Value of BF_{-1}.
`BF01`	Value of BF_{01}.

Value

Numeric scalar, BF_{-0}.

`BFminus1` *Bayes factor BF-1: H- vs H1*

Description

Bayes factor BF-1: H- vs H1

Usage

```
BFminus1(y1, y2, n1, n2, a_1_a = 1, b_1_a = 1, a_2_a = 1, b_2_a = 1)
```

Arguments

y1	Number of successes in arm 1 (control).
y2	Number of successes in arm 2 (treatment).
n1	Sample size in arm 1.
n2	Sample size in arm 2.
a_1_a, b_1_a	Shape parameters of the Beta prior for p_1 under the alternative (analysis prior).
a_2_a, b_2_a	Shape parameters of the Beta prior for p_2 under the alternative (analysis prior).

Value

Numeric scalar, BF_{-1}.

`BFplus0` *Bayes factor BF+0: H+ vs H0*

Description

Bayes factor BF+0: H+ vs H0

Usage

```
BFplus0(BFplus1, BF01)
```

Arguments

BFplus1	Value of BF_{+1}.
BF01	Value of BF_{01}.

Value

Numeric scalar, BF_{+0}.

`BFplus1` *Bayes factor BF+1: H+ vs H1*

Description

Bayes factor BF+1: H+ vs H1

Usage

```
BFplus1(y1, y2, n1, n2, a_1_a = 1, b_1_a = 1, a_2_a = 1, b_2_a = 1)
```

Arguments

`y1`	Number of successes in arm 1 (control).
`y2`	Number of successes in arm 2 (treatment).
`n1`	Sample size in arm 1.
`n2`	Sample size in arm 2.
`a_1_a, b_1_a`	Shape parameters of the Beta prior for p_1 under the alternative (analysis prior).
`a_2_a, b_2_a`	Shape parameters of the Beta prior for p_2 under the alternative (analysis prior).

Value

Numeric scalar, BF_{+1} = posterior odds / prior odds for H+ vs H1.

`BFplusMinus` *Bayes factor BF+-: H+ vs H-*

Description

Bayes factor BF+-: H+ vs H-

Usage

```
BFplusMinus(BFplus1, BFminus1)
```

Arguments

`BFplus1`	Value of BF_{+1}.
`BFminus1`	Value of BF_{-1}.

Value

Numeric scalar, BF_{+-}.

ntwoarmbinbf01 *Sample size calibration for two-arm binomial Bayes factor designs*

Description

Searches over a grid of total sample sizes n to find the smallest n such that Bayesian power, Bayesian type-I error, and probability of compelling evidence under H0 meet specified design criteria. Optionally, frequentist type-I error and power constraints are also evaluated. Unequal fixed randomisation between the two arms is allowed via alloc1 and alloc2.

Usage

```
ntwoarmbinbf01(
  k = 1/3,
  k_f = 1/3,
  power = 0.8,
  alpha = 0.05,
  pce_H0 = 0.9,
  test = c("BF01", "BF+0", "BF-0", "BF+-"),
  nrange = c(10, 150),
  n_step = 1,
  progress = TRUE,
  compute_freq_t1e = FALSE,
  p1_grid = seq(0.01, 0.99, 0.02),
  p2_grid = seq(0.01, 0.99, 0.02),
  p1_power = NULL,
  p2_power = NULL,
  a_0_d = 1,
  b_0_d = 1,
  a_0_a = 1,
  b_0_a = 1,
  a_1_d = 1,
  b_1_d = 1,
  a_2_d = 1,
  b_2_d = 1,
  a_1_a = 1,
  b_1_a = 1,
  a_2_a = 1,
  b_2_a = 1,
  output = c("plot", "numeric"),
  a_1_d_Hminus = 1,
  b_1_d_Hminus = 1,
  a_2_d_Hminus = 1,
  b_2_d_Hminus = 1,
  a_1_a_Hminus = 1,
  b_1_a_Hminus = 1,
  a_2_a_Hminus = 1,
```

```
  b_2_a_Hminus = 1,
  alloc1 = 0.5,
  alloc2 = 0.5
)
```

Arguments

`k` Evidence threshold for rejecting the null (inverted BF).

