COMPUTING CENTRE NEWSLETTER
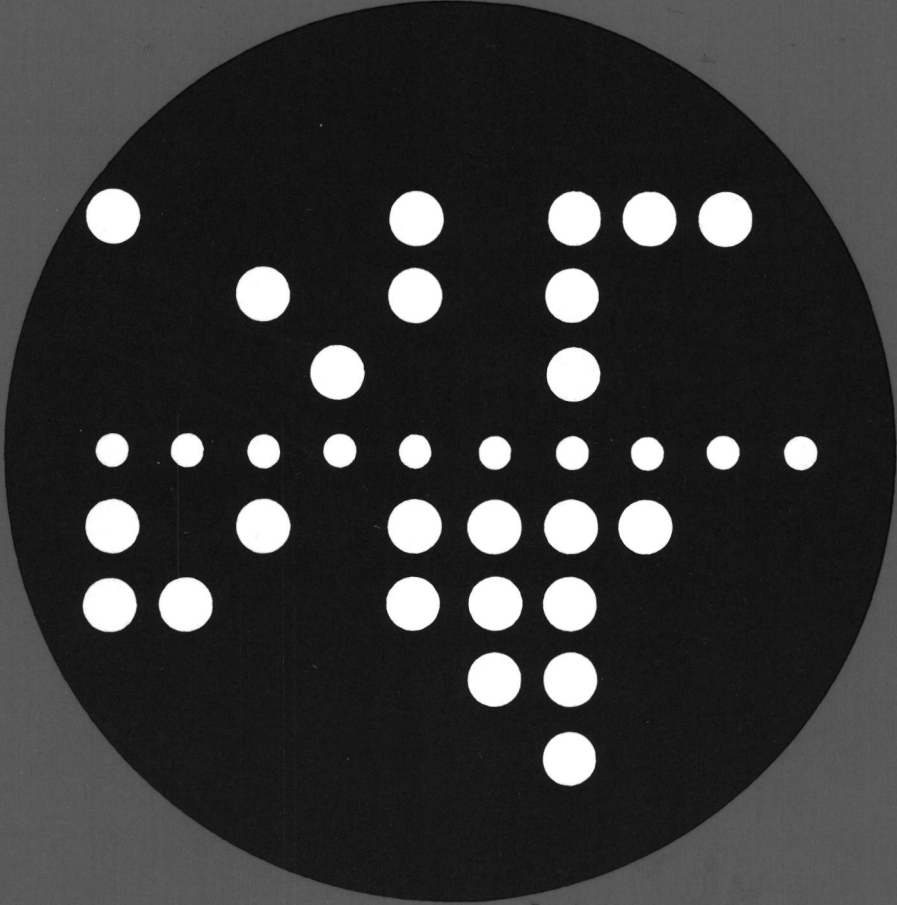
March 1980 · N. **39**

Commission of the European Communities

JOINT RESEARCH CENTRE

Ispra Establishment

CONTENTS

EDITORIAL NOTE.

The Computing Centre Newsletter is published monthly except for
August and December.

It describes developments, modifications and specific topics in
relation to the use of the computing installations of the Joint
Research Centre, Ispra Establishment.

The aim of the Newsletter is   to provide information of
importance to the users of the computing installations, in a
form which is both interesting and readable.

The Newsletter also includes articles which are of intellectual
and educational value in order to keep the users informed of new
advances in computer science topics.

The Editorial Board is composed as follows:

              J.   Pire.   Responsible Editor.

              M.   Dowell.   Technical Editor.

              C.   Pigni.
                                    Editors.
              H.   de Wolde.

ANALYSIS OF FORTRAN PROGRAMS USING PFORT

A. A. Pollicini

Introduction

The user of the Computing Centre are informed that a FORTRAN Syntax Checker is now available on the IBM 370/165 computer system.
In fact the PFORT Verifier [1] which is a software tool developed and distributed by Bell Laboratories has been recently installed.
PFORT is the designation both of the formalization of the syntax of a restricted FORTRAN language and of a processor which recognizes statements adhering to the defined syntax.
The language is a subset of the standard ANS X3.9-1966.
The processor performs a static analysis of a FORTRAN program which is read in as input. It produces reports about the discovered deviations from the PFORT language as well as possible causes of side-effects in inter-unit communications.

