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NUMBER 22 & 23

Pascal Users Group

# Pascal News

COMMUNICATIONS ABOUT THE PROGRAMMING LANGUAGE PASCAL BY PASCALERS

SEPTEMBER, 1981

Two for one ...



Or one for two?

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P.O. Box 4406  
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POLICY: PASCAL NEWS

(15-Sep-80)

\* Pascal News is the official but informal publication of the User's Group.

\* Pascal News contains all we (the editors) know about Pascal; we use it as the vehicle to answer all inquiries because our physical energy and resources for answering individual requests are finite. As PUG grows, we unfortunately succumb to the reality of:

1. Having to insist that people who need to know "about Pascal" join PUG and read Pascal News - that is why we spend time to produce it!

2. Refusing to return phone calls or answer letters full of questions - we will pass the questions on to the readership of Pascal News. Please understand what the collective effect of individual inquiries has at the "concentrators" (our phones and mailboxes). We are trying honestly to say: "We cannot promise more that we can do."

\* Pascal News is produced 3 or 4 times during a year; usually in March, June, September, and December.

\* ALL THE NEWS THAT'S FIT, WE PRINT. Please send material (brevity is a virtue) for Pascal News single-spaced and camera-ready (use dark ribbon and 18.5 cm lines!)

\* Remember: ALL LETTERS TO US WILL BE PRINTED UNLESS THEY CONTAIN A REQUEST TO THE CONTRARY.

\* Pascal News is divided into flexible sections:

POLICY - explains the way we do things (ALL-PURPOSE COUPON, etc.)

EDITOR'S CONTRIBUTION - passes along the opinion and point of view of the editor together with changes in the mechanics of PUG operation, etc.

HERE AND THERE WITH PASCAL - presents news from people, conference announcements and reports, new books and articles (including reviews), notices of Pascal in the news, history, membership rosters, etc.

APPLICATIONS - presents and documents source programs written in Pascal for various algorithms, and software tools for a Pascal environment; news of significant applications programs. Also critiques regarding program/algorithm certification, performance, standards conformance, style, output convenience, and general design.

ARTICLES - contains formal, submitted contributions (such as Pascal philosophy, use of Pascal as a teaching tool, use of Pascal at different computer installations, how to promote Pascal, etc.).

OPEN FORUM FOR MEMBERS - contains short, informal correspondence among members which is of interest to the readership of Pascal News.

IMPLEMENTATION NOTES - reports news of Pascal implementations: contacts for maintainers, implementors, distributors, and documentors of various implementations as well as where to send bug reports. Qualitative and quantitative descriptions and comparisons of various implementations are publicized. Sections contain information about Portable Pascals, Pascal Variants, Feature-Implementation Notes, and Machine-Dependent Implementations.

----- ALL-PURPOSE COUPON ----- (15-Dec-81)

Pascal Users Group  
P.O. Box 4406  
Allentown, Pa. 18104-4406 USA

**\*\*Note\*\***

- We will not accept purchase orders.
- Make checks payable to: "Pascal Users Group", drawn on a U.S. bank in U.S. dollars.
- Note the discounts below, for multi-year subscription and renewal.
- The U. S. Postal Service does not forward Pascal News.

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| [ ] My new address/phone is listed below   |             |       |      |        |        |
| [ ] Enclosed please find a contribution, idea, article or opinion which is submitted for publication in the <u>Pascal News</u> . |             |       |      |        |        |
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## JOINING PASCAL USERS GROUP?

Membership is open to anyone: Particularly the Pascal user, teacher, maintainer, implementor, distributor, or just plain fan. Please enclose the proper prepayment (check payable to "Pascal User's Group"); we will not bill you. Please do not send us purchase orders; we cannot endure the paper work! When you join PUG any time within a year: January 1 to December 31, you will receive all issues of Pascal News for that year. We produce Pascal News as a means toward the end of promoting Pascal and communicating news of events surrounding Pascal to persons interested in Pascal. We are simply interested in the news ourselves and prefer to share it through Pascal News. We desire to minimize paperwork, because we have other work to do.

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American Region (North and South America) Join through PUG(USA).

European Region (Europe, North Africa, Western Asia): Join through PUG(EUR) Pascal Users Group, c/o Grado Computer Systems & Software, Weissenburgerstrasse 25, D-8000, Munchen 80, Germany.

United Kingdom Region: join through PUG(UK) : Pascal Users Group, c/o Shetlandtel, Walls, Shetland, ZE2 9PF, United Kingdom.

Australasian Region (Australia, East Asia - incl. India & Japan): PUG(AUS). Pascal Users Group, c/o Arthur Sale, Department of Information Science, University of Tasmania, Box 252C GPO, Hobart, Tasmania 7001, Australia. International telephone: 61-02-202374

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## RENEWING?

Please renew early (before November) and please write us a line or two to tell us what you are doing with Pascal, and tell us what you think of PUG and Pascal News. Renewing for more than one year saves us time.

## ORDERING BACK ISSUES OR EXTRA ISSUES?

Our unusual policy of automatically sending all issues of Pascal News to anyone who joins within a year means that we eliminate many requests for backissues ahead of time, and we don't have to reprint important information in every issue--especially about Pascal implementations!

Issues 1 .. 8 (January, 1974 - May 1977) are out of print.

Issues 9 .. 12, 13 .. 16, & 17 .. 20 are available from PUG(USA) all for \$15.00 a set, and from PUG(AUS) all for \$A15.00 a set.

Extra single copies of new issues (current academic year) are: \$5.00 each - PUG(USA); and \$A5.00 each - PUG(AUS).

## SENDING MATERIAL FOR PUBLICATION?

Your experiences with Pascal (teaching and otherwise), ideas, letters, opinions, notices, news, articles, conference announcements, reports, implementation information, applications, etc. are welcome. Please send material single-spaced and in camera-ready (use a dark ribbon and lines 18.5 cm. wide) form.

All letters will be printed unless they contain a request to the contrary.

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APPLICATION FOR LICENSE TO USE VALIDATION SUITE FOR PASCAL

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In making this application, which should be signed by a responsible person in the case of a company, the requestor agrees that:

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- b) The requestor will not distribute or otherwise make available machine-readable copies of the Validation Suite, modified or unmodified, to any third party without written permission of the copyright holders.

In return, the copyright holders grant full permission to use the programs and documentation contained in the Validation Suite for the purpose of compiler validation, acceptance tests, benchmarking, preparation of comparative reports and similar purposes, and to make available the listings of the results of compilation and execution of the programs to third parties in the course of the above activities. In such documents, reference shall be made to the original copyright notice and its source.

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b) Each logical record is an 80 character card image. Select block size in logical records per block.

- 40       20       10

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Richard J. Cichelli  
On behalf of A.H.J. Sale and R.A.Freak

## Editor's Contribution

### GOOFED AGAIN

Yes as all you loyal Pennsylvanians have noticed in the last issue of PN we managed to mess up the zip code of Allentown PA, and of course the USPS has come down on us like a ton of bricks! Please note that the zip is 18014 not 18170. It has been corrected in the new APC.

### THE NEW APC

Speaking of the new APC we have simplified it some more, and added current prices for the UK and Europe, and have modified the reverse side of the coupon to reflect the new foreign editors and their current addresses.

### THE LATEST EUROPEAN SOLUTION

Speaking of the European editors, we have two new ones! One for the UK, and one for the Continent. Nick Hushes will be handling all business for Britain, and Hellmut Heher will be in charge of the European Region. Please see the APC for their addresses.

### ON CALLING

Please restrict yourself to written correspondence when dealing with PUG. This is strictly a scholarly function. None of the editors (including myself) gets paid. All have a real job that pays their bills, and they owe their office hours to their employer. All PUG work is done on their own time. So please write to the appropriate regional editor. It leaves a documentary trail that can be followed and handled as fast as we can. Honest!

### COMBINED ISSUE

This is of course a combined issue. We are doing this to catch up and to beat the postal system and their high rates. If this upsets anyone we are sorry. We are doing our best.

### ON BEING THE EDITOR

Anyone who is interested in being the new editor of PN should write to me at the main address (APC).

### STANDARDS

Good news from the standard front! 7185.1 was approved by the international committee. More next issue from Jim Miner the Standards Editor.

# Here and There With Pascal

## Summary of Implementations

### THIS ISSUE

The highlight of this issue is the long awaited (from last issue at least!) of Andrew Tanenbaum's EM1 compiler. I think it is really great. Tell us what you think! In the Here and There section Gress Marshall has summarized the past few issues (15 .. 19) implementation notes. Thanx. In addition to the EM1 compiler, the Applications section includes an improved version of the subroutine "options", as well as a tree printing routine, and a set of routines to compress and expand text using Huffman codes. Good work! And finally the articles section has some fine contributions. Many people have asked (on the phone ... see above) about how the various CP/M compilers stack up. Now we have an answer. Also there is an article of the experiences of a novice teaching Pascal. From a geography teacher no less! And finally a probins article by Jonathan Ymuner concerning problems with Pascal and some proposals for their solution.

Hope you like it.

