Commission of the European Communities

Joint Research Centre - Ispra

Computing Centre Newsletter

July 1976 ● No 3

Contents

Note of the Editor

The present Newsletter will be published monthly except for August and December.

The Newsletter will include:

- Developments, changes, uses of installations
- Announcements, news and abstracts on initiatives and accomplishments.

The Editor thanks in advance those who will want to contribute to the Newsletter by sending articles in English or French to one of the following persons of the Editorial Board.

Note de la Rédaction

Le présent Bulletin sera publié mensuellement excepté durant les mois d'août et décembre.

Le Bulletin traitera des:

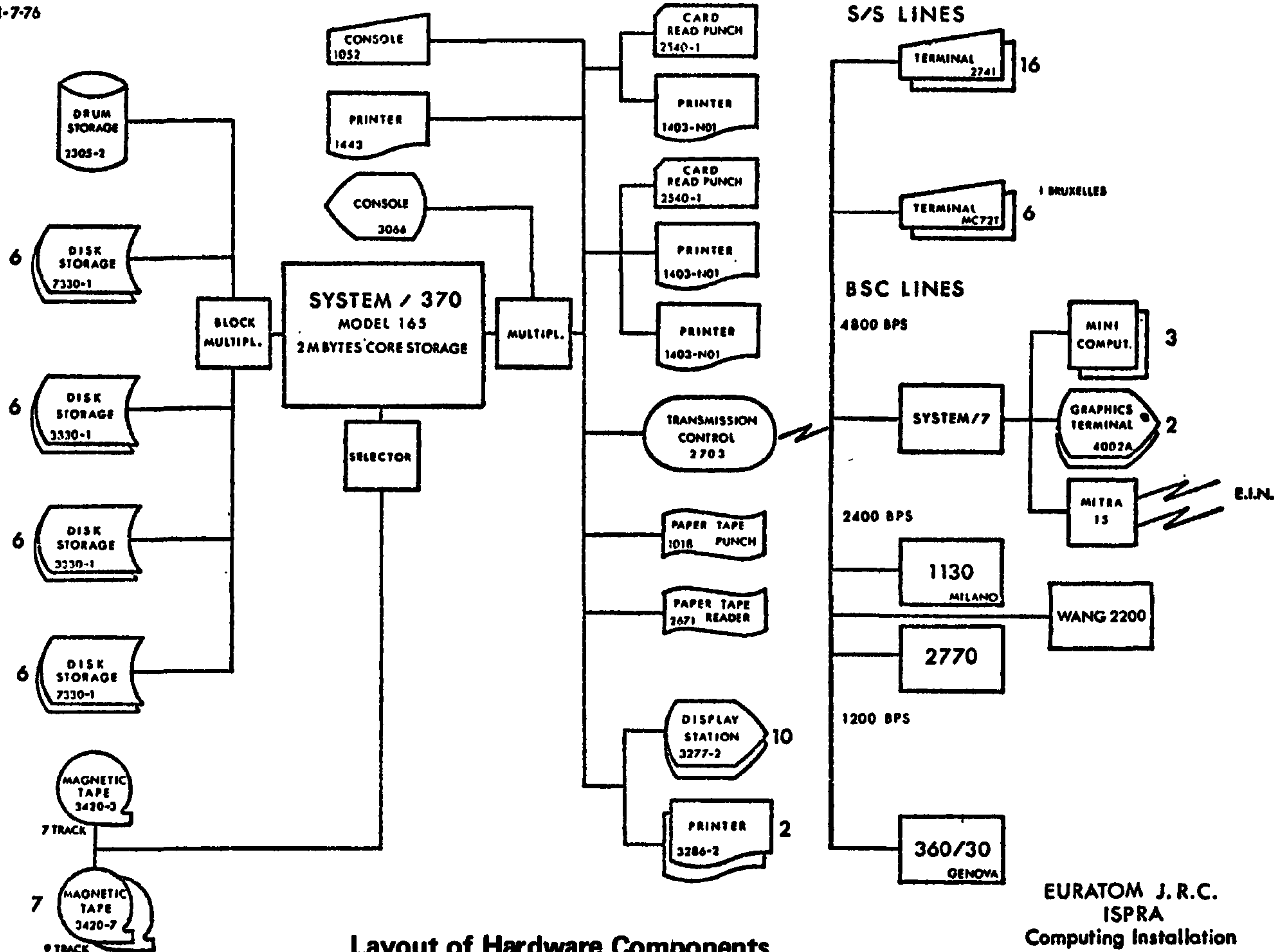
- Développements, changements et emploi des installations
- Avis, nouvelles et résumés concernant les initiatives et les réalisations.

