# FBSTDir - Full Bayesian Significance Test
# Hypotheses Tests Tools for Beta/Dirichlet Variates

This document briefly presents instructions for using a set of FBST tools for problems related to Beta and Dirichlet variates. Many of these problems arise in Bayesian analysis of contingency tables.

The programs must be run under MS-DOS prompt, available on Windows 95/98/XP/Vista. Each program returns the evidence in favor of the hypothesis to be tested. (Notice that the evidence *is not* the p-value, see references below.)

Download FBSTDIR.ZIP at http://each.uspnet.usp.br/lauretto and uncompress it in some directory (e.g. c:\fbstdir). Open the MS-DOS prompt and go to this directory, using the command:

cd <fbstdir directory>

e.g: cd c:\fbstdir

Beyond the mandatory parameters associated to each hypothesis test, there are three optional parameters:

- outputfile: output file name on which the evidence in favour of the hypothesis will be written
- maxMC: maximum number of iteractions in the Monte Carlo integration (default=2e+6)
- precision: precision in the evidence computation (default=1e-3)

### 1. FBSTPROP - Test for Proportion

Given a random variable $\pi \sim Beta(A_1, A_2)$, the null hypothesis is

$$H : \pi = p_0$$

where $p_0 \in [0,1]$.

**Usage:**

```
fbstprop <A1> <A2> <p0> [ outputfile [ maxMC [ precision ] ] ]
```

Examples:

```
fbstprop 41 61 0.5
fbstprop 41 61 0.5 evid.txt
fbstprop 41 61 0.5 evid.txt 1000000
fbstprop 41 61 0.5 evid.txt 1000000 0.002
```

### 2. FBSTHOMO – Homogeneity Test

Given two random variables $\pi_1 \sim Beta(A_{11}, A_{12})$ and $\pi_2 \sim Beta(A_{21}, A_{22})$, the null hypothesis is

$$H : \pi_1 = \pi_2 .$$

**Usage:**

`fbsthomo <A11> <A12> <A21> <A22> [ outputfile [ maxMC [ precision ] ] ]`

### 3. FBSTIND – Independence Test

Given two random variables $\pi_1 \sim Beta(A_{11}, A_{12})$ and $\pi_2 \sim Beta(A_{21}, A_{22})$, the null hypothesis is

$$\begin{aligned} H &: \pi_1 = t\,u \\ t &= (A_{11} + A_{12} - 2)/(S - 4) \\ u &= (A_{11} + A_{21} - 2)/(S - 4) \\ S &= A_{11} + A_{12} + A_{21} + A_{22} \end{aligned} .$$

**Usage:**

`fbstind <A11> <A12> <A21> <A22> [ outputfile [ maxMC [ precision ] ] ]`

### 4. FBSTMCN – McNemar Test

Given two random variables $\pi_1 \sim Beta(A_{11}, A_{12})$ and $\pi_2 \sim Beta(A_{21}, A_{22})$, the null hypothesis is

$$H : \pi_2 = 1 - \pi_1 .$$

**Usage:**

`fbstmcn <A11> <A12> <A21> <A22> [ outputfile [ maxMC [ precision ] ] ]`

### 5. FBSTHW2 - Test of Hardy-Weinberg Equilibrium (2 alleles)

Given a random variable $(\pi_{aa}, \pi_{ab}, \pi_{bb}) \sim Dirichlet(A_{aa}, A_{ab}, A_{bb})$, the null hypothesis is

$$H : \exists\, p \in (0,1) \mid \pi_{aa} = p^2, \pi_{ab} = 2p(1-p), \pi_{bb} = (1-p)^2 .$$

**Usage:**

fbsthw <$A_{aa}$> <$A_{ab}$> <$A_{bb}$> [ outputfile [ maxMC [ precision ] ] ]

For the multiallelic case, see the program FBSTHW available at:
http://each.uspnet.usp.br/lauretto

Any doubts and suggestions about FBST tools may be sent to cpereira@ime.usp.br or marcelolauretto@usp.br.

**References:**

Pereira,C.A.B.; Stern,J.M. (1999). Evidence and Credibility: Full Bayesian Significance Test for Precise Hypotheses. *Entropy Journal*, 1, 99–110.

Lauretto, M.S.; Nakano, F.; Faria Jr, S.R; Pereira, C.A.B.; Stern, J.M. (2009) A straightforward multiallelic significance test for the Hardy-Weinberg equilibrium law. Genetics and Molecular Biology, 32, 3, 619–625.