Rick

ALL	#15:101	Pascal I (Derived from Pascal S)	
BESM-6	#15:107		
Burroughs B5700	#15:107		
Burroughs B6700/B7700 (MCP)	#19:113		
CDC 6000	#19:115		
CDC 6000	#15:108		
Cyber 70 and 170	#15:108		
DEC PDP-11	#19:115	UCSD Pascal	
DEC PDP-11	#15:111		
DEC PDP-11	#15:112	UCSD Pascal	
DEC PDP-11	#15:124		
DEC PDP-11 (RSTS)	#15:100	Pascal S	
DEC PDP-11 (RSX-11M/IAS)	#17:86		
DEC PDP-11 (RSX-11M/RT-11)	#15:101	Concurrent Pascal	
DEC PDP-11 (Unix)	#15:111		
DEC PDP-11 (Unix)	#15:100	Pascal E	
DEC PDP-11 (Unix)	#15:103	Modula	
DEC PDP-15	#15:124		
DEC VAX	#17:89		
DEC VAX (Unix)	#19:115		
DG Eclipse	#17:106		
DG Eclipse (AOS)	#15:110	RDOS, DOS)	
DG Eclipse (AOS)	#15:109		
DG Eclipse (RDOS)	#15:108		
DG Nova (AOS)	#15:110	RDOS, DOS)	
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Facom 230-45S	#15:112		
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IBM 370	#19:117		
IBM 370	#15:124		
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IBM Series 1	#19:116		
IBM Series 1	#15:114		
ICL 1900	#15:116		
Intel 8080/8085	#15:119		
Intel 8080/8085	#15:118		
Intel 8080/8085	#15:119		
Intel 8080/8085	#17:102		
Intel 8080/8085	#15:117		
Intel 8080/8085 (CP/M)	#17:105		
Intel 8080/8085 (TRS-80)	#15:100		
Intel 8080/8085 (Northstar)	#15:100		
Intel 8086	#15:119		
Intel 8086	#15:103		
MOS Tech 6502 (Apple)	#15:107		
Modcomp II and IV	#15:120		
		Motorola 6800	#15:120
		Motorola 6800	#19:120
		Motorola 6800	#19:121
		Motorola 6800	#17:102
		Motorola 6800 (Flex)	#15:123
		Motorola 68000	#19:121
		Motorola 6809	#15:103
		Motorola 6809 (MDOS09)	#17:102
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		Perkin-Elmer 7/16	#15:121
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		Sperry-Univac V77	#15:124
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		Zilog Z-80	#19:123
		Zilog Z-80	#15:124
		Zilog Z-80	#17:88
		Zilog Z-80	#17:104
		Zilog Z-80 (CP/M)	#17:103
		Zilog Z-80 (TRS-80)	#15:124
		Zilog Z-80 (TRS-80)	#19:124
		Zilog Z80	#15:118
		Zilog Z80	#15:119
		Zilog Z8000	#15:119

# Applications

## EM1 COMPILER

```
1 #include ".../local.h"
2 #include ".../em1.h"
3
4 (c) copyright 1980 by the Vrije Universiteit, Amsterdam, The Netherlands. Explicit permission is hereby granted to universities to use or duplicate this program for educational or research purposes. All other use or duplication by universities, and all use or duplication by other organizations is expressly prohibited unless written permission has been obtained from the Vrije Universiteit. Requests for such permissions may be sent to
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6 Dr. Andrew S. Tanenbaum
7 Wiskundig Seminarium
8 Vrije Universiteit
9 Postbox 7161
10 1007 MC Amsterdam
11 The Netherlands
12
13 Organizations wishing to modify part of this software for subsequent sale must explicitly apply for permission. The exact arrangements will be worked out on a case by case basis, but at a minimum will require the organization to include the following notice in all software and documentation based on our work:
14
15 This product is based on the Pascal system developed by Andrew S. Tanenbaum, Johan W. Stevenson and Hans van Steyvers of the Vrije Universiteit, Amsterdam, The Netherlands.
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```

```
57 f: size of reals in words (2)
58 i: controls the number of bits in integer sets (16)
59 l: insert code to keep track of source lines (-)
60 o: optimize (+)
61 p: size of pointers in words (1)
62 r: check subranges (-)
63 s: accept only standard pascal programs (-)
64 t: trace procedure entry and exit (-)
65 u: treat '_' as letter (-)
66
67 [.....]
68 #ifdef STANDARD
69 label 9999;
70 #endif
71
72 const
73
74 (powers of two)
75 t1 = 128;
76 t2 = 255;
77 t3 = 256;
78 t4 = 16384;
79 t5 = 32767;
80
81 (EM-1 sizes)
82 bytebits = 8;
83 wordbits = 16;
84 wmb = 15; (wordbits-1)
85 minint = -t5w;
86 maxint = t5w;
87 maxintstring = '0000032767';
88 maxlongstring = '2147483647';
89
90
91
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100
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```

```
113 p-option. Floating point numbers in EM-1 currently have size 4, but this might change in the future to 8. The default can be overwritten by the f-option. The routines involved with alignment are 'even', 'address' and 'arraysize'.
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```

```
169 type
170 (scalar types)
171 symbol (comma,semicolon,colon,colon2,notary,bracket,ident,
172 intout,charact,realout,longout,stringout,allict,ainsy,
173 plusy,percent,arrow,arrayy,recordy,setsy,filesy,
174 packedy,progy,labely,consty,typesy,varsy,procsy,
175 funcy,beginsy,gotosy,ifsy,whilesy,repeaty,foray,
176 withay,cassey,becomes,staray,divy,mody,alseny,
177 anday,oray,exesy,notay,asy,asy,asy,
178 leay,insy,andsy,elesy,untilsy,ofsy,dosy,
179 downtosy,cosy,thensy,rbrack,rparent,period
180 ); (the order is important)
181
182 chartype (lower,upper,digit,layout,tabch,
183 quotech,quotech,odottech,periodch,leasch,
184 greaterch,lparentch,lbracoch,
185 rparentch,rbrackch,rbrackch,cominch,semich,arrowch,
186 plusch,minch,alsh,star,equal,
187 ); (also symbols)
188
189 others
190 );
191
192 standpf (pread,preadln,write,partials,pput,pgot,
193 preat,prewrite,pnes,dispose,ppack,punpack,
194 pmack,prelease,ppage,phalt,
195 ); (all procedures)
196
197 eof,feofn,fabs,fsg,ford,forb,fpred,fauc,fodd,
198 fsumo,fround,fsin,foos,fsqp,fsqr,ftn,fsqrtan
199 ); (all functions)
200
201 ); (the order is important)
202
203 (EM, SPL, CLS, VM,
204 OF, GETX, MDI, RDC, DR, MSL, MSL,
205 ); (see input files)
206
207 CRF, FUY, WRI, MBI, WAC, WSC, WRS, WSS, WMB,
208 WMB, WVR, WVR, WML, WSL, WSP, WRI, WSI, WLM, PAC,
209 ); (see output files, order important)
210
211 ABS, RND, SIN, COS, EXP, SQRT, LOG, ATN
212 ); (floating point)
213
214 ABI, ABL, BCP, BVS, NEWI, SAV, EST, IBI, IBI,
215 ASS, OTO, PAC, WMP, DIS, ARZ, MDI, MDL,
216 ); (miscellaneous)
217
218
219
220
221
222
223
224
```

225 rrange= 0..rval; 281 end;

226 bytes 0..lbit;

228 (pointer types)

229 sp= "structure; 284

230 ip= "identifier; 285 fname:ip; (one deeper)

231 l= "labl; 286 (first name: root of tree)

232 bps= "blockinfo; 287 case occur:where of

233 sp= "nameinfo; 288 blok:();

289 rec: ();

290 arec:(w:sttr) (name space opened by with statement)

291 end;

292 blockinfo:record (all info of the current procedure)

293 blk:pp; (pointer to blockinfo of surrounding proc)

294 lc:integer; (data location counter (from begin of proc))

295 lbno:integer; (number of last local label)

296 forwcount:integer; (number of not yet specified forward procs)

297 lchain:ip; (first label: header of chain)

298 end;

300 structure:record

301 size:integer; (size of structure in bytes)

302 sflag:flagset; (flag bits)

303 case form:structform of

304 scalar : (scaino:integer; (number of range descriptor)

305 fconst:ip (names of constants)

306 );

307 subrange:(ain,am:integer; (lower and upper bound)

308 ranetype:ip; (type of bounds)

309 subno:integer (number of subr descriptor)

310 );

311 pointer : (sttype:sp; (type of pointed object)

312 power : (dast:sp; (type of set elements)

313 files : (f:filetype:sp; (type of file elements)

314 arrays,orarray: (type of array elements)

315 inttype:sp; (type of array index)

316 arpos:position (position of array descriptor)

317 );

318 records : (fstfid:ip; (points to first field)

319 tagap:sp (points to tag if present)

320 );

321 variant : (varval:integer; (tag value for this variant)

322 mtrvar:sp; (next equilevel variant)

323 subtag:sp (points to tag for sub-case)

324 );

325 tag : (fstvar:sp; (first variant of case)

326 tfid:sp (type of tag)

327 );

328 end;

329

331 identifier:record

332 idtype:sp; (type of identifier)

333 name:alpha; (name of identifier)

334 link,plink:ip; (see enterid,searchid)

335 next:ip; (used to make several chains)

336 iflag:flagset; (several flag bits)

337 case klass:ideclass of

338 types : ();

339 konst : (value:integer); (for integers the value is

340 computed and stored in this field.

341 For strings and reals an assembler constant is

342 defined labeled '1', '2', ...

343 This '1' number is then stored in value.

344 For reals value may be negated to indicate that

345 the opposite of the assembler constant is needed.)

346 vars : (vpos:position); (position of var)

347 field : (ffoffset:integer); (offset to begin of record)

348 oarrbnd : (); (idtype points to array)

349 proc,func

350 (name pf:kindofpf of (identification)

351 standard:(key:stastandpf);

352 formal,actual,forward,extra: (lv gives declaration level.

353 pfpos:position; (lv gives instruction segment of this proc and

354 is relevant for formal pf's and for

355 functions (no conflict)).

356 for functions: ad is the result address.

357 for formal pf's: ad is the address of the

358 descriptor)

359 pfno:integer; (unique pf number)

360 parhead:ip; (head of parameter list)

361 head:integer (1s when heading summed)

362 )

363 end;

364

365

367 labl:record

368 next:ip; (chain of labels)

369 seen:boolean;

370 labval:integer; (label number given by the programmer)

371 labname:integer; (label number given by the compiler)

372 labid:integer (same name only locally used,

373 otherwise dibno of label information)

374 end;

375

376 var (the most frequent used externals are declared first)

377 sy:symbol; (last symbol)

378 sstr; (type,access method,position,value of expr)

379 (returned by inqpr)

380 ch:char; (last character)

381 chtype: (type of ch, used by inqpr)

382 val:integer; (if last symbol is an constant)

383 ix:integer; (string length)

384 col:boolean; (true if current ch replaces a newline)

385 newstrng:boolean; (true for strings in " ")

386 id:alpha; (if last symbol is an identifier)

387 (same counters)

388 line:integer; (line number on code file (1..n))

389 dibno:integer; (number of last global number)

390 lmax:integer; (deepest level of nesting of ls)

391 level:integer; (current static level)

393 ptrsize:integer;

394 realize:integer; (file header size)

395 rsize:integer; (index in arg)

396 lastpfno:integer; (unique pf number counter)

397 oopt:integer; (C-type strings allowed if on)

398 dopt:integer; (longs allowed if on)

399 lopt:integer; (number of bits in sets with base integer)

400 sop:integer; (standard option)

401 (pointers pointing to standard types)

402 realptr,inptr,txtptr,emptyst,boolptr:sp;

403 charptr,nilptr,stringptr,longptr:sp;

404

405 (flags)

406 give:line:boolean; (give source line number at next statement)

407 including:boolean; (no LHM's for included code)

408 eof:expected:boolean; (quit without error if true (nextch))

409 main:boolean; (complete programme or a module)

410 inttypedec:boolean; (true if nested in typedefinition)

411 flused:boolean; (true if floating point instructions are used)

412 seconddot:boolean; (indicates the second dot of '...')

413 (pointers)

414 fptr:ip; (head of chain of forward reference pointers)

415 progr:ip; (program identifier)

416 currproc:ip; (current proc/func ip (see casestatement))

417 top:ip; (pointer to the most recent name space)

418 lastsp:ip; (pointer to nameinfo of last searched ident)

419 (records)

420 b:blockinfo; (all info to be stored at pfdeclaration)

421 e:errrec; (all info required for error messages)

422 f:fsttr; (fsttr for current file name)

423 (arrays)

424 source:fttype; (name of pascal source file)

425 strbuf:array[1..max] of char;

426 lpp:array[boolean] of ip;

427 (pfno:standard input, true:standard output)

428 rv:array(r:range) of alpha; (reserved words)

429 (reserved words)

430 frv:array(0..idmax) of integer; (indices in rv)

431

432 rsv:array(r:range) of symbol; (symbol for reserved words)

433

434 ca:array[chr] of chartype; (char type of a character)

435

436 ca:array(r:parmatch, equal) of symbol; (symbol for single character symbols)

437

438 lms:array[libnum] of array[1..4] of char; (mnemonics of pascal library routines)

439

440 opt:array('a'..'z') of integer;

441 foroopt:array('a'..'z') of boolean; (for different options)

442

443 wdef:ip:array[idclass] of ip; (used in searchid)

444

445 arv:array(0..maxarg) of record name:alpha; ad:integer end; (here here the external heading names)

446

447

448 (files)