La Rédaction remercie d'avance ceux qui voudront bien contribuer au Bulletin en envoyant des articles en anglais ou français à l'un des membres du Comité de Rédaction.

Editor : Sylvia R. Gabbai
Layout : Paul De Hoe
Graphical and Printing Workshop, JRC Ispra

Acknowledgement should be given for their technical support to Mr. E. Eiselt, Mrs. M.G. Giaretta, Mrs. M. Van Andel, Mr. G. Clivio, A. Margnini, G. Zurlo

1-7-76



Layout of Hardware Components

3

Computing Installation Description
Hardware Components

N	Type	Unit	Model	Function Description
1	IBM	3165	KOO	Central Processing Unit
2	IBM	3360	5	Processing Storage (1MB)
2	TELEX	6360	5	Processing Storage (1 MB)
				Total central storage capacity 2 Megabytes
				Channels:
1	IBM	2880	2	Block multiplexor channel
1	IBM	2860	1	Selector channel
1	IBM	2870	1	Byte multiplexor channel with one selector subchannels
				Direct Access Units:
1	IBM	3830	2	Storage control
2	IBM	3333	1	Disk storage and control
4	IBM	3330	1	Disk storage
				Total 12 disk storage units (track length 13030 bytes)
2	ITEL-	7830	1	Storage control
12	ITEL-	7330	1	Disk storage
				Total 12 disk storage units (track length 13030 bytes)
1	IBM	2835	2	Storage control
1	IBM	2305	2	Fixed head storage (track length 14660 bytes)
				Magnetic Tapes:
1	IBM	3803	1	Tape control unit
7	IBM	3420	7	Magnetic tape unit (9 tracks density 800/1600 bpi)
1	IBM	3420	3	Magnetic tape unit (7 tracks density 200/556/800 bpi)

				Peripheral Units:
1	IBM	2821	5	Control unit
2	IBM	1403	NO1	Printer
1	IBM	2540	1	Card reader/punch
1	IBM	2821	1	Control unit
1	IBM	1403	NO1	Printer
1	IBM	2540	1	Card reader/punch
1	IBM	2822	1	Control unit
1	IBM	2671	1	Paper tape reader
1	IBM	2826	1	Paper tape control
1	IBM	1018	1	Paper tape punch
1	IBM	1443	NO1	Printer (system log)
1	IBM	1052	7	Printer keyboard (secondary console)
				Display Stations:
1	IBM	3066	1	System console (Primary)
1	IBM	3272	2	Control unit
10	IBM	3277	2	Display station
2	IBM	3286	2	Printer
				Teleprocessing and RJE Network
1	IBM	2703	1	Transmission control
4				Lines BSC 4800 bauds (1 line S/7 connection, 1 line external RJE)
4				Lines BSC 2400 bauds (3 lines external RJE)
8				Lines BSC 1200 bauds (1 line external RJE)
				Terminals:
6	IBM	MC72T		Communication terminal
16	IBM	2741	1	Communication terminal
				Concentrator:
1	IBM	S/7	E16	Computing system – EIN network connection – 2 graphic stations TEKTRONIX 4002 – 3 mini-computers WANG 2200
				Auxiliary Machines:
14	IBM	029	22	Printing card punch
3	IBM	029	C22	Printing card punch interpreter
4	IBM	129	3	Printing card punch interpreter
1	IBM	082	1	Sorter
1	IBM	557	1	Alphabetical interpreter
1	D-MAC			Curve-follower
1	CALCOMP	900/1136		Graphic output system

Simulation Techniques at the JRC Computing Centre

F. Argentesi

Some Notes about the Simulation Approach

The basic assumption of the simulation approach is that of the possibility of substituting a system or process by a more or less defined mathematical model.
The mathematical model is then thought of as an experimental tool for the analysis of the system behaviour in a large set of conditions.
Traditionally distinctions are made between model built up for practical and theoretical purposes.
For several authors (see for instance J.M. Smith, 1974) are simulation models only the models that refer to particular systems, generally to a single well defined system. Theoretical models are instead more general in character and they refere to large set of systems.Simulations models take into account lot of details they produce analysis of particular cases and are mainly practical purpose oriented.
The so called theoretical models have to be thought of as scientific theory in the general sense. Therefore the simulation methodology is different in some way from the traditional theorization of science, because it is referred to specific systems without the aim of achieving results of general character.
The simulation methodology in a very synthetic way could be subdivided in following steps:

- **System Analysis**

The study of a system in order to ascertain its salient elements and to delineate their interactions and behaviour mechanisms.

