

To: WG11 Members

From: Editors of Language Independent Arithmetic, Part 1

Title: Draft Response to International Comments from
Czechoslovakia, France, Japan, the United
Kingdom and the United States.

The above member bodies provided comments with their votes on the progression to DIS of CD 10967, Language Independent Arithmetic, Part 1. These comments have been circulated as document SC22 N1010. Attached is a draft for a response from WG11 to these comments. Please review the comments and the draft response before the meeting in April, so that we can approve a final response at that meeting.

DRAFT FOR
RESPONSE TO INTERNATIONAL COMMENTS ON PROMOTION OF
CD 10967, LANGUAGE COMPATIBLE ARITHMETIC STANDARD, TO DIS

6 March 1992

1 INTRODUCTION

The DIS ballot results on the progression of CD 10967 (Language Compatible Arithmetic Standard) to DIS [1] include comments from Czechoslovakia, France, Japan, the United Kingdom, and the United States. This document is a response to those comments. All of the comments are constructive, and we wish to thank the authors for their work.

The comments were discussed at the September meeting of WG11, and more recently with contributors of comments from France, the United Kingdom and the United States. These discussions resulted in a straw ballot in WG11 on changes proposed [2] for the LCAS. Based on comments from the straw ballot, a revised proposal [3] for changes has been prepared.

2 CZECHOSLOVAKIA

The Czech comment references the comments which accompanied the Czech ballot for CD, document SC22/N868. Responses to these comments were included in document SC22/934. The responses in SC22/N934 are still valid with the following exception:

The first of these earlier comments reads

"It is important to clarify basic properties that are common to all programming languages. The draft could help to create standard languages."

The response given in SC22/N934 should be revised to read

"The proposed changes for clause 2.2 (revised proposal [3]) would help to provide such clarification through its normative requirements on language bindings in Annex B."

3 FRANCE

Comment: France proposes that the first paragraph of clause 2 be changed to read:

"A Standard Language implementation conforms to this International Standard:

- if the Language Standard supports at least one signed integer type and/or at least one floating point type, and
- if the implementations of those types are provided in a way that satisfies all the requirements of clauses 4

through 7, for those operations defined in the Language Standard."

Response: We believe that the revised proposal for changes to the LCAS [3] captures the essential ideas in the comment from France, and at the same time meets objections raised to the French comment at the September 1991 meetings of WG11 and SC22.

4 JAPAN

Comment: Binding for COBOL should be included in Annex B.

Response: The LCAS provides specifications for integer and (real) floating point data types and the basic arithmetic operations on them. COBOL provides specifications for (real) fixed point data types, and the basic arithmetic operations on them. The differences between the LCAS and COBOL arithmetic data types are so great that an attempt to force COBOL into an LCAS mold would be a disservice to both standards.

The LCAS has now become Part 1 of Language Independent Arithmetic - Integer and Real Floating Point, with Parts 2 and 3 to deal with Real Mathematical Procedures and Complex Arithmetic and Procedures, respectively.

We recommend that a new work item for Part 4, Fixed Point Arithmetic be proposed by those prepared to develop it.

5 RESPONSE TO COMMENTS FROM THE UNITED KINGDOM

The following responses are to comments on the First Committee Draft (LCAS 3.1) from Roger Scowen for the UK. We appreciate the careful reading of this draft of the document. The numbering of the responses corresponds to the numbering in these comments.

2. Clause 4.3, line -3: The text should read "rnd_F->I is a rounding function from RR to ZZ" because the domain of a rounding function is defined to be RR."

We will make this correction.

3. All of Draft 3.1: Please indicate clearly in each new draft, the changes which have been made since the last draft.

In the future we will provide change bars if we can figure out how to do it in TeX. Annex A of this document contains a list of the changes made from Draft 3.0 to 3.1.

4.1. Scope, Paragraph 3: Repeats definition of "implementation" in 3.2.

Repeating will save confusion in 1.1 where the term is used before it is defined in 3.2

4.2. Clause 3.2: Comments such as "See FD in 4.2." should be notes. Notes and examples should also be notes.

We will make this change.