`k_f` Evidence threshold for "compelling evidence" in favour of the null.

`power` Target Bayesian power.

`alpha` Target Bayesian type-I error.

`pce_H0` Target probability of compelling evidence under H_0.

`test` Character string, one of "BF01", "BF+0", "BF-0", "BF+-".

`nrange` Integer vector of length 2 giving the search range for total n.

`n_step` Step size for n.

`progress` Logical; if TRUE, print progress to the console.

`compute_freq_t1e` Logical; if TRUE, compute frequentist type-I error over a grid.

`p1_grid, p2_grid` Grids of true proportions for frequentist T1E.

`p1_power, p2_power` Optional true proportions for frequentist power.

`a_0_d, b_0_d, a_0_a, b_0_a` Shape parameters for design and analysis priors under H_0.

`a_1_d, b_1_d, a_2_d, b_2_d` Shape parameters for design priors under H_1 or H_+.

`a_1_a, b_1_a, a_2_a, b_2_a` Shape parameters for analysis priors under H_1 or H_+.

`output` "plot" or "numeric".

`a_1_d_Hminus, b_1_d_Hminus, a_2_d_Hminus, b_2_d_Hminus` Optional design priors under H_- for directional tests.

`a_1_a_Hminus, b_1_a_Hminus, a_2_a_Hminus, b_2_a_Hminus` Shape parameters for analysis priors under H-.

`alloc1, alloc2` Fixed randomisation probabilities for arm 1 and arm 2; must be positive and sum to 1. Defaults are 0.5 and 0.5.

Value

If output = "plot", returns invisibly a list with recommended sample sizes and a ggplot object printed to the device. If output = "numeric", returns a list with recommended n and summary.

Examples

```
# Standard calibration with equal allocation: power 80%, type-I 5%, CE(H0) 80%

ntwoarmbinbf01(power = 0.8, alpha = 0.05, pce_H0 = 0.8, output = "numeric")


# 1:2 allocation (control:treatment) via alloc1 = 1/3, alloc2 = 2/3

ntwoarmbinbf01(power = 0.8, alpha = 0.05, pce_H0 = 0.8,
               alloc1 = 1/3, alloc2 = 2/3, output = "numeric")


# BF+0 directional test with plot

ntwoarmbinbf01(power = 0.8, alpha = 0.05, pce_H0 = 0.9,
               test = "BF+0", output = "plot")
```

`optimal_twostage_2arm_bf` *Optimal two-stage two-arm Bayes-factor design for binary endpoints*

Description

Computes an optimal two-stage two-arm Bayes-factor design for binary endpoints, minimizing the expected sample size under the null hypothesis while correcting the operating characteristics for the possibility of early stopping for futility.

Usage

```
optimal_twostage_2arm_bf(
  alpha = 0.05,
  beta = 0.2,
  k = 1/3,
  k_f = 3,
  n1_min = c(5, 5),
  n2_max = c(50, 50),
  alloc1 = 0.5,
  alloc2 = 0.5,
  power_cushion = 0,
  pceH0 = NULL,
  interim_fraction = c(0, 1),
  grid_step = 1L,
  coarse_step = 10L,
  progress = TRUE,
  max_iter = 10000L,
  ncores = getOption("bfbin2arm.ncores", 1L),
  compute_freq_oc = NULL,
```

```
  calibration_mode = c("Bayesian", "frequentist", "hybrid"),
  calibration_EN = NULL,
  p1_EN_H0 = NULL,
  p2_EN_H0 = NULL,
  alpha_freq = alpha,
  beta_freq = beta,
  p1_power = NULL,
  p2_power = NULL,
  p_null_grid = NULL,
  test = "BF01",
  a_0_d = 1,
  b_0_d = 1,
  a_0_a = 1,
  b_0_a = 1,
  a_1_d = 1,
  b_1_d = 1,
  a_2_d = 1,
  b_2_d = 1,
  a_1_a = 1,
  b_1_a = 1,
  a_2_a = 1,
  b_2_a = 1,
  a_1_d_Hminus = 1,
  b_1_d_Hminus = 1,
  a_2_d_Hminus = 1,
  b_2_d_Hminus = 1,
  a_1_a_Hminus = 1,
  b_1_a_Hminus = 1,
  a_2_a_Hminus = 1,
  b_2_a_Hminus = 1
)
```