- **Model Formulation**

The construction of a complete, logical structure in order to provide a reasonable symbolic substitute, or model of the system's elements and interactions, including the determination and collection of data required to support the model structure.

- **Verification and Validation**

The determination of the rectitude of the model in its algorithmic structure and the comparison of the responses emanating from the verified model with available information regarding the corresponding behaviour of the simulated system.

• **Model Analysis**

The contrasting of model responses under alternative environmental specifications (or input conditions).

The entire effort of a simulation's construction is directed toward the creation of a credible system representation from which inferences regarding the actual system's performance and behaviour can be made without the need of resorting the costly (or impossible) experimentation with the actual system.

In these few notes it is impossible to give details about the realization of these four steps even for few type of systems. Here we will only notice the fairly relevant difference that, in the simulation methodology, exist between continuous and discrete systems.

In general continuous systems are analysed by deterministic models (o.d.e. systems) and discrete systems contain in their models several stochastic elements.

These distinctions can be noticed also in a first glance to the main feature of the different types of simulation languages briefly described in the next section.

At the Applied Statistics and Mathematics Groups of Department A, the research activity in the simulation methodology is mainly oriented to the problem of model formulation and model validation for both deterministic and stochastic models. At present our activity is directed in the following lines:

a) System identification (deterministic and stochastic)
b) Statistical sensitivity analysis
c) Time series analysis (stochastic stationary systems).

Some Notes about Simulation Languages

At the JRC Computer Centre (CETIS) the main tools for the approach to simulation problems are largerly implemented. From the software point of view the following simulation languages can be directly utilized:

Continuous Simulation

a) CSMP III
b) DYNAMO II

Discrete Systems Simulation

a) GPSS/360
b) SIMPL/1

Moreover, the discrete simulation language SIMULA can be easily available if needs in its utilization will grow in the future activities of the JRC.

The continuous simulation models are used it the process can be considered as a continuous flux of matter or of information in which not individual entities are distinguishable. These models are normally given in the form of differential equations or of difference equations. Therefore the so called simulation languages for continuous systems are mainly constituted by one or more algorithms for the numerical solution of o.d.e. systems.
Moreover the languages give facilities for handling tables and preparing proper outputs in terms of both tables and diagrams. The most powerful of these languages is in our opinion the CSMP III, a FORTRAN IV based language developed by IBM.
CSMP III accepts FORTRAN subroutines as programming elements, so that all the potentialities of the large FORTRAN mathematical and statistical routine libraries can be considered as parts of the language.
This simulation language supplies a large spectrum of the most useful integration algorithms and it can solve o.d.e. systems of 200 simultaneous equations. Therefore a large class of simulation problems in various fields (biology, agriculture, chemistry, physics, engineering, economics) can be approached in the framework of CSMP III.
The DYNAMO II language is much wrakier and oriented to utilizers without mathematical background. The numerical solution of the o.d.e. systems (the model) is achieved by using the Euler method only. Therefore the accuracy of the solution can be frequently fairly low (especially in the case of stiff o.d.e. systems).
Nevertheless it has been noticed that DYNAMO II, for some kinds of utilizers, is more intuitive than CSMP III.

DYNAMO II has been developed by A. Pugh at M.I.T. in the framework of Industrial Dynamics, Urban Dynamics and World Dynamics approaches. The experience has shown that DYNAMO II is fairly easy to learn and that simple problems can be programmed and elaborated in short times. Unfortunately this language is limited and by its use becomes difficult the treatment of complex problems. The most negative limitation seems to be the impossibility of using indexed variables (has to be noticed that DYNAMO III not available at the moment at the JRC permits the utilization of indexed variables).
The simulation of discrete systems is different of that of continuous systems because in this case the process is described by "Entities" which pass throughout the system making use or leaving the systems components (machines, storage) at well defined times called "events".
The evolution of the systems state is achieved by the instantaneous transformation of this state that takes only in correspondence of the events. In this kind of models the aim is generally that of studying the system beha-

viour from the point of view of its capacity, i.e. the amount of the "entities flux" that go through the system in a given time.
For what concerning the simulation of discrete systems has to be noticed the fact that FORTRAN IV and PL/I are still used languages because of the widespread nature of the problems that are considered as discrete simulation problems. Nevertheless, the difficulties in treating discrete simulation problems in FORTRAN IV (or PL/I) make its use practical only for well established and specialised teams.
Has to be noticed moreover, that opposite to the problem oriented languages (GPSS, SIMPL/I, SIMULA) the FORTRAN simulation programs are of difficult use for the people that have not participated to their elaboration.