```
449  ml:file of byte;  (the M1 code)
450  errors:file of error;
451  (the compilation errors)
452  (=====)
454  procedure gen2bytes(b:byte; i:integer);
455  var b1,b2:byte;
456  begin
457  if i<0 then
458  if i<minint then begin b1:=0; b2:=7 end
459  else begin i:=i-1; b1:=tda1 - i mod td; b2:=tda1 - i div td end
460  else begin b1:=i mod td; b2:=i div td end;
461  write(ml,b1,b2);
462  end;
464  procedure genct(i:integer);
465  begin
466  if (i>0) and (i<sp_max0) then write(ml,i,sp_max0)
467  else gen2bytes(sp_max0,i);
468  end;
470  procedure genclb(i:integer);
471  begin if i<td then write(ml,sp_1lb1,i) else gen2bytes(sp_1lb2,i) end;
473  procedure genilb(i:integer);
474  begin lino:=lino+1;
475  if i<sp_max0 then write(ml,i,sp_max0) else genclb(i);
476  end;
478  procedure genlb(i:integer);
479  begin if i<td then write(ml,sp_dlb1,i) else gen2bytes(sp_dlb2,i) end;
481  procedure gen0(b:byte);
482  begin write(ml,b); lino:=lino+1 end;
484  procedure gen1(b:byte; i:integer);
485  begin gen0(b); genct(i) end;
487  procedure gen2(b:byte; d:integer);
488  begin gen0(b); genlb(d) end;
490  procedure genident(name:type; var a:alpha);
491  var i,j:integer;
492  begin i:=lino;
493  while (a[i]=' ') and (i>1) do i:=i-1;
494  write(ml,name,i);
495  for j:=1 to i do write(ml,ord(a[j]));
496  end;
498  procedure genmp(m:integer);
499  var i:integer;
500  begin gen0(sp_max); write(ml,sp_max,m);
501  for i:=1 to m do write(ml,ord(linml[i]));
502  end;
504  procedure genman(b:byte; fil:ip);
```

```
561  if lip=nil then top^.fname:=fil else
562  begin
563  repeat lip:=lip;
564  if lip^.name=nm then
565  begin lip:=lip^.llink; lleft:=true end
566  else
567  begin if lip^.name=nm then again:=true; (name conflict)
568  lip:=lip^.rlink; lleft:=false;
569  end;
570  until lip=nil;
571  if lleft then lip^.llink:=fil else lip^.rlink:=fil
572  end;
573  fil^.llink:=nil; fil^.rlink:=nil;
574  if again then errid:=02,nam;
575  end;
577  procedure initpos(var p:position);
578  begin p.lv:=level; p.ad:=0;
579  ifdef SEGMENTS
580  p.ad:=0
581  #endif
582  end;
584  procedure initf(fp:tp; fd:integer);
585  begin with a do begin
586  asp:=fp; packit:=false; ak:=fzid; pos.ad:=fd; pos.lv:=level;
587  ifdef SEGMENTS
588  pos.ag:=0;
589  #endif
590  end end;
592  function newp(kl:ideclass; alpha: idtyp; idtyp: antip):ip;
593  var p:ip; flflag:st;
594  begin fl:=[];
595  case kl of
596  types,ovrbed: (similar structure)
597  new(p,types);
598  konst:
599  begin new(p,konst); p^.value:=0 end;
600  vars:
601  begin new(p,vars); p^.used:=assigned; initpos(p^.vpos) end;
602  field:
603  begin newp(field); p^.offset:=0 end;
604  proc_func: (same structure)
605  begin newp(proc,actual); p^.pkind:=actual;
606  initpos(p^.ppos); p^.pfoo:=0; p^.parhead:=nil; p^.head:=0
607  end;
608  end;
609  p^.name:=p^.class:=kl; p^.idtype:=idtyp; p^.next:=ent;
610  p^.llink:=nil; p^.rlink:=nil; p^.iflag:=f; newp:=p
611  end;
613  function newp(sf:structform; sz:integer):sp;
614  var p:sp; sf:flagst;
615  begin sf:=[];
616  case sf of
```

```
505  var n:alpha; i,j:integer;
506  begin
507  if fil^.pfoo.lv<1 then n:=fil^.name else
508  begin n:= ' '; j:=1; i:=fil^.pfoo;
509  while i<0 do
510  begin j:=j+1; n[j]:=chr(1 mod 10 + ord('0')); i:=i div 10 end;
511  end;
512  gen0(b); genident(sp_max,n)
513  end;
515  procedure genend;
516  begin write(ml,sp_max) end;
518  procedure genlin;
519  begin give:=false;
520  if opt['!']<off then if main then gen1(sp_max,orig)
521  end;
523  procedure genreg(ad,sz,nr:integer);
524  begin
525  if sz<wordsize then
526  begin gen1(sp_max,mesreg); genct(ad); genct(nr); genend end
527  end;
529  (=====)
531  procedure puterr(err:integer);
532  (as you will notice, all error numbers are preceded by 'e' and '0' to
533  ease their renumbering in case of new error numbers.
534  )
535  begin e:=err; write(errors,e);
536  if err>0 then begin gen1(sp_max,meserror); genend end
537  end;
539  procedure error(err:integer);
540  begin e.mess:=spaces; e.mesi:=-1; puterr(err) end;
542  procedure errid(err:integer; var id:alpha);
543  begin e.mess:=id; e.mesi:=-1; puterr(err) end;
545  procedure errint(err:integer; i:integer);
546  begin e.mesi:=i; e.mess:=spaces; puterr(err) end;
548  procedure aspperr(err:integer);
549  begin if a.sp=off then begin error(err); a.sp:=nil end end;
551  procedure teststand;
552  begin if opt<off then error(-01) end;
554  procedure enterid(fil: ip);
555  (enter id pointed at by fil into the name-table,
556  which on each declaration level is organized as
557  an unbalanced binary tree)
558  var nam:alpha; lip:lip; lleft,again:boolean;
559  begin nam:=fil^.name; again:=false;
560  lip:=top^.fname;
```