Some Insights into the Language Subset

The PFORT Language is unequivocally defined in the report [1] by syntax charts integrated by interpretative comments and notes. However, a general idea of its boundary may be drawn from the following table.

SUBJECT	PFORT RESTRICTION
Character set	Dollar Sign ($) and apostrophe (') are not included
Continuation lines	The label field must be blank
Hollerith constants	(a) May only be associated with entities of type INTEGER; (b) the alternative form enclosed in apostrophes is not allowed
Hexadecimal constant	Not allowed at all
Dimension of Arrays	Limited to three
Subscripts	For v an integer variable and k, kk integer constans, the allowed expressions are limited to the set: $\{k; v; v-k; v+k; k*v-kk; k*v+kk\}$

(continued)

SUBJECT	PFORT RESTRICTION
Arithmetic expressions (exponentiation)	(a) Consecutive exponentiations are not allowed; (b) INTEGER entities may be raised to an INTEGER exponent giving an INTEGER result, REAL and DOUBLE PRECISION entities may be raised either to an INTEGER or REAL or DOUBLE PRECISION exponent, the result is DOUBLE PRECISION if one or both operands are DOUBLE PRECISION, otherwise it is REAL, COMPLEX entities may be raised to an INTEGER exponent giving a COMPLEX result
Arithmetic expressions (other operators)	The only allowed data type combinations are: REAL with DOUBLE PRECISION giving DOUBLE PRECISION result, REAL with COMPLEX giving COMPLEX result
Relational expressions	The only allowed data type combinations are: INTEGER with Hollerith constants, REAL with DOUBLE PRECISION
Arithmetic assignment	If the expression and the lefthand-side element do not match in type, the value of the expression will be converted only in the following cases: REAL and DOUBLE PRECISION toward INTEGER and viceversa, REAL towards DOUBLE PRECISION and viceversa
DO statement	(a) The control variable and the DO parameters cannot be redefined within the range of the DO-loop; (b) the extended range of the DO-loop is not allowed
COMMON statement	COMPLEX and DOUBLE PRECISION entities must precede any entity of all other types
EQUIVALENCE statement	(a) The declared number of subscripts must be used for array elements; (b) Arrays of different types must be referred to using the leftmost element (e.g. A(1,1,1) or A(1,1))

(continued)

SUBJECT	PFORT RESTRICTION
Type statement	(a) The length declarator is never allowed; (b) Initial values cannot be assigned
DATA statement	(a) Arrays names cannot be used; (b) Elements and data-items must be equal in number and agree in type except Hollerith constants which can be associated with INTEGER elements
FORMAT statement	(a) H edit descriptor has no alternative form (b) T edit descriptor is not allowed; (c) A edit descriptor is only allowed with unary field width (e.g. nA1); (d) only two parenthesis levels are allowed
Input/Output list	Redundant parentheses are not allowed
READ,WRITE statements	Only Formatted and Unformatted sequential forms are allowed
IMPLICIT, DEFINE FILE,FIND, NAMELIST,PRINT, ENTRY statements	Are not allowed at all
RETURN statement	Cannot be omitted in SUBROUTINE and FUNCTION subprograms
Alternate RETURN	Is not allowed
Identifiers	Names used for COMMON block or dummy argument of arithmetic statement function cannot be used for different purposes in the same program unit
Sequence of statement	In any program unit, different classes of statement must appear in the following order: I FUNCTION or SUBROUTINE statement if present, II Specification statements (except EQUIVALENCE,DATA and FORMAT), III EQUIVALENCE statements, IV DATA statements, V Arithmetic statement function definitions, VI Executable and FORMAT statements, VII END line

How to use the PFORT Verifier

The Verifier may be accessed in batch, by invoking the catalogued procedure PFVER as shown below:

```
//TESTPF  EXEC  PFVER
//GO.SYSIN  DD  *
     FORTRAN Source Statements
/*
```

The job requires 300 kbytes of storage.
The output listing contains a list of the analyzed source, with intermixed messages which are made visible by three asterisks on the left.
The interpretation of the messages is very easy because the texts are self explanatory.
However, note should be taken of the fact that the normal process of a program unit may be perturbed if an internal overflow occurs. This is pointed out by the message:

*** IN unit, TABLE OVERFLOW OF array

in which 'unit' refers to a PFORT subprogram and 'array' is the name of the internal array causing overflow.
In the installed version, overflow may occur during analysis of quite "large" subprograms, therefore the fact should not happen very frequently. Anyway the extension of the size of some critical array could be envisaged in the future.