Arguments

alpha	Numeric scalar, Bayesian type-I-error target.
beta	Numeric scalar, 1 minus the minimal Bayesian power target.
k	Numeric scalar, efficacy threshold; evidence against the null hypothesis is declared when the corresponding Bayes factor is smaller than k.
k_f	Numeric scalar, futility threshold; compelling evidence for the null hypothesis is declared when the corresponding Bayes factor is at least k_f.
n1_min	Numeric vector of length 2, minimum interim sample sizes for arms 1 and 2.
n2_max	Numeric vector of length 2, maximum final sample sizes for arms 1 and 2.
alloc1, alloc2	Positive numbers, allocation probabilities to arms 1 and 2.
power_cushion	Numeric scalar, optional extra power cushion used in the fixed-sample search of step 1.
pceH0	Optional numeric scalar in [0,1]. If specified, candidate two-stage designs must satisfy corrected CE_H0 >= pceH0.

interim_fraction
: Numeric vector of length 2 giving lower and upper bounds for the interim sample size in each arm as a fraction of the fixed sample size.

grid_step
: Positive integer giving the spacing of the interim design grid.

coarse_step
: Positive integer giving the spacing of the coarse fixed-sample search grid in step 1.

progress
: Logical; if `TRUE`, prints progress information.

max_iter
: Integer, maximum number of total fixed-sample sizes searched in step 1.

ncores
: Integer; number of parallel worker processes to use in the calibration. Defaults to `getOption("bfbin2arm.ncores", 1L)`. In vignettes and examples, a conservative value (e.g. 1 or 2) is recommended for CRAN checks, whereas users can increase this to exploit all available cores on their own machines.

compute_freq_oc
: Logical or `NULL`. Controls whether frequentist operating characteristics are computed for candidate two-stage designs during the search.

calibration_mode
: Character string specifying the calibration mode. Must be one of `"Bayesian"`, `"frequentist"`, or `"hybrid"`.

calibration_EN
: Character string or `NULL` specifying whether the design is ranked by Bayesian or frequentist expected sample size under the null hypothesis.

p1_EN_H0, p2_EN_H0
: Numeric scalars specifying the null response probabilities in control and treatment arm used when `calibration_EN = "frequentist"`.

alpha_freq
: Numeric scalar, frequentist type-I error target.

beta_freq
: Numeric scalar, 1 minus the frequentist power target.

p1_power, p2_power
: Numeric scalars specifying the success probabilities in control and treatment arm used for the frequentist power calculation.

p_null_grid
: Optional numeric vector giving the grid of null response probabilities used for frequentist type-I-error maximization. If `NULL`, a default grid is used.

test
: Character string, one of `"BF01"`, `"BF+0"`, `"BF-0"`, `"BF+-"`.

a_0_d, b_0_d, a_0_a, b_0_a
: Shape parameters for design and analysis priors under H_0.

a_1_d, b_1_d, a_2_d, b_2_d
: Shape parameters for design priors under H_1 or H_+.

a_1_a, b_1_a, a_2_a, b_2_a
: Shape parameters for analysis priors under H_1 or H_+.

a_1_d_Hminus, b_1_d_Hminus, a_2_d_Hminus, b_2_d_Hminus
: Optional design priors under H_- for directional tests.

a_1_a_Hminus, b_1_a_Hminus
: Shape parameters of the analysis prior under the directional null hypothesis H0- for arm 1.

a_2_a_Hminus, b_2_a_Hminus
: Shape parameters of the analysis prior under the directional null hypothesis H0- for arm 2.