```
617  scalar:
618  begin new(p,scalar); p^.scal:=0; p^.fconst:=nil end;
619  subrange:
620  new(p,subrange);
621  pointer:
622  begin new(p,pointer); p^.styp:=nil end;
623  power:
624  new(p,power);
625  files:
626  begin new(p,files); sf:=[]; with file end;
627  arrays,ovrarr: (same structure)
628  new(p,arrays);
629  records:
630  new(p,records);
631  variant:
632  new(p,variant);
633  tag:
634  new(p,tag);
635  end;
636  p^.form:=sf; p^.size:=sz; p^.sf:=sf; newp:=p;
637  end;
639  procedure initf;
640  var a:ohar;
641  begin
642  (initialize the first name space)
643  new(top,ohar); top^.occur:=ak; top^.llink:=nil; top^.fname:=nil;
644  level:=0;
645  (reserved words)
646  rw[0]:='if'; rw[1]:='do'; rw[2]:='of';
647  rw[3]:='to'; rw[4]:='in'; rw[5]:='on';
648  rw[6]:='end'; rw[7]:='for'; rw[8]:='nil';
649  rw[9]:='var'; rw[10]:='div'; rw[11]:='mod';
650  rw[12]:='set'; rw[13]:='and'; rw[14]:='not';
651  rw[15]:='then'; rw[16]:='else'; rw[17]:='with';
652  rw[18]:='case'; rw[19]:='type'; rw[20]:='goto';
653  rw[21]:='file'; rw[22]:='begin'; rw[23]:='until';
654  rw[24]:='while'; rw[25]:='array'; rw[26]:='const';
655  rw[27]:='label'; rw[28]:='repeat'; rw[29]:='record';
656  rw[30]:='down to'; rw[31]:='packed'; rw[32]:='program';
657  rw[33]:='function'; rw[34]:='procedure';
658  (corresponding symbols)
659  rsy[0]:='if'; rsy[1]:='do'; rsy[2]:='of';
660  rsy[3]:='to'; rsy[4]:='for'; rsy[5]:='or';
661  rsy[6]:='and'; rsy[7]:='for'; rsy[8]:='nil';
662  rsy[9]:='var'; rsy[10]:='div'; rsy[11]:='mod';
663  rsy[12]:='set'; rsy[13]:='and'; rsy[14]:='not';
664  rsy[15]:='then'; rsy[16]:='else'; rsy[17]:='with';
665  rsy[18]:='case'; rsy[19]:='type'; rsy[20]:='goto';
666  rsy[21]:='file'; rsy[22]:='begin'; rsy[23]:='until';
667  rsy[24]:='while'; rsy[25]:='array'; rsy[26]:='const';
668  rsy[27]:='label'; rsy[28]:='repeat'; rsy[29]:='record';
669  rsy[30]:='down to'; rsy[31]:='packed'; rsy[32]:='program';
670  rsy[33]:='function'; rsy[34]:='procedure';
671  (indices into rw to find reserved words fast)
672  frw[0]:=0; frw[1]:=0; frw[2]:=6; frw[3]:=15; frw[4]:=22;
```



```

673   frm(5):=28; frm(6):=32; frm(7):=33; frm(8):=35;
674   (char types)
675   for c:=chr(0) to chr(maxcharord) do os(c):=others;
676   for c:=0 to 9 do os(c):=digit;
677   for c:=a to z do os(c):=upper;
678   for c:=A to Z do os(c):=lower;
679   os(chr(maxline))::=layout;
680   os(chr(maxtab))::=layout;
681   os(chr(maxformfeed))::=layout;
682   os(chr(maxover))::=layout;
683   (characters with corresponding char type in ASCII order)
684   os(chr(tab))::=stabsch;
685   os(' ')::=space;   os('!')::=exclam;   os('\"')::=quote;
686   os('\"')::=apost;   os('\"')::=double;   os('\"')::=quote;
687   os('\"')::=parant;   os('\"')::=parant;   os('\"')::=parant;
688   os('\"')::=parant;   os('\"')::=parant;   os('\"')::=parant;
689   os('\"')::=parant;   os('\"')::=parant;   os('\"')::=parant;
690   os('\"')::=parant;   os('\"')::=parant;   os('\"')::=parant;
691   os('\"')::=parant;   os('\"')::=parant;   os('\"')::=parant;
692   (single character symbols in char type order)
693   os('\"')::=parant;   os('\"')::=parant;   os('\"')::=parant;
694   os('\"')::=parant;   os('\"')::=parant;   os('\"')::=parant;
695   os('\"')::=parant;   os('\"')::=parant;   os('\"')::=parant;
696   os('\"')::=parant;   os('\"')::=parant;   os('\"')::=parant;
697   os('\"')::=parant;   os('\"')::=parant;   os('\"')::=parant;
698   os('\"')::=parant;   os('\"')::=parant;   os('\"')::=parant;
699   end;
701   procedure init3;
702   var p,q:ip; k:kdclass;
703   begin
704   (undefined identifier pointers used by searchid)
705   for k:types to fno do
706   (undefined type pointers, some size are filled in by handleopt)
707   realptr :=newp(scalar,istsize);
708   longptr :=newp(scalar,logsize);
709   charptr :=newp(scalar,charsize);
710   boolptr :=newp(scalar,booleansize);
711   nilptr :=newp(pointer,0);
712   stringptr:=newp(pointer,0);
713   emptyset :=newp(power,istsize); emptyset^.elset:=nil;
714   textptr :=newp(files,0); textptr^.fltype:=charptr;
715   (standard type names)
716   enterid(newp(types,'integer','intptr,mll));
717   enterid(newp(types,'real','realptr,mll));
718   enterid(newp(types,'char','charptr,mll));
719   enterid(newp(types,'boolean','boolptr,mll));
720   enterid(newp(types,'text','textptr,mll));
721   (standard constant names)
722   q:=nil; p:=newp(const,'false',boolptr,q); enterid(p);
723   q:=p; p:=newp(const,'true',boolptr,q); enterid(p);
724   boolptr^.foont:=p;
725   q:=p; p:=newp(const,'maxint','intptr,mll); p^.value:=maxint; enterid(p);
726   p:=newp(const,'spaces,charptr,mll); p^.value:=maxcharord;
727
728

```

```

729   charptr^.foont:=p;
730   end;
731
732   procedure init3;
733   var j:standp; p:ip; q:mp;
734   p:=array(standp) of alpha;
735   ftype:=array(foef..farotn) of sp;
736   begin
737   (names of standard procedures/functions)
738   p[read]:=read; p[readin]:=readin;
739   p[write]:=write; p[writein]:=writein;
740   p[put]:=put; p[putin]:=putin;
741   p[page]:=page; p[pagein]:=pagein;
742   p[write]:=write; p[writein]:=writein;
743   p[dispose]:=dispose; p[pack]:=pack;
744   p[unpack]:=unpack; p[mark]:=mark;
745   p[release]:=release; p[halt]:=halt;
746   p[ord]:=ord; p[ordin]:=ordin;
747   p[abs]:=abs; p[absin]:=absin;
748   p[ord]:=ord; p[ordin]:=ordin;
749   p[ord]:=ord; p[ordin]:=ordin;
750   p[ord]:=ord; p[ordin]:=ordin;
751   p[ord]:=ord; p[ordin]:=ordin;
752   p[ord]:=ord; p[ordin]:=ordin;
753   p[ord]:=ord; p[ordin]:=ordin;
754   p[ord]:=ord; p[ordin]:=ordin;
755   p[ord]:=ord; p[ordin]:=ordin;
756   (parameter types of standard functions)
757   ftype[foef]:=nil; ftype[foein]:=nil;
758   ftype[fofd]:=nil; ftype[fofdin]:=nil;
759   ftype[fofr]:=nil; ftype[fofrin]:=nil;
760   ftype[fofd]:=nil; ftype[fofdin]:=nil;
761   ftype[fofr]:=nil; ftype[fofrin]:=nil;
762   ftype[fofd]:=nil; ftype[fofdin]:=nil;
763   ftype[fofr]:=nil; ftype[fofrin]:=nil;
764   ftype[fofd]:=nil; ftype[fofdin]:=nil;
765   ftype[fofr]:=nil; ftype[fofrin]:=nil;
766   (standard procedure/function identifiers)
767   for j:=read to halt do
768   begin new(p.proc,standp); p^.klass:=proc;
769   p^.name:=p[j]; p^.pkind:=standp; p^.key:=j; enterid(p);
770   end;
771   for j:=foef to farotn do
772   begin new(p.fno,standp); p^.klass:=fno; p^.idtype:=ftype[j];
773   (idtype is used not for result type but for parameter type if)
774   p^.name:=p[j]; p^.pkind:=standp; p^.key:=j; enterid(p);
775   end;
776   (program identifier)
777   prog:=newp(proc,'main','mll,mll);
778   (new name space for user external)
779   new(blck); q:=occur:blk; q^.allink:=top; q^.fname:=nil; top:=q;
780   end;
781
782   procedure init4;
783   var c:char;
784   (pascal library mnemonic)

```