At the end of each program unit there is a detailed cross reference table in which every identifier appears in alphabetical order with its actual attributes and the statement number of each occurrence in the program unit.
Similarly all statement labels are listed with a reference to the statement number of their occurrences in the program unit.

Example:

PROGRAM UNIT   *MAIN
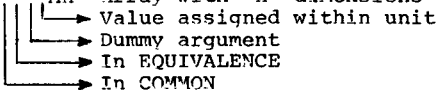
NAME	TYPE	USE	ATTRIBUTES	REFERENCES		
A	ED	V	SA2	2	8	9
INT	I	V	SS	3	5	
...	.	.	..	4	11	.
10						
...				.	.	.

The letters that may be used under the column headings have the following meanings:

TYPE   :   E   Explicitly typed
              D   DOUBLE precision
              C   Complex
              H   Hollerith
              I   Integer
              L   Logical
              R   Real

USE   :   FA   Arithmetic-statement function argument
              FN   Function name
              E   External (function or subroutine)
              GT   Assigned GOTO variable
              IF   Intrinsic function
              SF   Arithmetic statement function
              SN   Subroutine name
              V   Variable

ATTRIBUTES: CEASS   Scalar
                   An   Array with 'n' dimensions (n=1,2,3)
                    └──► Value assigned within unit
                   └────► Dummy argument
                  └──────► In EQUIVALENCE
                 └────────► In COMMON

Additionally there is the layout of each COMMON block present in the program unit.

After the end of the last program unit, messages are reported about unresolved external references, type mismatch in association between dummy and actual arguments, etc.
A map of the program structure follows.
For each program unit there are the lists of arguments, common blocks, called units and units calling it.
Finally there is a summary of storage allocation for all COMMON blocks and a list of possible unsafe references to global entities which may be the cause of side effects in communication between units.

Possible applications of PFORT

Programming by using only a limited set of the features allowed by a programming language is always an advisable technique.
Of course the subset must be powerful enough to express all kinds of operations to be performed.
If so, the produced code has the valuable merit of simplicity and clarity because some sophisticated and complex features are not used.
Moreover, if the restrictions to the language follow functional criteria as in the case of PFORT, more profitable benefits may be obtained.

- 7 -

A FORTRAN program conforming to PFORT has two main advantages:

- it is more portable because features not generally available as well as machine-dependent features are not included in the subset;
- it is more reliable because features which behave differently on different computer systems are avoided.

For these reasons the use of PFORT is advisable in many and unlike occasions within a computing centre.
For instance, it is useful in the evaluation of the efforts needed in moving a FORTRAN program from one computer to another. Therefore J.R.C. personnel interested in obtaining programs from outside should consider the opportunity of a preliminary estimation of the adaption work on the basis of the PFORT output.
Still more usefull is the application of the Verifier a priori. That is, in the development of new programs a regular check of conformance to PFORT will insure a final product which is easy to share with other institutions or to maintain in a changing environment. For the same reasons it is also advisable to introduce a clause referring to PFORT conformity for products developed under contract.

We may also consider the expected change of the central computer of the Ispra establishment as a special case of applicability of PFORT.
Indeed a number of FORTRAN programs will have to be moved to a new computer.
In order to estimate in advance the extent of the conversion problems it would be sensible for the users to establish for each FORTRAN program a conversion report.
Such a report should contain:
- a compilation of the used version of the program;
- a significant sample input (one or more cases);
- the actual results produced by the program, using the sample input,
- the PFORT output obtained in processing the source program.

Of course the use of PFORT implies for the users an additional effort to interpret the output messages. But this will not be without benefits. Indeed, the integration of the additional information with the previous experience will result in an increased understanding of the used program.