Value

A list with the following components:

- `design` — Four-element integer vector containing the selected two-stage design: interim sample sizes in arms 1 and 2 followed by final sample sizes in arms 1 and 2.
- `naive_oc` — Named list of uncorrected fixed-sample operating characteristics and fixed-sample sizes found in step 1.
- `occ` — Named numeric vector of corrected Bayesian operating characteristics for the selected two-stage design.
- `priors` — List storing design hyperparameters and search settings.
- `freq_occ` — Named numeric vector with fixed-sample and two-stage frequentist operating characteristics for the final design when frequentist calibration or reporting is active; otherwise `NULL`.
- `conv` — Character string describing the search outcome. Typical values include `"converged"`, `"no_feasible_fixed"`, `"no_interim_grid"`, and `"no_feasible_design"`. In frequentist or hybrid calibration modes, additional informative status values may be returned when the best available design is returned although all requested constraints were not fully satisfied.

Examples

```
## Fast Bayesian example with small search space
res <- optimal_twostage_2arm_bf(
  alpha = 0.10,
  beta = 0.20,
  k = 1 / 3,
  k_f = 3,
  n1_min = c(3, 3),
  n2_max = c(12, 12),
  alloc1 = 0.5,
  alloc2 = 0.5,
  power_cushion = 0,
  pceH0 = NULL,
  interim_fraction = c(0.25, 0.75),
  grid_step = 2L,
  coarse_step = 4L,
  progress = FALSE,
  max_iter = 24L,
  calibration_mode = "Bayesian",
  test = "BF01",
  a_0_d = 1, b_0_d = 1,
  a_0_a = 1, b_0_a = 1,
  a_1_d = 1, b_1_d = 1,
  a_2_d = 1, b_2_d = 1,
  a_1_a = 1, b_1_a = 1,
  a_2_a = 1, b_2_a = 1
)
res$design
res$occ
```

```
res2 <- optimal_twostage_2arm_bf(
  alpha = 0.05,
  beta = 0.20,
  k = 1 / 3,
  k_f = 3,
  n1_min = c(5, 5),
  n2_max = c(20, 20),
  alloc1 = 0.5,
  alloc2 = 0.5,
  power_cushion = 0.02,
  pceH0 = 0.50,
  interim_fraction = c(0.25, 0.75),
  grid_step = 1L,
  coarse_step = 4L,
  progress = FALSE,
  max_iter = 40L,
  calibration_mode = "Bayesian",
  test = "BF+0",
  a_0_d = 1, b_0_d = 1,
  a_0_a = 1, b_0_a = 1,
  a_1_d = 1, b_1_d = 2,
  a_2_d = 2, b_2_d = 1,
  a_1_a = 1, b_1_a = 1,
  a_2_a = 1, b_2_a = 1,
  a_1_d_Hminus = 1, b_1_d_Hminus = 1,
  a_2_d_Hminus = 1, b_2_d_Hminus = 1,
  a_1_a_Hminus = 1, b_1_a_Hminus = 1,
  a_2_a_Hminus = 1, b_2_a_Hminus = 1
)
res2$design
res2$occ
```

`plot_twostage_2arm_bf` *Plot an optimal two-stage two-arm Bayes factor design*

Description

Given the result from `optimal_twostage_2arm_bf()`, this function produces a six-panel base R plot showing the design schematic, operating characteristics, and the design and analysis priors under H_0 and H_1.

Usage

```
plot_twostage_2arm_bf(
  res,
  main = "Optimal two-stage two-arm Bayes factor design"
)
```

Arguments

res	A list returned by `optimal_twostage_2arm_bf()`, containing components `$design`, `$naive_oc`, `$occ` and `$priors`.
main	Character string with the main title of the plot.

Value

Invisibly returns `NULL`; called for its side effect of producing a plot.