4.3. 1.1 Note: Replace "Please see A.1.3 for" by "A.1.3 describes."

We will make this change.

4.4. Definitions, "arithmetic data type": Delete "(the complex numbers)".

We will make this change.

4.5. First note of Clause 7: Unnecessary since it repeats a definition in 3.2.

The definition of "implementation" is important and bears repeating. This will save confusion if that section of the standard is read in isolation.

5.1. Define "Range checking function" explicitly in 3.2

We are currently reexamining the range checking functions and will include a definition in 3.2 when we are clear what the definition ought to be.

5.2. Move example of "signature" from clause 4 to 3.2 along with with the the definition.

We will make this change.

5.3. The difference between operations and functions is not clear in LCAS; it should be made explicit.

We will include the following definition in 3.2.

operation: a term synonymous with "function" throughout this document.

5.4. The definitions for "shall" and "should" are unnecessary in an ISO/IEC standard.

We have been asked by readers to include definitions of these terms in the document. The definitions will be changed to agree with ISO guidelines and the ISO guidelines will be cited as a reference.

5.5. sign_I wanted.

We will add this function.

5.6. 4.1.3 Axioms: Too wishy-washy about mod_I. Choose one or require both.

Each of the mod_I functions is required by some language standard, although no language requires both. So we have included both functions in the LCAS.

5.7. Rnd_and_chk function definition of this function is imprecise.

We will change the text: "This combination ... is captured by" to "It is therefore simpler to use the function defined by the signature and axiom:".

5.8. Conversion operation I to F loses accuracy.

It is the nature of cvtI->F that it can lose accuracy since there is no reasonable way to map a large number of integers into a low precision floating point type. The programmer must keep this in mind when choosing to use the function. Because the LCAS requires the parameters of the two data types be available to the program, it will be possible to write code that anticipates this lose of accuracy in a portable fashion by comparing the absolute value of the integer to $r^{**}p$, where r is the radix and p is the precision of the

floating point type.

5.9. Conversion operation F to I is vague.

We will add the following note before the last paragraph of Section 4.3.

Note -- Depending upon the choice of $\text{rndF} \rightarrow \text{I}$, the function $\text{cvtF} \rightarrow \text{I}$ will produce results which are identical with the function floor, truncate, bound or ceiling. These functions will be described in more detail in Part 2 of LIA.

6. Annex B.10 Prolog: Update to reflect changes since December 1990.

We will include all these updates.

The following responses are to Comments on LCAS 3.0 received from Roger Scowen which did not appear in the Comments on LCAS 3.1.

2.2. Omit references to complex numbers since they aren't covered by the LCAS.

Including the references helps avoid confusion, and correctly sets expectations.

2.5. Don't italicize explanations of mathematical expressions -- only the expressions themselves.

We will reexamine the mathematical expressions to make sure the typography meets WG11 and ISO directives.

6 UNITED STATES

Comment 1: Wait until SC22 has decided on the multipart structure.

Response: This has now been done.

Comment 2: Significant work remains to be done on concerns raised by public comments in the areas of notification, rounding and compatibility with ISO/IEC 559 (IEEE 754).

Response: We believe that the proposed changes to the LCAS (see [2] and [3]) will resolve the problems noted by the US.

7 REFERENCES:

1. Summary of Voting and Comments Received on a Proposal to Promote CD 10967 to DI. ISO/IEC JTC1/SC22 N1010, August 1991.

2. Proposal for Changes to CD 10967, WG11 N292.

3. Revised Proposal for Changes to CD 10967, WG11 N302.

ANNEX A

DIFFERENCES BETWEEN VERSIONS 3.0 AND 3.1 OF THE LCAS

DOCUMENTS

1. LCAS V3.0: Language Compatible Arithmetic Standard 26 December 1990
2. LCAS V3.1: Information technology -- Programming languages -- Language compatible arithmetic 1 March 1991

Changes were made for three reasons -- some were ordered by WG11, some were done to conform to the ISO Directives (part 3), and others were made to clarify the wording or correct typographical errors. There were no semantic changes made to the contents of the standard.