GPSS is a language developed by G. Gordon for IBM.
The structure of the system to be simulated is described in terms of a flow diagram, produced by a set of well defined type of blocks. Each block represents a specific action that is a typical basic operation that could take place in the system. The connections between blocks give the time sequence of the realization of the actions in the systems. When there is a choice among different actions there is more than one connection leaving the block.
Through the system there are entities in movement called **transactions**; these transactions can use **facilities** or be stored in **storage**. Transactions can be yet generated or destroyed and it is possible to collect some statistics about their story.
There is a proper algorithm for the time evolution and it is possible making simple mathematical and logical operations on the parameters. The block-diagram is easily transformed in the input because at each block corresponds only one instruction in the language. GPSS is a fairly specialized language, therefore only a limited class of problems can be treated by its use. It is especially suitable for problems with fluxes of documents or information, simple queuing problem and so on. Nevertheless GPSS is largerly used mainly because it is of a fairly intuitive utilization.

The SIMULA language has been designed by Nygaard and Dahl at the Norwegian Computing Centre. It is largerly different from the other discrete simulation languages. SIMULA is an ALGOL based language and it follows the logical structures and feature of ALGOL. The entities that flow through the system are called **processes** among which are considered also the machines that constitute the system. At every process are associated a set of **local data** that define its characteristics and a **behaviour pattern** describing its time history. In this history are listed all the transformations of the parameters characterising the process, the relationship with the other processes (wait, etc.), and the history finishes, if needed with the elimination of the process itself. The processes are grouped in sets

called **activities**, with similar operating rules. The management of the processes is done by ausiliary listings called **elements**, in which the names of the processes are defined.
The control of the events stream done by an automatic routine, that can be modified through instruction called **sequencing**. SIMULA is a very rich language, therefore its use is fairly complex.

SIMPL/1 is a simulation language for discrete systems based on PL/I developed by IBM. This language does not differ remarkably from the basic structure of the typical class of discrete simulation languages. It is much more powerful in the mathematical and logical operations and it can accept PL/I subroutines. SIMPL/1 presents large output possibilities for both tables and diagrams. Moreover, the peculiar software feature of SIMPL/1 seems to be especially useful for the statistical analysis of the simulation responses.
It has to be noticed that the statistical analysis of the simulation outputs is one of the most relevant points of the dicrete simulation methodology. Large classes of problems can be approached with the support of both types of simulation languages described.
In the following we will try to set up a list of some relevant application areas:

Continuous Simulation

1. Physical and chemical systems
   (Dynamics problems, chemical kinetics, etc.)
2. Biochemical systems
   (Enzyme kinetics, biochemical oscillators, etc.)
3. Ecological and Economics systems
   (Population dynamics, ecosystems dynamics, etc.)

Discrete Simulation

Manufacturing	Facilities planning, assembly line balancing, manpower allocation, quality control, inventory management, equipment maintenance, plant location planning.
Distribution	Warehouse procedures, number and location of warehouses, inventory management, work crew scheduling, truck routing, design of truck docking facilities.
Banking	Bank floor operations, cheque transit procedures, interest rate and other policies.
Railways	Yard operations, network operations, crew scheduling, commuter rate studies, freight blocking strategies.
Shipping	Scheduling of port facilities, cargo mix, harbour design, freight scheduling.

Airlines	Runway utilization, air traffic control, terminal facility planning, crew scheduling, reservation system lodeling, timetables.
Traffic Control	Road planning, safety studies, timing of traffic lights.
City Planning	Transportation networks, welfare studies, budget planning, planning of services and facilities.
Medical	Blood bank inventory, hospital bed and patient scheduling, scheduling of staff, scheduling of nursing activities.
Process	Refinery scheduling, bulk delivery planning in chemical works.

References

J.M. SMITH – (1974) Models in Ecology, C.U.P.