Examples

```
res <- optimal_twostage_2arm_bf(
  alpha = 0.10, beta = 0.20, k = 1/3, k_f = 3,
  n1_min = c(3, 3), n2_max = c(8, 8),
  alloc1 = 0.5, alloc2 = 0.5,
  power_cushion = 0,
  interim_fraction = c(0.5, 0.5),
  grid_step = 1,
  progress = FALSE,
  max_iter = 16,
  test = "BF01",
  a_0_d = 1, b_0_d = 1,
  a_0_a = 1, b_0_a = 1,
  a_1_d = 1, b_1_d = 1,
  a_2_d = 1, b_2_d = 1,
  a_1_a = 1, b_1_a = 1,
  a_2_a = 1, b_2_a = 1
)
if (is.numeric(res$design) && length(res$design) == 4 && !anyNA(res$design)) {
  plot_twostage_2arm_bf(res)
}
```

---

postProbHminus *Posterior probability P(p2 <= p1 | data)*

Description

Posterior probability P(p2 <= p1 | data)

Usage

```
postProbHminus(y1, y2, n1, n2, a_1_a = 1, b_1_a = 1, a_2_a = 1, b_2_a = 1)
```

Arguments

y1	Number of successes in arm 1 (control).
y2	Number of successes in arm 2 (treatment).
n1	Sample size in arm 1.

n2	Sample size in arm 2.
a_1_a, b_1_a	Shape parameters of the Beta prior for p_1 under the alternative (analysis prior).
a_2_a, b_2_a	Shape parameters of the Beta prior for p_2 under the alternative (analysis prior).

Value

Numeric scalar, posterior probability $P(p_2 <= p_1|y_1, y_2)$.

---

postProbHplus — *Posterior probability P(p2 > p1 | data) under independent Beta priors*

Description

Uses Beta posteriors induced by the analysis priors to compute $P(p_2 > p_1 \mid y_1, y_2)$.

Usage

```
postProbHplus(y1, y2, n1, n2, a_1_a = 1, b_1_a = 1, a_2_a = 1, b_2_a = 1)
```

Arguments

y1	Number of successes in arm 1 (control).
y2	Number of successes in arm 2 (treatment).
n1	Sample size in arm 1.
n2	Sample size in arm 2.
a_1_a, b_1_a	Shape parameters of the Beta prior for p_1 under the alternative (analysis prior).
a_2_a, b_2_a	Shape parameters of the Beta prior for p_2 under the alternative (analysis prior).

Value

Numeric scalar, posterior probability $P(p_2 > p_1|y_1, y_2)$.

powertwoarmbinbf01 *Bayesian power, type-I error, and PCE(H0) for two-arm binomial Bayes factors*

Description

Computes Bayesian power, Bayesian type-I error, and the probability of compelling evidence under H_0 (or H_- for BF+-), for a given sample size and Bayes factor test. Optionally, frequentist type-I error and frequentist power are computed by summing over the rejection region.

Usage

```
powertwoarmbinbf01(
  n1,
  n2,
  k = 1/3,
  k_f = 1/3,
  test = c("BF01", "BF+0", "BF-0", "BF+-"),
  a_0_d = 1,
  b_0_d = 1,
  a_0_a = 1,
  b_0_a = 1,
  a_1_d = 1,
  b_1_d = 1,
  a_2_d = 1,
  b_2_d = 1,
  a_1_a = 1,
  b_1_a = 1,
  a_2_a = 1,
  b_2_a = 1,
 output = c("numeric", "predDensmatrix", "t1ematrix", "ceH0matrix", "frequentist_t1e"),
  a_1_d_Hminus = 1,
  b_1_d_Hminus = 1,
  a_2_d_Hminus = 1,
  b_2_d_Hminus = 1,
  compute_freq_t1e = FALSE,
  p1_grid = seq(0.01, 0.99, 0.02),
  p2_grid = seq(0.01, 0.99, 0.02),
  p1_power = NULL,
  p2_power = NULL,
  a_1_a_Hminus = 1,
  b_1_a_Hminus = 1,
  a_2_a_Hminus = 1,
  b_2_a_Hminus = 1
)
```