---

[1] Ryder B. G.
    The PFORT Verifier
    Software Practice and Experience 4 (1974)

M. Dowell

A series of informatics courses for 1980 have been organized by EFIS in conjuction with the Computing Centre. Some of these courses have been specifically designed to be useful for users of the central computer system, whilst others are intended to offer more general informatics education. Details of the courses have been circulated (in AVIS no. IS/A - 19/80 "Cours 1980 en Informatique").

   In this article we take the opportunity to give a few notes
   on each relevant course.
   We would also encourage users to register for courses which
   are relevant for their needs.
   Registration forms are available from Mrs. A. Cambon in the
   Computing Support Library, or from Mrs. Vinterer, EFIS,
   Ed. 36C.

Details of Courses

1. Programming Techniques (1)

   Part I   - April 14-18, 1980
   Part II   - April 21-24, 1980
   Part III - May 5-8 & 27-30, 1980

   This course is one which is generally applicable to all
   computer users and not just of specific interest to users of
   the central computer system.

   The course is intended to present a methodological approach
   to programming and problem solving.

   The course is divided into 3 parts:

   part I   : Methods for problem solving
   part II   : Fundamental of programming techniques
   part III : Advanced techniques

   The course will be of benefit to both experienced and
   inexperienced computer users.

   ──────────────────────

   (1) Because of the large number of registrations to-date,
       another edition of the course will take place in
       September/November.

2. Use of the Facilities of the JRC-Computing Centre

April 29-30, 1980   (Note this course has been re-scheduled from March 25-26,1980)

This course is of particular interest to new or inexperienced users of the central computer service.
The course will give details of how to make use of the facilities of the Computing Centre and also give basic information about how to use the batch and interactive services.

3. BASIC

May 19-23, 1980

A course which describes the elements and structure of the BASIC language with particular reference to its' use on minicomputers.

4. Software Libraries

Details of new subroutine library facilities for users of the central computer service. Details of various mathematical, statistical, graphic and utility libraries will be given.

5. Job Control Language

June 12-13,1980
June 19-20,1980
June 26-27,1980

This course will give a full description of the JCL facilities available on the IBM 370/165 at Ispra. This course will be of considerable value to users of the central computer service.

6. FORTRAN

Level I : September 08-12,1980
Level II : December 01-05,1980

This series of lectures will describe the FORTRAN language.
Part I will deal with the more commonly used features.
In Part II more advanced features will be described.
The courses will not be specifically oriented to the FORTRAN available on the IBM 370/165, but some references will be made to specific IBM dependent information.

7. The Use of IBM Utilities

Level I : October 02-03,1980
Level II : December 01-05,1980

The course will give details of the generally used IBM
Utilities (part I) and also some of the less frequently used
IBM utilities (part II). Again, this course will be of value
for many central computer service users.

8. Librarian

October 23-24,1980

This course will give details of how to use the Librarian
system for storage and manipulation of data sets on the batch
system and TSO.

9. Introduction to Minicomputers

December 15-19,1980

This series of courses offers, to members of the JRC, the
opportunity to increase their expertise in certain areas
of computer science. This should in turn enable them to
make more effective use of the computing facilities
available within the JRC.

SUPPORT TO COMPUTING AND COMPUTING ADVISORY SERVICE

H. I. de Wolde

The Computing Advisory Service, including the Support Library, has been established to help the users of the computer installation with encountered problems.
This activity is not an easy one: the duty consultant is expected to understand the problem and gives some advice or solution in a very short time.
However, the background of other specialists is always available.

The action of Support to Computing, of which the Advisory Service is a part, includes the following manpower resources:

- Martyn Dowell, responsible person. Also charged with
  the publications, Newsletter,
  Green Books, Courses.   80%
- Adriana Cambon, clerical-technical assistent.   100%
- Ronald Meelhuysen, senior programmer.   80%

Additionally:

- Angelo Inzaghi.   Specialities: Engineering,
                     Numerical methods.   10%
- Aurelio Pollicini. Specialities: Computer
                     Languages, JCL, program
                     structure.   10%
- Herman de Wolde.   Speciality: Graphics.   10%

The total available manpower is consequently less than 2 man.year/year, which is far inferior to the general recommended level of about 8 man.year/year for equivalent sites.
Fortunately, the System Group gives a sound background towards all kind of problems concerning the typical configurations dependent aspects and interactive programming.
However, we must emphasize again, that the System Group should not be contacted directly.
This principle is not based on the desire to keep some monopoly on consulting affairs, but serves as a membrane to diffuse only those questions which cannot be solved by the support team.
As the System Group is also grossly understaffed, we have to use the available manpower in the most economical way.