```

785   lan[ELN]:=e'el';   lan[EFL]:=e'efl';   lan[CLS]:=c'cls';
786   lan[VM]:=v'vm';
787   lan[OPW]:=o'opw';   lan[ORX]:=o'orx';   lan[ROD]:=r'rod';
788   lan[RDC]:=r'rdc';   lan[RDE]:=r'rde';   lan[RDL]:=r'rdl';
789   lan[RLM]:=r'rlm';
790   lan[CMX]:=c'cmx';   lan[PMX]:=p'pmx';   lan[WRU]:=w'wru';
791   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';
792   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';
793   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';
794   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';
795   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';
796   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';
797   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';
798   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';
799   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';
800   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';
801   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';
802   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';
803   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';
804   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';
805   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';   lan[WSU]:=w'wsu';
806   (options)
807   for c:=a to z do begin opt[c]:=0; forceopt[c]:=false end;
808   opt['a']:=true;
809   opt['r']:=floatsize div wordsize; (default real size in words)
810   opt['i']:=maxint div 2;
811   opt['l']:=true;
812   opt['p']:=true;
813   opt['s']:=true;
814   opt['t']:=true;
815   opt:=off;
816   (scalar variables)
817   b:=nil;
818   b:=nil;
819   b:=nil;
820   b:=nil;
821   b:=nil;
822   e:=nil;
823   e:=nil;
824   e:=nil;
825   e:=nil;
826   e:=nil;
827   e:=nil;
828   l:=0;
829   d:=0;
830   w:=0;
831   m:=0;
832   g:=0;
833   i:=0;
834   w:=0;
835   i:=0;
836   i:=0;
837   i:=0;
838   i:=0;
839   i:=0;
840   i:=0;

```

```

841   argv[0].ed:=1;
842   end;
843
844   procedure handleopt;
845   begin
846   opt:=opt+'d';
847   opt:=opt+'d';
848   opt:=opt+'i';
849   opt:=opt+'s';
850   realsize:=opt['r'] * wordsize; realptr^.size:=realize;
851   ptrsize:=opt['p'] * wordsize; nilptr^.size:=ptrsize;
852   fsize:=div(intsize + 2*ptrsize);
853   textptr^.size:=fsize+bufsize; stringptr^.size:=ptrsize;
854   if opt<off then begin opt:=off; dopt:=off end;
855   else if opt<off then begin opt:=off; dopt:=off end;
856   if opt<off then enterid(newp(types,'string','stringptr,mll));
857   if opt<off then enterid(newp(types,'long','longptr,mll));
858   if opt<off then begin gen((p_mes,mesoptoff); genend end;
859   if ptrsize<wordsize then begin gen((p_mes,mesvirtual); genend end;
860   if dopt<off then ftype:=true; (temporary kludge)
861   end;
862
863   (=====)
864
865   procedure trace(name:alpha; fip:ip; var nandib:integer);
866   var i:integer;
867   begin
868   if opt['t']<off then
869   begin
870   if nandib=0 then
871   begin dibo:=dibo+1; nandib:=dibo; genlb(dibo);
872   gen0(p_mes,write(m_mes,sp_soon,8));
873   for i:=1 to 8 do write(m_mes,ord(fip^.name[i])); genend;
874   end;
875   gen((op_srt,0); gen0(op_mes,nandib);
876   gen0(op_mes); genid(m_mes,trace);
877   end;
878   end;
879
880   function formof(fsp:sp; form:formset):boolean;
881   begin if fsp=all then formof:=false else formof:=fsp^.form in forms end;
882
883   function sizeof(fsp:sp):integer;
884   var s:integer;
885   begin s:=0;
886   if fsp<all then s:=fsp^.size;
887   if s<0 then if odd(s) then s:=s+1;
888   sizeof:=s;
889   end;
890
891   function even(i:integer):integer;
892   begin if odd(i) then i:=i+1; even:=i end;
893
894   procedure exchange(i1,i2:integer);
895   var d1,d2:integer;
896   begin d1:=i2-1; d2:=i1o-12;

```

```
897   if (d1<0) and (d2<0) then
898     begin gen!(ps_esc,d1); gen!(d2) end
899   end;
901   procedure atop(a:byte);
902   begin gen!(a,even(sizeof(a.asp))) end;
904   procedure spndemptxet(fap:sp);
905   var i:integer;
906   begin
907     for i:=2 to sizeof(fap) div wordsize do gen!(op_loc,0); a.asp:=fap
908   end;
910   procedure push(local:boolean; ad:integer; sz:integer);
911   begin assert not odd(sz);
912     if sz=wordsize then
913       begin if local then gen!(op_lal,ad) else gen!(op_lae,ad);
914         gen!(op_loi,sz)
915       end
916     else
917       if local then gen!(op_lol,ad) else gen!(op_loe,ad)
918     end;
920   procedure pop(local:boolean; ad:integer; sz:integer);
921   begin assert not odd(sz);
922     if sz=wordsize then
923       begin if local then gen!(op_lal,ad) else gen!(op_lae,ad);
924         gen!(op_sti,sz)
925       end
926     else
927       if local then gen!(op_lol,ad) else gen!(op_loe,ad)
928     end;
930   procedure lexical(m:byte; lv:integer; ad:integer; sz:integer);
931   begin gen!(op_lex,level-lv); gen!(op_mdi,ad); gen!(m,sz) end;
933   procedure loadpos(var p:position; sz:integer);
934   begin with a do
935     if lv<0 then
936       #ifdef SECTIONS
937         if ag<0 then
938           begin gen!(op_lsa,ag); gen!(op_mdi,ad); gen!(op_loi,sz) end
939         else
940           #endif
941           push(global,ad,sz)
942         else
943           if lv=level then push(local,ad,sz) else
944             lexical(op_loi,lv,ad,sz);
945   end;
947   procedure decaddr(var p:position);
948   begin if p.lv=0 then gen!(op_lae,p.ad) else loadpos(p,ptrsize) end;
950   procedure loadadr;
951   begin with a do begin
952     case ok of
```

```
953     fixed;
954     with pos do
955       if lv<0 then
956         #ifdef SECTIONS
957           if ag<0 then
958             begin gen!(op_lsa,ag); gen!(op_mdi,ad) end
959           else
960             #endif
961             gen!(op_lae,ad)
962           else
963             if lv=level then gen!(op_lal,ad) else
964               begin gen!(op_lex,level-lv); gen!(op_mdi,ad) end;
965     pfixed:=
966     loadpos(pos,ptrsize);
967     ploaded:=
968     ;
969     indexed:=
970     gen!(op_sas);
971     end; [case]
972     ak:=ploaded;
973   end end;
975   procedure load;
976   var sz:integer;
977   begin with a do begin
978     sz:=sizeof(asp); if not packbit then sz:=seven(sz);
979     if asp=all then
980       case ok of
981         cst:
982           gen!(op_loc,pos,ad); [only one-word scalars]
983         fixed:
984           loadpos(pos,sz);
985         pfixed:
986           begin loadpos(pos,ptrsize); gen!(op_loi,sz) end;
987         loaded:
988         ;
989         ploaded:
990           gen!(op_loi,sz);
991         indexed:
992           gen!(op_lsa);
993         [case]
994         ak:=loaded;
995     end end;
997   procedure store;
998   var sz:integer;
999   begin with a do begin
1000     sz:=sizeof(asp); if not packbit then sz:=seven(sz);
1001     if asp=all then
1002       case ok of
1003         fixed:
1004           with pos do
1005             if lv<0 then
1006               #ifdef SECTIONS
1007                 if ag<0 then
1008                   begin gen!(op_lsa,ag);
```

```
1009     gen!(op_mdi,ad); gen!(op_sti,sz)
1010   end
1011   else
1012     #endif
1013     pop(global,ad,sz)
1014   else
1015     if level=lv then pop(local,ad,sz) else
1016       lexical(op_sti,lv,ad,sz);
1017   pfixed:=
1018   loadpos(pos,ptrsize); gen!(op_sti,sz) end;
1019   ploaded:=
1020   gen!(op_sti,sz);
1021   indexed:=
1022   gen!(op_sas);
1023   end; [case]
1024 end end;
1026   procedure fieldadr(off:integer);
1027   begin with a do
1028     if (ak=pfixed) and not packbit then pos.ad:=pos.ad+off else
1029       begin loadadr; gen!(op_mdi,off) end
1030   end;
1032   procedure loadheap;
1033   begin if forsof(a.asp,[arrays..records]) then loadadr else load end;
1035   [.....]
1037   procedure nextoh;
1038   begin
1039     col:=col+input; read(input,oh); e.ohno:=e.ohno+1; ehay:=col+oh;
1040   end;
1042   procedure nextin;
1043   begin
1044     if eof(input) then
1045       begin
1046         if not eofexpected then error(+03) else
1047           begin
1048             if f1used then begin gen!(ps_esc,seeffloat); genend end;
1049             gen!(ps_eof)
1050           end;
1051     #ifdef STANDARD
1052     goto 3999
1053   #endif
1054   #ifdef STANDARD
1055   halt
1056   #endif
1057   end;
1058   e.ohno:=0; e.lino:=e.lino+1; e.linar:=e.linar+1;
1059   if not including then
1060     begin e.orig:=e.orig; gvaline:=true end;
1061   end;
1063   procedure options(normal:boolean);
1064   var o:integer; i:integer;
```