Arguments

- `n1`, `n2` — Sample sizes in arms 1 and 2.
- `k` — Evidence threshold for rejecting the null (inverted BF).
- `k_f` — Evidence threshold for "compelling evidence" in favour of the null.
- `test` — Character string, one of `"BF01"`, `"BF+0"`, `"BF-0"`, `"BF+-"`.
- `a_0_d`, `b_0_d`, `a_0_a`, `b_0_a` — Shape parameters for design and analysis priors under H_0.
- `a_1_d`, `b_1_d`, `a_2_d`, `b_2_d` — Shape parameters for design priors under H_1 or H_+.
- `a_1_a`, `b_1_a`, `a_2_a`, `b_2_a` — Shape parameters for analysis priors under H_1 or H_+.
- `output` — One of `"numeric"`, `"predDensmatrix"`, `"t1ematrix"`, `"ceH0matrix"`, `"frequentist_t1e"`.
- `a_1_d_Hminus`, `b_1_d_Hminus`, `a_2_d_Hminus`, `b_2_d_Hminus` — Optional design priors under H_- for directional tests.
- `compute_freq_t1e` — Logical; if `TRUE`, compute frequentist type-I error over a grid.
- `p1_grid`, `p2_grid` — Grids of true proportions for frequentist T1E.
- `p1_power`, `p2_power` — Optional true proportions for frequentist power.
- `a_1_a_Hminus`, `b_1_a_Hminus`, `a_2_a_Hminus`, `b_2_a_Hminus` — Shape parameters for analysis priors under H_- (directional tests).

Value

Depending on `output`, either a named numeric vector with components `Power`, `Type1_Error`, `CE_H0` (and optionally frequentist metrics) or matrices of predictive densities.

Examples

```
# Basic Bayesian power for BF01 test
powertwoarmbinbf01(n1 = 30, n2 = 30, k = 1/3, test = "BF01")

# Directional test BF+0 with frequentist type-I error
powertwoarmbinbf01(n1 = 40, n2 = 40, k = 1/3, k_f = 3,
                   test = "BF+0", compute_freq_t1e = TRUE)

# Predictive density matrices (advanced)
powertwoarmbinbf01(n1 = 25, n2 = 25, output = "predDensmatrix")
```

predictiveDensityH0 *Predictive density under H0: p1 = p2 = p*

Description

Beta-binomial predictive density for data (y1,y2) under H0.

Usage

```
predictiveDensityH0(y1, y2, n1, n2, a_0_d = 1, b_0_d = 1)
```

Arguments

`y1`	Number of successes in arm 1 (control).
`y2`	Number of successes in arm 2 (treatment).
`n1`	Sample size in arm 1.
`n2`	Sample size in arm 2.
`a_0_d, b_0_d`	Design-prior parameters for common p under H0.

Value

Numeric scalar, predictive density.

predictiveDensityH1 *Predictive density under H1: p1 != p2*

Description

Product of two independent Beta-binomial predictive densities.

Usage

```
predictiveDensityH1(y1, y2, n1, n2, a_1_d = 1, b_1_d = 1, a_2_d = 1, b_2_d = 1)
```

Arguments

`y1`	Number of successes in arm 1 (control).
`y2`	Number of successes in arm 2 (treatment).
`n1`	Sample size in arm 1.
`n2`	Sample size in arm 2.
`a_1_d, b_1_d`	Design-prior parameters for p1.
`a_2_d, b_2_d`	Design-prior parameters for p2.

Value

Numeric scalar, predictive density.

predictiveDensityHminus_trunc

Predictive density under H-: p2 <= p1 (truncated prior)

Description

Predictive density under H-: p2 <= p1 (truncated prior)

Usage

```
predictiveDensityHminus_trunc(
  y1,
  y2,
  n1,
  n2,
  a_1_d = 1,
  b_1_d = 1,
  a_2_d = 1,
  b_2_d = 1
)
```

Arguments

y1	Number of successes in arm 1 (control).
y2	Number of successes in arm 2 (treatment).
n1	Sample size in arm 1.
n2	Sample size in arm 2.
a_1_d, b_1_d	Design-prior parameters for p1.
a_2_d, b_2_d	Design-prior parameters for p2.