C'est avec consternation que le membres du Centre de Calcul ont appris le décès d'un de leurs collègues, Monsieur Christian Simmenlagh, survenu dans un accident de la route, le 20 juin 1976.

Aux parents et proches du défunt, Computer Centre Newsletter exprime ses condoléances émues.

Statistics of computing installation utilization

Report of computing installation exploitation for the month of May

	YEAR 1976	YEAR 1975
Number of working days	20 d	17 d
Work hours from 8.00 to 24.00for	14.00 h	12.00 h
Duration of scheduled maintenance	23.45 h	10.84 h
Duration of unexpected maintenance	2.75 h	7.58 h
Total maintenance time	26.20 h	18.42 h
Total exploitation time	274.800 h	180.080 h
CPU time in problem mode	120.617 h	62.630 h
Teleprocessing:		
CPU time	1.30 h	0.70 h
I/O number	581.000	495.000
Equivalent time	5.37 h	4.20 h
Elapsed time	157.50 h	87.20 h
Batch processing:		
Number of jobs	8,332	6,943
Number of cards read	2,853,000	2,170,000
Number of cards punched	153,000	191,000
Number of lines printed	23,351,000	20,191,000
Number of pages printed	524,000	451,000

BATCH PROCESSING DISTRIBUTION BY CLASS

	A	1	2	3	4	5	D	TOTAL
Number of jobs	1216	2734	1094	1890	331	205	364	7834
Elapsed time (hrs)	24	108	89	177	65	69	71	603
CPU time (hrs)	0.8	14	15	33	26	10	20	119
Equivalent time (hrs)	7.6	40.2	37.3	77.6	37.4	38.8	29.1	268
Turn around time (hrs)	0.4	0.6	1.2	0.9	1.8	2.2	3.4	0.9

PERCENTAGE OF JOBS FINISHED IN LESS THAN

TIME	15′	30′	1^h	2^h	4^h	8^h	1^D	2^D	3^D	6^D
% year 1975	24.3	42.0	61.3	77.8	88.7	91.8	97.5	99.6	99.8	100
% year 1976	42.2	60.1	75.5	88.0	96.2	98.9	99.3	100		

Utilization of the computer center by the objectives and appropriation accounts for the month of May

		IBM 370/165 equivalent time in hours
120	General Infrastructure	57.5663
130	Scientific and Technical Support	1.4810
143	ESSOR Reactor	4.5113
145	Medium Activity Laboratory	—
146	Central Bureau for Nuclear Measurements (CBNM)	—
191	Technical Support to Commission Activities	1.5436
193	Technical Support to Power Stations	1.4493
211	Waste Disposal	0.2185
213	Materials Science and Basic Research on Materials	0.8728
214	Hydrogen	1.6899
221	Reactor Safety	57.0753
222	Applied Informatics	23.6800
223	Information Analysis Services	46.8100
230	European Informatics Network	3.4252
251	Standards and Reference Materials	10.4627
252	Protection of the Environment	8.5113
253	Remote Sensing of Earth's Resources	9.2357
254	New Technologies	—
412	Fissile Materials Control	0.5324
	TOTAL	229.0653
190	Services to external users	25.0847
	TOTAL	**254.1500**

EQUIVALENT TIME TABLE FOR ALL JOBS OF THE ADMINISTRATION – MONTHLY AND CUMULATIVE STATISTICS

	January	February	March	April	May	June	July	August	September	October	November	December
Year 1975	64	55	62	73	62	61	94	52	51	59	74	70
accumulation	64	119	181	254	316	377	471	523	574	633	707	777
Year 1976	84	82	101	77	57							
accumulation	84	166	267	344	401							

EQUIVALENT TIME TABLE FOR THE JOBS OF ALL THE OBJECTIVES – MONTHLY AND CUMULATIVE STATISTICS

	January	February	March	April	May	June	July	August	September	October	November	December
Year 1975	178	171	168	166	142	166	228	137	152	170	190	176
accumulation	178	349	517	683	825	991	1219	1356	1508	1678	1868	2044
Year 1976	206	237	270	241	229							
accumulation	206	443	713	954	1183							

EQUIVALENT TIME TABLE FOR THE JOBS OF THE EXTERNAL USERS – MONTHLY AND CUMULATIVE STATISTICS

	January	February	March	April	May	June	July	August	September	October	November	December
Year 1975	16	28	24	28	32	31	26	15	18	19	12	18
accumulation	16	44	68	96	128	159	185	200	218	237	249	267
Year 1976	18	19	28	16	25							
accumulation	18	37	65	81	106							