```
1066   procedure goto;
1067   var b:byte;
1068   begin
1069     if normal then
1070       begin nextoh; o:=oh end
1071     else
1072       begin read(am,b); c:=chr(b) end
1073   end;
1075   begin
1076     repeat goto;
1077     if (o='a') and (c='a') then
1078       begin ci:=o; goto i:=0;
1079       if c='.' then begin i:=1; goto end else
1080         if c='-' then goto else
1081           if c[0]digit then
1082             repeat i:=i*10 + ord(o) - ord('0'); goto;
1083             until not c[0]digit
1084           else i:=1;
1085           if i>=0 then
1086             if not normal then
1087               begin forceopt[ci]:=true; opt[ci]:=i end
1088             else
1089               if not forceopt[ci] then opt[ci]:=i;
1090           end;
1091           until c='.';
1092   end;
1094   procedure linedirective;
1095   var i,j:integer;
1096   begin i:=0; j:=0;
1097     repeat nextoh until (ch=' ') or eof;
1098     while ch[0]digit do
1099       begin i:=i*10 + ord(ch) - ord('0'); nextoh end;
1100     while (ch=' ') and not eof do nextoh;
1101     if (ch='*') or (eof) then error(-04) else
1102       begin nextoh;
1103         while (ch='*') and not eof do
1104           begin
1105             if ch='/' then j:=0 else
1106               begin if j=0 then e.fnam:=emptyfnam;
1107                 i:=i+1; if j<=fnam then e.fnam[j]:=ch;
1108                 end;
1109             nextoh
1110           end;
1111     if source=emptyfnam then source:=e.fnam;
1112     including:=source<'>.fnam;
1113     i:=i-1; e.lin:=i;
1114     if not including then e.orig:=i
1115   end;
1116   while not eof do nextoh;
1117   end;
1119   procedure putdig;
1120   begin ix:=ix+1; if ix<max then strbuff[ix]:=ch; nextoh end;
```

```

1122 procedure indent;
1123 label 1;
1124 var i:integer;
1125 begin i:=0; id:=space;
1126 repeat
1127   if ch>upper then ch:=chr(ord(ch)-ord('A')+ord('a'));
1128   if k<idmax then begin k:=k+1; id[k]:=ch end;
1129   nextch
1130 until ch<=digit;
1131 [lower=0,upper=1,digit=2, ugly but fast]
1132 for i:=frk-1 to frk-1-1 do
1133   if rw[i]<id then
1134     begin sy:=ray[i]; goto 1 end;
1135   sy:=idmax;
1136 1:
1137 end;

1139 procedure innumber;
1140 label 1;
1141 const lam = 10;
1142 var
1143   i:integer;
1144   is:=packed array[1..lam] of char;
1145   begin ix:=0; sy:=idmax; val:=0;
1146   repeat putdig until ch<=digit;
1147   if (ch='.') or (ch='e') or (ch='E') then
1148     begin
1149       if ch='.' then
1150         begin putdig;
1151           if ch='.' then
1152             begin seconddot:=true; ix:=ix+1; goto 1 end;
1153           if ch<=digit then error(+05) else
1154             repeat putdig until ch<=digit;
1155         end;
1156       if (ch='e') or (ch='E') then
1157         begin putdig;
1158           if (ch='e') or (ch='E') then putdig;
1159           if ch<=digit then error(+06) else
1160             repeat putdig until ch<=digit;
1161         end;
1162       if ix>lam then begin error(+07); ix:=lam end;
1163       sy:=nextch; fl:=next; r:=next; d:=next; m:=next; val:=next;
1164       genidb(d:=next; genid(p:=next); write(am:=next; sy:=next; ix:=next);
1165       for i:=1 to ix do write(am:=next; ord(strbuf[i])); genid;
1166     end;
1167   !:if (ch<=lower) or (ch<=upper) then teststandard;
1168   if sy=idmax then
1169     if ix>lam then error(+08) else
1170       begin ix:=0; seconddot:=false; ix:=next;
1171         while ix>0 do
1172           begin i:=ix-1; if i:=strbuf[i]; ix:=ix-1 end;
1173           if ix<=lam then
1174             while i<=lam do
1175               begin val:=val*10 + ord('0') + ord(strbuf[i]); i:=i+1 end
1176             else if ix<=lam then
1177               begin sy:=longest; d:=next; m:=next; val:=next;
1178             end;

```

```

1177   genidb(d:=next; genid(p:=next); write(am:=next; sy:=next; ix:=next);
1178   while ix<=lam do
1179     begin write(am:=next; ord(strbuf[i])); i:=i+1 end;
1180   genid;
1181   end error(+09);
1182   end;
1183 end;

1186 procedure instrng(q:char);
1187 var i:integer;
1188 begin ix:=0; zerostring:=q;
1189 repeat
1190   repeat nextch; ix:=ix+1; if ix<=max then strbuf[ix]:=ch;
1191   until (ch=q) or eol;
1192   if ch<=q then nextch else error(+10);
1193   until ch<=q;
1194   if not zerostring then
1195     begin ix:=ix-1; if ix=0 then error(+011) end
1196   else
1197     begin strbuf[ix]:=chr(0); if ch<=q then error(+012) end;
1198     if (ix=1) and not zerostring then
1199       begin sy:=chrnext; val:=ord(strbuf[1]) end
1200     else
1201       begin sy:=stringnext; d:=next; m:=next; val:=next;
1202         if ix>max then begin error(+013); ix:=max end;
1203         genidb(d:=next; genid(p:=next); write(am:=next; sy:=next; ix:=next);
1204         for i:=1 to ix do write(am:=next; ord(strbuf[i])); genid;
1205       end;
1206 end;

1208 procedure incomment;
1209 var stop:=char;
1210 begin nextch; stop:=next;
1211 if ch='*' then options:=true;
1212 while (ch<=next) and (ch<=stop) do
1213   begin stop:=next; if ch='*' then stop:=next;
1214   if ch='*' then error(+014);
1215   if eol then nextch; nextch;
1216   end;
1217 if ch='*' then teststandard;
1218 nextch;
1219 end;

1221 procedure inlay;
1222 [read next basic symbol of source program and return its
1223 description in the global variables sy, op, id, val and ix]
1224 label 1;
1225 begin
1226   !:same ch<=of
1227   nextch;
1228   begin e:=ch:=next; ch:=next;
1229   layout;
1230   begin if eol then nextch; nextch; goto 1 end;
1231   lower:=upper:=idmax;
1232   digit:=innumber;

```

```

1233 quotech,qquotech;
1234 instrng(ch);
1235 colonch;
1236 begin nextch;
1237   if ch=':' then begin sy:=colonch; nextch end else sy:=colon1;
1238 end;
1239 periodch;
1240 begin nextch;
1241   if seconddot then begin seconddot:=false; sy:=colon2 end else
1242     if ch='.' then begin sy:=colon2; nextch end else sy:=period;
1243 end;
1244 lessch;
1245 begin nextch;
1246   if ch='<' then begin sy:=less; nextch end else
1247     if ch='<' then begin sy:=less; nextch end else sy:=ltay;
1248 end;
1249 greaterch;
1250 begin nextch;
1251   if ch='>' then begin sy:=less; nextch end else sy:=gtay;
1252 end;
1253 lparench;
1254 begin nextch;
1255   if ch='(' then sy:=lparen else
1256     begin teststandard; incomment; goto 1 end;
1257 end;
1258 lbracket;
1259 begin incomment; goto 1 end;
1260 rparench,lbracket,rbracket,comma,semicolon,arrowch,
1261 plusch,mulch,slash,star,equal;
1262 begin sy:=nextch; nextch end;
1263 otherch;
1264 begin
1265   if (ch='@') and (e:=next) then llineofactive else
1266     begin error(+015); nextch end;
1267   goto 1;
1268 end (same);
1269 end;

1272 procedure nextf(f:=symbol; err:=integer);
1273 begin if sy=f then inlay else error(-err) end;

1275 function find1(sy1,sy2:so; err:=integer):boolean;
1276 [symbol of sy1 expected. return true if sy in sy1]
1277 begin
1278   if not (sy in sy1) then
1279     begin error(-err); while not (sy in sy1+sy2) do inlay end;
1280   find1:=sy in sy1;
1281 end;

1283 function find2(sy1,sy2:so; err:=integer):boolean;
1284 [symbol of sy1+sy2 expected. return true if sy in sy1]
1285 begin
1286   if not (sy in sy1+sy2) then
1287     begin error(-err); repeat inlay until sy in sy1+sy2 end;
1288   find2:=sy in sy1;

```

```

1289 end;

1291 function find3(sy1:symbol; sy2:so; err:=integer):boolean;
1292 [symbol sy1 or one of sy2 expected. return true if sy found and skip]
1293 begin find3:=true;
1294 if not (sy in [sy1]+sy2) then
1295   begin error(-err); repeat inlay until sy in [sy1]+sy2 end;
1296 if sy=sy1 then inlay else find3:=false;
1297 end;

1299 function endofloop(sy1,sy2:so; sy:=symbol; err:=integer):boolean;
1300 begin endofloop:=false;
1301 if find2(sy2+sy1,sy1,err) then nextf(sy,err+1)
1302 else endofloop:=true;
1303 end;

1305 function lastsemicolon(sy1,sy2:so; err:=integer):boolean;
1306 begin lastsemicolon:=true;
1307 if not endofloop(sy1,sy2,semicolon,err) then
1308   if find2(sy2,sy1,err+2) then lastsemicolon:=false;
1309 end;

1311 [.....]

