ratpack user manual

Title	ratpack (VHDL rational arithmetic package).
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Rev. history	
v0.3.0	2014-09-22 Updated for github (contents of /doc moved to top-level directory, minor documentation changes).
v0.2.0	2014-02-21 Changed documentation format to RestructuredText. Code has been reorganized into new directory structure.
v0.1.3	2010-11-17 Added max, min.
v0.1.2	2010-11-17 Added gcditer (iterative GCD using rational numbers).
v0.1.1	2010-06-07 Minor update in documentation (README).
v0.1.0	2010-05-14 First public release.

1. Introduction

`ratpack` is a rational arithmetic package written in VHDL.

Currently, the `ratpack` package implements the following:

- the RATIONAL data type.
- to_rational: construction function of a rational given two integers (numerator and denominator).
- int2rat: conversion function of an integer to its rational representation.
- numerator: extracts the numerator of a rational number.
- denominator: extracts the denominator of a rational number.

- "+", "-", "*", "/": implementation of the basic arithmetic operations for rationals.
- abs: extracts the absolute value of a given rational number.
- max: extracts the maximum of two rationals.
- min: extracts the minimum of two rationals.
- ">", "<", ">=", "<=", "=", "/=": overload comparison operators for rationals.
- gcd: computes the greatest common divisor of two integers (positive, covers the pathological case of division by zero).
- mediant: computes the mediant rational of two given rationals.

`ratpack` is distributed along with two VHDL testbenches: a simple one (`ratpack_tb1.vhd`) and a testbench generating the Farey series of orders 1 to 12 (`ratpack_tb2.vhd`). An exemplary rational arithmetic ALU has also been included but it is currently left untested (not testbench for it).

The `ratpack` project can be download from the following OpenCores website: http://opencores.org/project,ratpack

An up-to-date version of the `ratpack` code base is also maintained on Github: http://github.com/nkkav/ratpack.git

2. File listing

The `ratpack` distribution includes the following files:

/ratpack	Top-level directory
/bench/vhdl	Benchmarks VHDL directory
AUTHORS	List of `ratpack` authors.
BUGS	Bug list.
ChangeLog	A log for code changes.
COPYING	The LGPL, version 3, governs `ratpack`. There are thoughts of changing the license to Modified BSD eventually.
README.rst	This file.
README.html	HTML version of README.
README.pdf	PDF version of README.
rst2docs.sh	Bash script for generating the HTML and PDF versions.
THANKS	Acknowledgements.
TODO	A list of future enhancements.
VERSION	Current version of the project sources.
/bench/vhdl	Testbench source code directory for the package
ratpack_tb1.vhd	A simple testbench.
ratpack_tb2.vhd	Testbench generating the Farey series (orders 1-12).

/rtl/vhdl	RTL source code directory for the package
ratalu.vhd	Implementation of a rational arithmetic ALU.
ratpack.vhd	The rational arithmetic package.
/sim/rtl_sim	RTL simulation files directory
/sim/rtl_sim/out	RTL simulation output files directory
ratpack_results1.txt	Output generated by the `ratpack_tb1.vhd` tests.
ratpack_results2.txt	Output generated by the `ratpack_tb2.vhd` tests.
/sim/rtl_sim/run	RTL simulation run scripts directory
ratpack.mk	GNU Makefile for running GHDL simulations.
run.sh	A bash script for running the GNU Makefile for GHDL.

3. `ratpack` usage

The `ratpack` package test script can be used as follows:

```
$./run.sh <package name> <test case>
```

After this process, the `ratpack_results.txt` file is generated containing simulation results.

Here follow some simple usage examples of this bash script.

1. Compile the `ratpack` package and do a simple test.

```
$ ./run.sh ratpack 1
```

2. Compile the `ratpack` package and generate the Farey series.

```
$ ./run.sh ratpack 2
```

4. Prerequisites

- Standard UNIX-based tools (tested on cygwin/x86)
  - make
  - bash
- GHDL simulator (http://ghdl.free.fr)

  Provides the "ghdl" executable and corresponding simulation environment.