EQUIVALENT TIME TABLE FOR ALL JOBS OF ALL USERS – MONTHLY AND CUMULATIVE STATISTICS

	January	February	March	April	May	June	July	August	September	October	November	December
Year 1975	214	216	208	215	190	222	266	166	181	202	219	208
accumulation	214	430	638	853	1043	1265	1531	1697	1878	2080	2299	2507
Year 1976	233	271	313	280	277							
accumulation	233	504	817	1097	1374							

WANG 2200

C.L. van den Muyzenberg

The WANG 2200 at the CETIS is a small computer with the following configuration:

- Central processor with 8K bytes storage (internal code = ASCI I)
- Video display, 16 lines each of 64 characters, keybord: Upper and lower case and BASIC keywords
- Printer, two different character types, both with upper and lower case characters (132/line)
- 2 floppy disk units
- A card reader for punched or mark-sensed cards .

A third disk unit and an interface to connect the WANG to the 370/165 have been ordered.

It is possible to use the WANG in four different modes:

1. As a desk calculator by simply typing PRINT, followed by the expression that is to be calculated.
2. As a computer, using the WANG supplied programs (Appendix A) or the programs written at Euratom (Appendix B)
3. As a computer, writing programs is BASIC
4. As a terminal to read cards, store cards on floppy disks, modify cards on the floppy disks, print cards on the printer, send jobs to the 370/165 for execution.

To use the WANG, simply go there and switch it on (every unit has its own switch; please switch all units off when you stop working).

To use the standard programs, ask Mr. C.L. van den Muyzenberg for the disk with these programs (when the 3rd disk unit arrives, the standard programs will be installed fixed on this unit).

It is recommended that users writing their own programs, save these programs on disk for later use or for modifications afterwards.

Making a private library of selected standard programs is possible. A number of standard programs have been developed already and are available for use (see Appendix B). If you have programs written for general use, please inform us.

Floppy disks have been ordered. It is recommended to use at least two of them (for copying programs while making modifications).

A short programming course will be held in August 1976. For any questions, or further information contact Mr. C.L. van den Muyzenberg.

Appendix A — WANG Supplied Programs

Put the floppy disk in the R unit.
Load a program with LOAD DCR "name" = the name of the program.
Start executing the program with RUN EXEC.

Warning: Some WANG supplied programs contain errors, please tell us about any errors you may find.

The programs are divided in four groups:

1. MAT Mathematical programs
2. GPSE General programs, statistical and engineering
3. FIN Finance and utilities
4. GAMES Games.

The name of the program is MATH, GPSE, FIN or GAMES followed by the number. You may find detailed descriptions and sample problems in the related WANG manuals.

3. FIN	PROGRAM	PAGE

4. GAMES	PROGRAM	PAGE

Appendix B — CETIS Supplied Programs

Put the floppy disk in the R unit.
Load a program with LOAD DCR "name" with name = the name of the program.
Start executing the program with RUN EXEC.

Please tell us about any errors you may find.

UTILITY	The program calls a series of separate modules by the use of the Special Function keys:
SF 0	Conversion functions between decimal and hexadecimal (370/165) vice versa, both fixed and float
SF 1	Use of magnetic tapes, calculation of the percentage of use of a tape when several data sets are written on the tape.
SF 3	Service programs: card to printer
SF 4	Print "how to use" of UTILITY
SF 31	EXIT

Le prochain numéro de Computing Center Newsletter ne paraîtra qu'en Septembre prochain.

La Rédaction souhaite à ses lecteurs de très bonnes vacances.

The Newsletter is available at:	*Des exemplaires du Bulletin sont disponibles chez:*
Mrs R. Porta Program's Library Bldg. 36 - Tel. 760	Mme R. Porta Bibliothèque des Programmes Bât. 36 - Tel. 760

Les personnes intéressées et désireuses de recevoir régulièrement "Computing Centre Newsletter" sont priées de remplir le bulletin suivant et de l'envoyer à:

Mme R. Porta
Bibliothèque des Programmes
Bât. 36, Tel. 760

Nom ....

Adresse ....

....

Tel. ....

The Persons interested in receiving regularly the "Computing Centre Newsletter" are requested to fill out the following form and to send it to:

Mrs R. Porta
Program Library
Building 36, Tel. 760

Name ....

Address ....

....

Tel. ....