The PragmAda Reusable Components

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Introduction

The PragmAda Reusable Components (PragmARCs) are a library of reusable components in a number of categories, and ranging from very basic to some quite high-level concepts. The PragmARCs have existed for over a decade, first in Ada 83 and now in Ada 95, and have been used on a variety of projects. A new version will probably appear once Ada 0X is standardized and widely available.

The PragmARCs contain a few components for backwards compatibility. Thus, the complex-number component may be obsolete, given the existence of such a package in Annex G, but is retained for those who continue to use it rather than change their software, and perhaps for those whose compilers don't support that Annex. Similarly, the need for control of ANSI-standard displays is not as great as it once was. There is also a package of elementary math functions that is implemented using Ada.Numerics.Generic_Elementary_Functions for those who used the PragmAda package before Ada 95 became available.

Some of these components may disappear in the Ada-0X version, just as some of the Ada-83 components (such as variable-length strings) disappeared in the Ada-95 version.

Data Structures

The PragmARCs include a number of data-structure components. The components in this category are:

- Lists
- Stacks
- Queues
- Bags
- Sets for discrete universe types
- Skip lists [O(log N) search time; insertions and deletions typically faster than balanced trees]

Most data structures are available in bounded and unbounded forms and protected and unprotected forms. Queues include protected blocking forms; the bounded blocking forms have been used in production real-time, embedded software.

PragmARC.Assignment, a helper component, simplifies the instantiation of data structures for many element types.

Following the lead of the Ada language itself, the intent has been to provide building blocks that the developer may use to create higher level abstractions. For example, maps can easily be implemented using skip lists.

It is likely that these components will continue to exist in the Ada-0X version, as most allow limited element types. The proposed standard container library does not

provide support for limited element types. In addition, the proposed library does not provide low-level building blocks, such as skip lists, that the advanced user may need direct access to.

Algorithms

Algorithms provided by the PragmARCs are:

- Binary search
- Hashing for strings
- Min and Max functions for any type with "<" defined
- Mixed case conversions for strings
- Quick string searching (faster than Boyer-Moore for most search patterns)
- Highly optimized quick sort
- Radix sort
- Marsaglia's "universal" random-number generator (high quality and portable)
- Prev and Succ functions with wrap-around semantics

Tasking-Related Components

- Forwarders
- Monitors
- Protected options
- Binary semaphores and "safe" semaphores
- Transporters

Forwarders, monitors, and transporters are examples of task decouplers. Protected queues are also task decouplers, but are better presented as data structures.

Miscellaneous Components

There are many components that don't fit into any specific category.

- Control strings for ANSI-standard displays
- Assertions
- Complex numbers
- Date handling, including day-of-week and leap-year functions and Image functions
- Playing card and card deck handling
- Get_Line function for obtaining an entire line from a text file
- Image functions for integer types, specifying width, base, and zero-filling of the image
- Linear equation solving using QR factorization
- Math constants beyond π and e
- Matrix math
- Neural networks using REM learning equations (faster and more robust than back propagation)
- Text menus for ANSI-standard displays
- A full-screen postfix calculator for ANSI-standard displays
- Automatic unit name strings (reflection)
- Regular expressions
- Word-by-word input from text files

Availability and Support

The PragmARCs are free software; they are supplied without cost in source form. They are released under the GNAT-Modified GNU Public License, which allows them to be used to produce completely proprietary software. PragmAda Software Engineering provides support for the components at reasonable prices. For more information, or to download the components, visit

http://home.earthlink.net/~jrcarter010/pragmarc.htm