1313 function searchid(fidals: setofid):ip;
1314 [search for current identifier symbol in the name table]
1315 label 1;
1316 var lip:=ip; is:=idless;
1317 begin lastap:=stop;
1318 while lastap<=id do
1319   begin lip:=lastap+1;
1320   while lip<=id do
1321     if lip<=id then
1322       if lip<=id then
1323         begin
1324           if lip<=id then
1325             lip:=lip+1; if lip<=id then
1326               goto 1;
1327           end
1328         else lip:=lip+1;
1329         else
1330           if lip<=id then lip:=lip+1;
1331         lastap:=lastap+1;
1332       end;
1333   err:=id<=id;
1334   if types in fidals then is:=types else
1335   if vars in fidals then is:=vars else
1336   if const in fidals then is:=const else
1337   if proc in fidals then is:=proc else
1338   if func in fidals then is:=func else is:=false;
1339   lip:=endoflip+1;
1340 1:
1341   searchid:=lip;
1342 end;

1344 function searchsection(f:= ip):ip;

```

```
1345 (to find record fields and forward declared procedure id's
1346 ->procedure pfdclaration
1347 ->procedure selector)
1348 label 1;
1349 begin
1350 while flp<=all do
1351 if flp.name=id then goto 1 else
1352 if flp.name=ec id then flp:=flp.rlink else flp:=flp.llink;
1353 1: searchsection:=flp
1354 end;
1355
1356 function searchlab(flplp: val:integer):lp;
1357 label 1;
1358 begin
1359 while flp<=all do
1360 if flp.labval=val then goto 1 else flp:=flp.nextlp;
1361 1:searchlab:=flp
1362 end;
1363
1364 procedure oponent(t:twostrut);
1365 var op:integer;
1366 begin with a do begin
1367 case is of
1368 ir: begin op:=op_dif; asp:=realptr; fltused:=true end;
1369 r1: begin op:=op_of1; asp:=intptr; fltused:=true end;
1370 il: begin op:=op_of2; asp:=longptr end;
1371 li: begin op:=op_of3; asp:=intptr end;
1372 lr: begin op:=op_of4; asp:=realptr; fltused:=true end;
1373 rl: begin op:=op_of5; asp:=longptr; fltused:=true end;
1374 end;
1375 gen0(op)
1376 end end;
1377
1378 procedure negate(l1:integer);
1379 var l2:integer;
1380 begin
1381 if a.asp=ntpr then gen0(op_neg) else
1382 begin l2:=l1; gen0(op_loo,0);
1383 if a.asp=longptr then
1384 begin oponent(l1); exchange(l1,l2); gen0(op_dab) end
1385 else [realptr]
1386 begin oponent(l1); exchange(l1,l2); gen0(op_fab) end
1387 end;
1388
1389 function desub(fsp:sp);
1390 begin
1391 if formof(fsp,subrange) then fsp:=fsp.rangetype; desub:=fsp
1392 end;
1393
1394 function nicescalar(fsp:sp):boolean;
1395 begin
1396 if fsp=ntpr then nicescalar:=true else
1397 nicescalar:=(fsp.for=scalar) and (fsp<=realptr) and (fsp<=longptr)
1398 end;
1399 end;
```

```
1457 function compat(p,q:sp):twostrut;
1458 begin compat:=noeq;
1459 if eqstrut(p,q) then compat:=eq else
1460 begin p:=desub(p); q:=desub(q);
1461 if eqstrut(p,q) then compat:=subeq else
1462 if p.for=q.for then
1463 case p.for of
1464 scalar:
1465 if (p=ntpr) and (q=realptr) then compat:=ir else
1466 if (p=realptr) and (q=intptr) then compat:=ri else
1467 if (p=intptr) and (q=longptr) then compat:=il else
1468 if (p=longptr) and (q=intptr) then compat:=li else
1469 if (p=longptr) and (q=realptr) then compat:=lr else
1470 if (p=realptr) and (q=longptr) then compat:=rl else
1471 ;
1472 pointer:
1473 if (p=ntpr) or (q=ntpr) then compat:=eq;
1474 power:
1475 if p=mpmtyset then compat:=se else
1476 if q=mpmtyset then compat:=se else
1477 if compat(p,elset,q,elset) <= subeq then
1478 compat:=subeq;
1479 arrays:
1480 if string(p) and string(q) and (p.size=q.size) then
1481 compat:=eq;
1482 files,array,records: ;
1483 end;
1484 end;
1485
1486 procedure checkasp(fsp:sp; err:integer);
1487 var ts:twostrut;
1488 begin
1489 ts:=compart(a.asp,fsp);
1490 case ts of
1491 eq:
1492 if fsp<=all then if withfile in fsp.sflag then aspperr(err);
1493 subeq:
1494 checkbada(fsp);
1495 il:
1496 begin oponent(ta); checkasp(fsp,err) end;
1497 lr,rl,lr,rl:
1498 oponent(ta);
1499 oponent(ta);
1500 asp:=emptysyt(fsp);
1501 notaq,ri,se:
1502 aspperr(err);
1503 end;
1504 end;
1505
1506 procedure force(fsp:sp; err:integer);
1507 begin load; checkasp(fsp,err) end;
1508
1509 function neident(kl:ldolaa; id:sp; nst:ip; err:integer):ip;
1510 begin neident:=nil;
1511 if sp<=ident then error(err) else
1512
```

```
1401 function bounds(fsp:sp; var fmin,fmax:integer):boolean;
1402 (compute bounds if possible, else return false)
1403 begin bounds:=false; fmin:=0; fmax:=0;
1404 if fsp<=all then
1405 if fsp.for= subrange then
1406 begin fmin:=fsp.min; fmax:=fsp.max; bounds:=true end else
1407 if fsp.for=scalar then
1408 if fsp.foomat<=0 then
1409 begin fmin:=0; fmax:=fsp.foomat.value; bounds:=true end
1410 end;
1411
1412 procedure genrok(fsp:sp);
1413 var min,max,sno:integer;
1414 begin
1415 if opt['r']<=off then if bounds(fsp,min,max) then
1416 begin
1417 if fsp.for=scalar then sno:=fsp.scalno else sno:=fsp.subrno;
1418 if sno=0 then
1419 begin d1bno:=d1bno+1; sno:=d1bno;
1420 genid(d1bno); gen1(pe_rom,min); genot(max); genend;
1421 if fsp.for=scalar then fsp.scalno:=sno else
1422 fsp.subrno:=sno
1423 end;
1424 end;
1425 end;
1426
1427 procedure checkbda(fsp:sp);
1428 var min,max1,min2,max2:integer; bool:boolean;
1429 begin
1430 if bounds(fsp,min,max1) then
1431 begin bool:=bounds(a.asp,min2,max2);
1432 if (bool=false) or (min2<min1) or (max2>max1) then
1433 genrok(fsp);
1434 end;
1435 a.asp:=fsp;
1436 end;
1437
1438 function eqstrut(p,q:sp):boolean;
1439 begin eqstrut:=(p=q) or (p=all) or (q=all) end;
1440
1441 function string(fsp:sp):boolean;
1442 var lsp:sp;
1443 begin string:=false;
1444 if formof(fsp,array) then
1445 if eqstrut(fsp,eltype.charptr) then
1446 if speak in fsp.sflag then
1447 begin lsp:=fsp.inctype;
1448 if lsp=all then string:=true else
1449 if lsp.for= subrange then
1450 if lsp.rangetype=intptr then
1451 if lsp.min=1 then
1452 string:=true
1453 end;
1454 end;
1455 end;
```

```
1513 begin neident:=newip(kl.id,ldt,ext); inayw end
1514 end;
1515
1516 function stringstrut:sp;
1517 var lsp:sp;
1518 begin (only used when ix and zerostring are still valid)
1519 if zerostring then lsp:=stringptr else
1520 begin lsp:=newip(array,ifcharize); lsp.sflag:=lspeak;
1521 lsp.eltype:=charptr; lsp.inctype:=nil;
1522 end;
1523 stringstrut:=lsp;
1524 end;
1525
1526 function address(var lc:integer; az:integer; pack:boolean):integer;
1527 begin
1528 if lc >= maxint-az then begin error(+017); lc:=0 end;
1529 if (not pack) or (az=1) then if odd(lc) then lc:=lc+1;
1530 address:=lc;
1531 lc:=lc+az;
1532 end;
1533
1534 function reserve(s:integer):integer;
1535 var r:integer;
1536 begin r:=address(b.lo,s,false); genreg(r,s,100); reserve:=r;
1537 if b.lo>max then lmax:=b.lo
1538 end;
1539
1540 function arraysize(fsp:sp; pack:boolean):integer;
1541 var sz,min,max,tot,n:integer;
1542 begin sz:=sizeof(fsp.eltype);
1543 if not pack then sz:=sz+1;
1544 if bounds(fsp.inctype,min,max) then; (we checked before)
1545 d1bno:=d1bno+1; fsp.arpos.lv:=0; fsp.arpos.ed:=d1bno;
1546 genid(d1bno); gen1(pe_rom,min); genot(max-min);
1547 genot(max); genend;
1548 a:=max-min+1; tot:=sz*s;
1549 if sz<0 then if tot div sz < 0 then begin error(+018); tot:=0 end;
1550 arraysize:=tot
1551 end;
1552
1553 procedure treevalk(flplp);
1554 var lsp:sp; i:integer;
1555 begin
1556 if flp<=all then
1557 begin treevalk(flplp.llink); treevalk(flplp.rlink);
1558 if flp.kl=vars then
1559 begin if not (used in flp.iflag) then errid(-+019),flp.name);
1560 if not (assigned in flp.iflag) then errid(-+020),flp.name);
1561 lsp:=flp.idtype;
1562 if not (sorg in flp.iflag) then
1563 genreg(flplp.vpos.ed,ssizeof(lsp,ord(formof(lsp,pointer)))));
1564 if flp<=all then if withfile in lsp.sflag then
1565 if lsp.for=files then
1566 if level=1 then
1567 begin
1568 for i:=2 to argo do with argo[i] do
```