In the following list of changes, (*) marks changes made to the normative portion of the standard.

A.1 CHANGES ORDERED BY SC22/WG11

(*) The title of the standard has been changed.

(*) A new helper function `rnd_and_chk` has been added to abbreviate the common use of the expression "`chk(x,rnd(x))`". This was requested by France (among others). See clauses 4.2.4, 4.2.6, 4.3, and A.4.2.4.

(*) The definition of "implementation" has been expanded to include "all pertinent documentation".

(*) "The syntax of expressions" has been added to clause 1.1 on the "specifications not within the scope of this standard." A note referring to annex B has also been added to item (h) in this clause.

The milestones have been moved to the end of annex A.0, and shortened.

The acknowledgments have been moved to the end of annex A.0, and two items were added: a list of authors, and a list of the standards committees involved.

The citation of ASN.1 has been changed to ASN.1 BER.

The formats of all citations to international standards have been checked and corrected. E.g., "ISO-9001" was changed to "ISO/IEC 9001."

The commentary on notification (first 2 paragraphs of annex A.3.2) has been reworded to clarify the use of "exception" in Ada, PL/I, and ISO TR 10176.

In the specific language annexes (B.1 thru B.10), the first sentence or two has been reworded to cite the international language standard rather than a national standard.

The bibliography has been completely reordered, and all titles and standard numbers have been checked.

Annex T became annex F, and its title has changed to "Typical Floating Point Formats."

We note that annex F "will be removed."

A.2 CHANGES MADE TO CONFORM TO THE ISO DIRECTIVES (PART 3)

(*) The title page has been reformatted.

(*) Running page headers have been added.

(*) Lists are "numbered" with letters. E.g., a), b), ...

The titles of annexes are now correctly formatted.

A.3 CHANGES MADE TO CLARIFY WORDING OR CORRECT TYPOGRAPHICAL ERRORS

(*) A definition of "signature" has been added to clause 3.2.

(*) Parenthesised comments in lists are now uniformly in italics.

Uses of the phrase "gradual underflow" have been removed.

(*) The square root symbol appears consistently with an overbar.

Sub-sub-clause numbering is now correct.

(*) "that replaces" --> "replacing"

In annex A.1.3, a reference to IEEE 754 accuracy constraints has been replaced by mention of LCAS accuracy constraints.

"accomodate" --> "accommodate"

In a discussion of rounding to n-digits, the phrase "representable floating point number" has been changed to "n-digit floating point number."

"hold" --> "holds"

"guard bit" --> "guard digit"

The discussion of empirical error (annex A.4.2.10.2) has been rewritten to clarify the difference between empirical and modelling errors.

An inaccurate reference to "post-notification behavior" in annex A.5(c) has been removed.

The list of covered standards in annex B.0 has been changed to a list of covered languages by removing the word "standards." Comments like "(draft)" have been removed from the list.

A reference to annex A.4.2.11 has been added in the fourth from last paragraph in annex B.0.

In the specific language annexes (B.1 thru B.10), the syntax corresponding to LCAS operations is now uniformly in a fixed-width font.

"may conform" --> "can conform" in several places

In annex B.5 (Fortran 77), a mention of "REAL" has been replaced by "REAL or DOUBLE PRECISION"

In annex B.7 (Modula-2), "these exceptional conditions" has been replaced with "all exceptional conditions."

Paragraphs 2 thru 5 of annex B.9 (PL/1) have been reworded to clarify which arithmetic types can conform.

"variables that represent expressions" --> "expressions"

In the glossary (annex E), a definition of boolean has been added, and the definition of in-range has been removed.

In the glossary entry for LCAS, "identify" has been changed to "refer to."