After the installation of the Support Group two years ago, we
have made, maybe surprisingly, many good contacts with the
users.
These personnal relations, however, have created a situation
which in one respect hampers strongly the well-functioning of
the group.

Recently, the amount of requested assistance, outside the
present consultancy hours of 11.30 - 12.30 every working day,
has increased to the point that other activities are really
disturbed by these interferences.
Mainly, the intruders are users with whom there have been
established very good personnal relationship. However, these
persons have taken up the habit to come along at any time of the
day.
We have to insist strongly that all our clients respect the
official hours.
If requests for advice in the limited time of 1 hour per day
becomes to heavy, we will try to extend the appointment hours.

The Computing Support Library is open during the whole day.
Much useful information on available software, how to use
certain facilities and error information may be found in this
library.
However, photocopies may be made, and document may be taken out
of this room, only with the explicit consent of Adriana Cambon,
or if absent, Martyn Dowell or Ronald Meelhuysen.

Please respect these rules and please collaborate!

Statistics of computing installation utilization.
Report of computing installation exploitation
for the month of   February   1980.

	YEAR 1979	YEAR 1980
General		
Number of working days	20 d	21 d
Work hours from 8.00 to 24.00 for	16.00h	16.00h
Duration of scheduled maintenance	15.33h	17.37h
Duration of unexpected maintenance	4.33h	13.00h
Total maintenance time	19.66h	30.37h
Total exploitation time	300.34h	359.63h *
CPU time in problem mode	176.61h	235.20h
Batch Processing		
Number of jobs	8540	8151
Number of cards input	1465000	1434000
Number of lines printed	27398000	30450000
Number of cards punched	114000	152000
CPU time	160.95h	210.63h
Number of I/O (Disk)	24004000	24252000
Number of I/O (Magnetic tape)	4544000	4151000
T.S.O		
Number of LOGON's	2676	6771
Number of messages sent by terminals	143000	270500
Number of messages received by terminals	689000	1380000
CPU time	14.42h	21.82h
Number of I/O (Disk)	3600000	3343000
Connect time	1457.04h	2696.80h
IMS		
Total time service is available	150.00h	125.18h
CPU time	1.07h	2.75h
Number of I/O (Disk)	309000	523400

* This figure includes 54.00h of overtime.

Utilisation of computer centre by objectives and appropriation accounts for the month of February 1980.

1.20.2	General Services - Administration - Ispra	55.16
1.20.3	General Services - Technical - Ispra	3.29
·1.30.3	Central Workshop	4.46
1.30.4	L.M.A.	-
1.90.0	ESSOR	21.19
1.92.0	Support to the Commission	4.22
2.10.1	Reactor Safety	208.36
2.10.2	Plutonium Fuel and Actinide Research	0.38
2.10.3	Nuclear Materials	25.56
2.20.1	Solar Energy	0.02
2.20.2	Hydrogen	-
2.20.4	Design Studies on Thermonuclear Fusion	57.68
2.30.0	Environment and Resources	15.80
2.40.0	METRE	2.05
2.50.1	Informatics	60.53
2.50.2	Training	-
2.50.3	Safeguards	13.58
	TOTAL	472.28
1.94.0	Services to External Users	24.82
	TOTAL	497.10

BATCH PROCESSING DISTRIBUTED BY REQUESTED CORE MEMORY SIZE

	100	200	300	400	600	800	1000	1200	1400	>1400
No. of jobs	2262	2026	1318	1476	459	115	34	52	13	-
Elapsed time	68	196	178	309	145	68	16	28	6	-
CPU time	2.8	25.3	28.4	63.0	41.2	26.4	6.7	13.1	1.9	-
"Equiv" time	21	68	58	120	56	32	8	15	3	-
"Turn" time	1.2	2.4	5.5	5.3	8.3	16.1	13.0	7.3	7.4	-
I/O (disk)	1957	5564	4065	7707	2041	799	181	239	157	-
I/O (tape)	1464	1098	278	1158	59	21	17	18	3	-

