ratpack user manual

Title	ratpack (VHDL rational arithmetic package).
Author	Nikolaos Kavvadias 2009, 2010, 2011, 2012, 2013, 2014
Contact	nikos@nkavvadias.com
Website	http://www.nkavvadias.com
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Rev. history	
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

2. File listing

The `ratpack` distribution includes the following files:

/ratpack	Top-level directory
/bench/vhdl	Benchmarks VHDL directory
ratpack_tb1.vhd	A simple testbench.
ratpack_tb2.vhd	Testbench generating the Farey series (orders 1-12).
/doc	Documentation directory
AUTHORS	List of `ratpack` authors.
BUGS	Bug list.
ChangeLog	A log for code changes.
COPYING	The LGPL, version 3, governs `ratpack`.
README	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.
/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. Prerequisities

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

  Provides the "ghdl" executable and corresponding simulation environment.