Value

Numeric scalar, predictive density under H-.

predictiveDensityHplus_trunc

Predictive density under H+: p2 > p1 (truncated prior)

Description

Predictive density under H+: p2 > p1 (truncated prior)

Usage

```
predictiveDensityHplus_trunc(
  y1,
  y2,
  n1,
  n2,
  a_1_d = 1,
  b_1_d = 1,
  a_2_d = 1,
  b_2_d = 1
)
```

Arguments

y1	Number of successes in arm 1 (control).
y2	Number of successes in arm 2 (treatment).
n1	Sample size in arm 1.
n2	Sample size in arm 2.
a_1_d, b_1_d	Design-prior parameters for p1.
a_2_d, b_2_d	Design-prior parameters for p2.

Value

Numeric scalar, predictive density under H+.

---

priorProbHminus — *Prior probability P(p2 <= p1) under independent Beta priors*

Description

Prior probability P(p2 <= p1) under independent Beta priors

Usage

```
priorProbHminus(a_1_a, b_1_a, a_2_a, b_2_a)
```

Arguments

a_1_a, b_1_a	Shape parameters of the Beta prior for p_1.
a_2_a, b_2_a	Shape parameters of the Beta prior for p_2.

Value

Numeric scalar, prior probability P(p2 <= p1).

priorProbHplus — *Prior probability P(p2 > p1) under independent Beta priors*

Description

Prior probability P(p2 > p1) under independent Beta priors

Usage

```
priorProbHplus(a_1_a, b_1_a, a_2_a, b_2_a)
```

Arguments

a_1_a, b_1_a	Shape parameters of the Beta prior for p_1.
a_2_a, b_2_a	Shape parameters of the Beta prior for p_2.

Value

Numeric scalar, prior probability P(p2 > p1).

twoarmbinbf01 — *Two-arm binomial Bayes factor BF01*

Description

Computes the Bayes factor BF_{01} comparing the point-null $H_0 : p_1 = p_2$ to the alternative $H_1 : p_1 \neq p_2$ in a two-arm binomial setting with Beta priors.

Usage

```
twoarmbinbf01(
  y1,
  y2,
  n1,
  n2,
  a_0_a = 1,
  b_0_a = 1,
  a_1_a = 1,
  b_1_a = 1,
  a_2_a = 1,
  b_2_a = 1
)
```

Arguments

y1	Number of successes in arm 1 (control).
y2	Number of successes in arm 2 (treatment).
n1	Sample size in arm 1.
n2	Sample size in arm 2.
a_0_a, b_0_a	Shape parameters of the Beta prior for the common-p under the null model (analysis prior).
a_1_a, b_1_a	Shape parameters of the Beta prior for p_1 under the alternative (analysis prior).
a_2_a, b_2_a	Shape parameters of the Beta prior for p_2 under the alternative (analysis prior).

Value

Numeric scalar, the Bayes factor BF_{01}.

Examples

```
twoarmbinbf01(10, 20, 30, 30)
```

---

twoarmbinbf_plus0_direct

Bayes factor BF+0 for the directional alternative vs point-null

---

Description

Computes the Bayes factor BF_{+0} comparing the directional alternative hypothesis H_+ (p_2 > p_1) against the point-null H_0 (p_1 = p_2).

Usage

```
twoarmbinbf_plus0_direct(
  y1,
  y2,
  n1,
  n2,
  a_0_a = 1,
  b_0_a = 1,
  a_1_a = 1,
  b_1_a = 1,
  a_2_a = 1,
  b_2_a = 1
)
```

Arguments

`y1, y2`	Integer counts of successes in arms 1 and 2.
`n1, n2`	Integer sample sizes in arms 1 and 2.
`a_0_a, b_0_a`	Shape parameters of the **analysis** prior for the common response probability under H_0.
`a_1_a, b_1_a`	Shape parameters of the **analysis** prior for the response probability in arm 1 under H_+.
`a_2_a, b_2_a`	Shape parameters of the **analysis** prior for the response probability in arm 2 under H_+.

Details

Both marginal likelihoods are formed using the **analysis** priors, which represent inferential beliefs at the time the data are evaluated. The design priors are used only for computing Bayesian operating characteristics (predictive power / type-I error) and play no role here.

Value

Numeric scalar; the Bayes factor $BF_{+0} = m_+(y_1, y_2)/m_0(y_1, y_2)$.

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