NOTE.
All times are in hours.
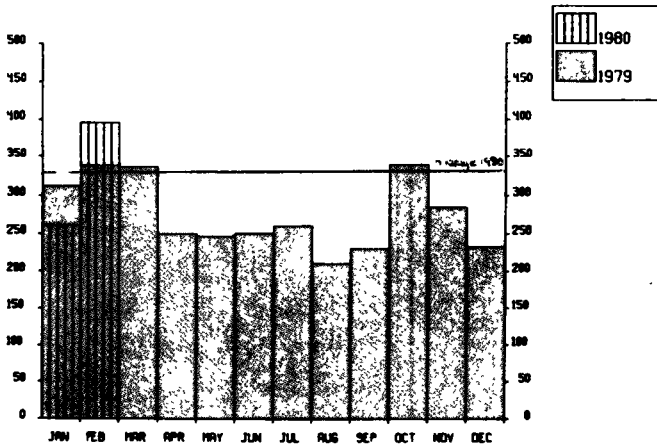"Equiv" means equivalent.
"Turn" means turn around.
All I/O transfers are measured in 1000's.

PERCENTAGE OF JOBS FINISHED IN LESS THAN

TIME	15mn	30mn	1hr	2hrs	4hrs	8hrs	1day	2day	3day	6day
%year 1979	25	37	50	66	82	94	99.6	99.8	100	100
%year 1980	26	39	51	63	75	87	96	99.2	100	100

HISTOGRAM OF TOTAL EQUIVALENT TIME(HRS)

Projected total for 1980 = 3934 hours(using average).
Total for 1979 was   = 3292 hours.

REFERENCES TO THE PERSONNEL/FUNCTIONS OF THE COMPUTING CENTRE.

Manager of The Computing Centre   J.Pire

 Responsible for User Registration   Ms. G.Rambs

Operations Sector
 Responsible for the Computer Room   A.Binda-Rossetti
 Substituted in case of abscence by:
                                    .
 Responsible for Peripherals   G.Nocera

Systems Group
 Responsible for the group   D.König
 Substituted in case of abscence by: P.A.Moinil

 Responsible for TSO Registration   C.Daolio

                                                     Room Tele.
Informatics Support Sector
 Responsible for the Sector   (f.f.) H.de Wolde 1883 1259

 Secretary   Mrs. G.Hudry   1873   787

 Responsible for User Support   H.de Wolde 1883 1259

 General Inf./Support Library   Mrs. A.Cambon   1871   730

 Advisory Service/List of Consultants(See Note 1) 1870   730

 A.Inzaghi   A.A.Pollicini
                     H.I. de Wolde
 R.Meelhuysen   M.Dowell

NOTE 1. The advisory service is available in the same room as
the Computing Support Library(room 1870). Exact details of the
advisory service times for a specific week can be found at the
head of any output listing(for that week).
Any informatics problem may be raised. However, the service is
not designed to help users with problems which are their søle
responsibility. For example, debugging of the logic of programs
and requests for information which can easily be retrieved from
available documentation.
If necessary, other competent personnel from the informatics
division may be contacted by the consultant but <u>not directly by
the users.</u>
The users should only contact the person who is the consultant
for that specific day and only during the specified hours.
Outside the specified hours general information may be
requested from Mrs. A. Cambon in the Computing Support
Library.

HOW TO OBTAIN COMPUTING CENTRE DOCUMENTATION.

Persons interested in receiving copies of the Computing Centre "green books" or in receiving regularly the "Computing Centre Newsletter" are requested to complete the appropriate part of the following form and send it to :-

> Ms. A. Cambon
>
> Support To Computing
>
> Building 36
>
> Tel. 730.

Indicate with a (✓) which options are required.

Please add my name to Newsletter mailing list	( )
Please send me copies of the following "green books":	
JRC-TSO Primer	( )
GRAPHIT	( )
Towards a New Programming Style	( )
LIBRARIAN	( )

        NAME   ....

        ADDRESS   ....

        ....

        ....

        TELEPHONE   ....