```

1569         if name=fip.name then ad:=fip.vpos.ad
1570     else
1571     begin
1572     begin
1573     if not (refer in fip.iflag) then
1574     begin gen(op,wrt,0);
1575     gen(top_lal,fip.vpos.ad); genop(CLS)
1576     end
1577     end
1578     else
1579     if level<1 then errid:=(+021),fip.name
1580     end
1581 end;
1582
1583
1584 procedure constant(fays:soa; var fap:sp; var fval:integer);
1585 var signed_min:boolean; lip:lip;
1586 begin signed:=(faypluss) or (faymin);
1587 if signed then begin min:=aymin; insyn end else min:=false;
1588 if find((ident..pluss),fays,+022) then
1589 begin fval:=val;
1590 case ay of
1591 stringst: fap:=stringst;
1592 charst: fap:=charst;
1593 intst: fap:=intst;
1594 realst: fap:=realst;
1595 longest: fap:=longst;
1596 shortest: fap:=shortst;
1597 ident:
1598 begin lip:=searchid((konst));
1599 fap:=lip.idtype; fval:=lip.value;
1600 end
1601 end; (case)
1602 if signed then
1603 if (fap<intst) and (fap<realst) and (fap<longst) then
1604 error(+023)
1605 else if min then fval:=-fval;
1606 (note: negating the v-number for reals and longs)
1607 insyn;
1608 end
1609 else begin fap:=nil; fval:=0 end;
1610 end;
1611
1612 function outinteger(fays:soa; fap:sp; err:integer):integer;
1613 var lip:lip; lval_min_max:integer;
1614 begin constant(fays,lip,lval);
1615 if fap<longst then
1616 if (not (fap=longst)) then
1617 begin
1618 if bounds(fap,min_max) then
1619 if (lval<min) or (lval>max) then error(+024)
1620 end
1621 else
1622 begin error(err); lval:=0 end;
1623 outinteger:=lval
1624 end;

```

```

1626 {*****}
1627
1628 function typid(arr:integer):sp;
1629 var lip:lip; lval:integer;
1630 newsubrange:boolean;
1631 begin lip:=nil;
1632 if ay<ident then error(err) else
1633 begin lip:=searchid((types)); lip:=lip.idtype; insyn end;
1634 typid:=lip
1635 end;
1636
1637 function simpletp(fays:soa):sp;
1638 var lip:lip; lval:sp; lip_min_max:integer; lip_max;
1639 newsubrange:boolean;
1640 begin lip:=nil;
1641 if find((ident..parent),fays,+025) then
1642 if ay<parent then
1643 begin insyn; lip:=top; (decl. const. local to innermost block)
1644 while top<>occur do top:=top.nlink;
1645 lip:=newsp((smallr.wordsize); hip:=nil; max:=0;
1646 repeat lip:=newident((konst,lip,hip,+026);
1647 if lip<nil then
1648 begin enterid(lip);
1649 hip:=lip; lip.value:=max; max:=max+1
1650 until endofloop(fays,(parent),(ident),comma,+027); (+028)
1651 if max<8 then lip.size:=bytesize;
1652 lip.flags:=hip; top:=lip; nextif((parent,+029);
1653 else
1654 begin newsubrange:=true;
1655 if ay<ident then
1656 begin lip:=searchid((types,konst)); insyn;
1657 if lip.klasstype then
1658 begin lip:=lip.idtype; newsubrange:=false end
1659 else
1660 begin lip:=lip.idtype; min:=lip.value end
1661 end
1662 else constant(fays,(colon2,ident..pluss),lip,min);
1663 if newsubrange then
1664 begin lip:=newsp(subrange,wordsize); lip.subno:=0;
1665 if not minmax(lip) then
1666 begin error(+030); lip:=nil; min:=0 end;
1667 lip.range:=lip;
1668 nextif((colon2,+031); max:=outinteger(fays,lip,+032);
1669 if min>max then begin error(+033); max:=min end;
1670 if (min<0) and (max<8) then lip.size:=bytesize;
1671 lip.min:=min; lip.max:=max
1672 end
1673 end;
1674 simpletp:=lip
1675 end;
1676
1677 function arraytp(fays:soa;
1678 atyp:atypform;
1679 sflag:flagset;

```

```

1681 function element(fays:soa):sp
1682 :sp;
1683 var lip:lip; hip:sp; min_max:integer; ok:boolean; spsy:symbol; lip:lip;
1684 ok:=true;
1685 begin insyn; nextif((break,+034); hip:=nil;
1686 repeat lip:=newsp(atyp,0); initpos(lip,arpos);
1687 lip.min:=hip; hip:=lip; (link reversed)
1688 if atyp=array then
1689 begin spsy:=colon; ok:=ident;
1690 lip:=newident((currbnd,lip,hip,+035);
1691 if lip<nil then enterid(lip);
1692 nextif((colon2,+036);
1693 lip:=newident((currbnd,lip,hip,+037);
1694 if lip<nil then enterid(lip);
1695 nextif((colon2,+038); lip:=typid(+039);
1696 ok:=not ok or (detub(lip));
1697 end
1698 else
1699 begin spsy:=comma; ok:=((ident..parent));
1700 lip:=simpletp(fays,(comma,"break",ofy,ident..packedy));
1701 ok:=bounds(lip,min_max)
1702 end;
1703 if not ok then begin error(+040); lip:=nil end;
1704 lip.lntype:=lip
1705 until endofloop(fays,(break,ofy,ident..packedy),ok,
1706 spsy,+041); (+042)
1707 nextif((break,+043); nextif((ofy,+044);
1708 lip:=element(fays);
1709 if lip<nil then sflag:=sflag + lip.sflag + [withfile];
1710 repeat (reverse links and compute aim)
1711 lip:=lip.nlink; hip:=lip; lip.min:=lip;
1712 if atyp=array then hip.min:=arraysize(hip, speak in sflag);
1713 lip:=hip; hip:=lip;
1714 until lip:=nil; (lip points to array with highest dimension)
1715 arraytp:=lip
1716 end;
1717
1718 function typ(fays:soa):sp;
1719 var lip:lip; sp:so; min_max:integer;
1720 sflag:flagset; lip:sp;
1721
1722 function fidlist(fays:soa):sp;
1723 (level 2: << typ)
1724 var lip:lip; lip:lip; lip:sp;
1725
1726 function varpart(fays:soa):sp;
1727 (level 3: << fidlist << typ)
1728 var lip:lip; lip:lip; lip:sp; lip:sp; lip:sp; lip:sp; lip:sp;
1729 min_max:=int; var:=integer; lid:=alpha;
1730 begin insyn; lip:=nil; lip:=nil;
1731 lip:=newsp(0);
1732 if ay<ident then error(+045) else
1733 begin lid:=id; insyn;
1734 if ay<colon then
1735 begin lip:=newsp((field,lid,nil,nil); enterid(lip); insyn;
1736 if ay<ident then error(+046) else

```

```

1737 begin lid:=id; insyn end;
1738 end;
1739 if ay<ofy then (otherwise you may destroy id)
1740 begin lid:=id; lip:=searchid((types)) end;
1741 end;
1742 if lip:=nil then (fap:=nil else (fap:=lip.idtype);
1743 if bounds(fap,int_max) then var:=var-int-1 else
1744 begin var:=0;
1745 if fap<nil then begin error(+047); fap:=nil end
1746 end;
1747 lip:=fap;
1748 if tip<nil then (explicit tag)
1749 begin tip:=fap;
1750 tip.flags:=address(of,sizeof(fap),speak in sflag)
1751 end;
1752 nextif((ofy,+048); min:=0; max:=min; head:=nil;
1753 repeat hip:=nil; (for each caselabel list)
1754 repeat var:=var-1;
1755 int:=outinteger(fays,(ident..pluss,comma,colon1,parent,
1756 semicolon,comma,rparent),tip,+049);
1757 lip:=head; (each label may occur only once)
1758 while lip<nil do
1759 begin if lip.varval<int then error(+050);
1760 lip:=lip.nlink
1761 end;
1762 var:=newsp(var,int,0); var.varval:=int;
1763 var.nlink:=head; head:=var; (chain of case labels)
1764 var.subst:=hip; hip:=var;
1765 (use this field to link labels with same variant)
1766 until endofloop(fays,(colon1,parent,semicolon,comma,rparent),
1767 (ident..pluss),comma,+051); (+052)
1768 nextif((colon1,+053); nextif((parent,+054);
1769 top:=fidlist(fays,(parent,semicolon,ident..pluss));
1770 if ay<max then min:=0;
1771 while var<nil do
1772 begin var:=min; min:=hip:=var.subst;
1773 var:=var.subst; top:=lip; lip:=hip
1774 end;
1775 nextif((parent,+055);
1776 ay:=min;
1777 until lastsemicolon(fays,(ident..pluss),+056); (+057 +058)
1778 if var>0 then error(+059);
1779 top.flags:=head; top.size:=min; ay:=min; varpart:=top;
1780 end;
1781
1782 begin (fidlist)
1783 if find((ident),fays,(array),+060) then
1784 repeat lip:=nil; hip:=nil;
1785 repeat lip:=newident((field,nil,nil,+061);
1786 if lip<nil then
1787 begin enterid(lip);
1788 if lip:=nil then hip:=lip else lip:=lip.next:=lip; lip:=lip;
1789 end;
1790 until endofloop(fays,(colon1,ident..packedy,semicolon,comma),
1791 (ident,comma,+062); (+063)
1792 nextif((colon1,+064);

```



