Block Adaptive Randomization User's Guide

Department of Biostatistics
P. O. Box 301402, Unit 1409
The University of Texas, M. D. Anderson Cancer Center
Houston, Texas 77230-1402, USA

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1 Method description

The BlockARAND software implements outcome-adaptive randomization in blocks for two-arm trials with binary outcomes as described in [1]. The randomization probability is calculated using

$$Pr(\text{assign arm 1}) = \frac{p^\lambda}{p^\lambda + (1-p)^\lambda}$$

where p is the probability of the response rate in arm 1 being better than arm 2. In additon, a stopping rule is placed from the beginning of the trial. The trial will be stopped and declare arm i to be the winning arm if

$$Pr(\text{response rate in arm } i \text{ better than arm } j) > c$$

By default, we choose $\lambda = 1/2$ and Jefferys prior, *i.e.* Beta(0.5, 0.5), for both arms. These defalt values can be changed by editing the config file.

2 Running the software

2.1 Executing from the command line

BlockARAND is a command line application. It runs on Windows using the .NET framework. It should also be possible to run the software on Mac OS X and Linux using the Mono framework.

The software has two input modes: conversational and file-based. The conversational mode asks the user for inputs one at a time. The file-based mode asks the user to prepare an input file. The former may be more convenient when first trying out the program. Most users will find the latter more convenient for repeated use. You may start with the file `input.txt` and edit it to suit your trial.

If the software is running from the command line with only the file name, it enters conversational mode. If the software is running with an additional argument, that argument is assumed to be the name of the input file.

You may exit the conversational mode at any time by typing Control-C.

If you run BlockARAND on a file, the output is printed to the command line. You can save the output to a file by redirecting the output using `>`. For example,

```
BlockARAND.exe input.txt > output.txt
```

will read from `input.txt` and write to `output.txt`.

2.2 Input parameters

Random number generator seed Any non-negative integer up to 20,000,000.

Minimum block size Must be at least 2 and no more than 10.

Maximum block size Must be at least as big as the minimum block size and no more than 10.

Denote the maximum block size by M. Since every block must contain at least one assignment to each arm, the minimum randomization probability is $1/M$. Also, the longest possible run has length $2M - 2$. (The longest run happens when one block has an A followed by all B's and the next block has the reversed sequence.)

Maximum number of patients Total number of patients enrolled if no early stopping rule applies.

Burn-in period The number of patients randomized with probability 0.5 regardless of the data.

Patients are randomized in blocks during the burn-in period. The block size is the maximum block size if an even number maximum block size is

entered, otherwise it is the maximum block size minus one.

Early stopping probability The trial will be stopped and declare arm i to be the winning arm if

$$Pr(\text{response rate in arm } i \text{ better than arm } j) > c$$

Number of repetitions Total number of repetitions for the simulation to run.

Scenarios A scenario is a pair of probabilities, the true probability of success on each arm.

Here is a typical input file:

```
## Design Parameters ##
1     # seed
2     # min block size
8     # max block size
200   # max number of patients
50    # burnin period (number of patients)
0.95  # early stopping probability
500   # number of repetitions for the simulation
###################################################

# Scenario 1
0.3   # probability of success on the first arm
0.8   # probability of success on the second arm


# Scenario 2
0.5   # probability of success on the first arm
0.8   # probability of success on the second arm


######################
# END
```

2.3 Output

```
Block Adaptive Randomization (version 1.0.1)
4/18/2012 11:28:17 AM
Random seed for simulation = 1

Design input parameters:
Minimum block size = 2
Maximum block size = 8
Maximum number of patients = 200
Burn-in period = 50

Number of repetitions for the simulation = 500

Simulation results:


Scenario 1

True probability of response:    0.30            0.80
Selection probability:           0.00            1.00
Average patients:                6.2             6.3

Scenario 2

True probability of response:    0.50            0.80
Selection probability:           0.02            0.98
Average patients:                12.1            13.5


Waiting for any key to exit ......
```

The two columns of numbers in the output correspond to the two treatment arms.

We recommend saving the entire output of the BlockARAND program and not just the operating characteristics. This assures that you have all the parameters that went into the design, including the version number of the software.

3 References

[1] John D. Cook. Block Adaptive Randomization (2011). *UT MD Anderson Cancer Center Department of Biostatistics Working Paper Series*. Working Paper 63.