

The PKtype processor

(Version 2.3, 23 April 2020)

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2* The *banner* string defined here should be changed whenever `PKtype` gets modified.

```
define my_name ≡ `pktype`
define banner ≡ `This is PKtype, Version 2.3` { printed when the program starts }
```

4* Both the input and output come from binary files. On line interaction is handled through Pascal's standard *input* and *output* files. Two macros are used to write to the type file, so this output can easily be redirected.

```
define print_ln(#) ≡ write_ln(output, #)
define print(#) ≡ write(output, #)
define typ_file ≡ stdout
define t_print_ln(#) ≡ write_ln(typ_file, #)
define t_print(#) ≡ write(typ_file, #)
```

```
program PKtype(input, output);
type <Types in the outer block 9>
var <Globals in the outer block 11>
  <Define parse_arguments 56*>
procedure initialize; { this procedure gets things started properly }
  var i: integer; { loop index for initializations }
  begin kpse_set_program_name(argv[0], my_name); kpse_init_prog(`PKTYPE`, 0, nil, nil);
  parse_arguments; print(banner); print_ln(version_string);
  <Set initial values 12>
end;
```

5* This module is deleted, because it is only useful for a non-local `goto`, which we don't use in C.

6* These constants determine the maximum length of a file name and the length of the terminal line, as well as the widest character that can be translated.

8* We use a call to the external C `exit` to avoid a non-local `goto`.

```
define abort(#) ≡
  begin print_ln(#); uexit(1)
end
```

10* The original Pascal compiler was designed in the late 60s, when six-bit character sets were common, so it did not make provision for lower case letters. Nowadays, of course, we need to deal with both upper and lower case alphabets in a convenient way, especially in a program like `PKtype`. So we shall assume that the Pascal system being used for `PKtype` has a character set containing at least the standard visible characters of ASCII code ("!" through "~").

Some Pascal compilers use the original name *char* for the data type associated with the characters in text files, while other Pascals consider *char* to be a 64-element subrange of a larger data type that has some other name. In order to accommodate this difference, we shall use the name *text_char* to stand for the data type of the characters in the output file. We shall also assume that *text_char* consists of the elements *chr(first_text_char)* through *chr(last_text_char)*, inclusive. The following definitions should be adjusted if necessary.

```
define char  $\equiv$  0 .. 255
```

```
define text_char  $\equiv$  char { the data type of characters in text files }
```

```
define first_text_char = 0 { ordinal number of the smallest element of text_char }
```

```
define last_text_char = 127 { ordinal number of the largest element of text_char }
```

⟨Types in the outer block 9⟩ +≡

```
text_file = packed file of text_char;
```

31* \langle Globals in the outer block 11 $\rangle + \equiv$
pk_file: *byte_file*; { where the input comes from }

32* In C, do path searching.

procedure *open_pk_file*; { prepares to read packed bytes in *pk_file* }
begin { Don't use *kpse_find_pk*; we want the exact file or nothing. }
pk_file \leftarrow *kpse_open_file*(*cmdline*(1), *kpse_pk_format*); *cur_loc* \leftarrow 0;
end;

33* We need a place to store the names of the input and output file, as well as a byte counter for the output file.

\langle Globals in the outer block 11 $\rangle + \equiv$
pk_name: *c_string*; { name of input and output files }
cur_loc: *integer*; { how many bytes have we read? }

34* We shall use a set of simple functions to read the next byte or bytes from *pk_file*. There are seven possibilities, each of which is treated as a separate function in order to minimize the overhead for subroutine calls. We comment out the ones we don't need.

```

define pk_byte  $\equiv$  get_byte
define pk_loc  $\equiv$  cur_loc
function get_byte: integer; { returns the next byte, unsigned }
  var b: eight_bits;
  begin if eof(pk_file) then get_byte  $\leftarrow$  0
  else begin read(pk_file, b); incr(cur_loc); get_byte  $\leftarrow$  b;
  end;
end;
@{
function signed_byte: integer; { returns the next byte, signed }
  var b: eight_bits;
  begin read(pk_file, b); incr(cur_loc);
  if b < 128 then signed_byte  $\leftarrow$  b else signed_byte  $\leftarrow$  b - 256;
  end;
@}
function get_two_bytes: integer; { returns the next two bytes, unsigned }
  var a, b: eight_bits;
  begin read(pk_file, a); read(pk_file, b); cur_loc  $\leftarrow$  cur_loc + 2; get_two_bytes  $\leftarrow$  a * 256 + b;
  end;
@{
function signed_pair: integer; { returns the next two bytes, signed }
  var a, b: eight_bits;
  begin read(pk_file, a); read(pk_file, b); cur_loc  $\leftarrow$  cur_loc + 2;
  if a < 128 then signed_pair  $\leftarrow$  a * 256 + b
  else signed_pair  $\leftarrow$  (a - 256) * 256 + b;
  end;
@}
@{
function get_three_bytes: integer; { returns the next three bytes, unsigned }
  var a, b, c: eight_bits;
  begin read(pk_file, a); read(pk_file, b); read(pk_file, c); cur_loc  $\leftarrow$  cur_loc + 3;
  get_three_bytes  $\leftarrow$  (a * 256 + b) * 256 + c;
  end;
@}
@{
function signed_trio: integer; { returns the next three bytes, signed }
  var a, b, c: eight_bits;
  begin read(pk_file, a); read(pk_file, b); read(pk_file, c); cur_loc  $\leftarrow$  cur_loc + 3;
  if a < 128 then signed_trio  $\leftarrow$  (a * 256 + b) * 256 + c
  else signed_trio  $\leftarrow$  ((a - 256) * 256 + b) * 256 + c;
  end;
@}
function signed_quad: integer; { returns the next four bytes, signed }
  var a, b, c, d: eight_bits;
  begin read(pk_file, a); read(pk_file, b); read(pk_file, c); read(pk_file, d); cur_loc  $\leftarrow$  cur_loc + 4;
  if a < 128 then signed_quad  $\leftarrow$  ((a * 256 + b) * 256 + c) * 256 + d
  else signed_quad  $\leftarrow$  (((a - 256) * 256 + b) * 256 + c) * 256 + d;
  end;

```

35* This module was needed when output was directed to *typ_file*. It is not needed when output goes to *stdout*.

36* As we are reading the packed file, we often need to fetch 16 and 32 bit quantities. Here we have two procedures to do this.

define *get_16* \equiv *get_two_bytes*

define *get_32* \equiv *signed_quad*

52* If any specials are found, we write them out here.

```

define four_cases(#) ≡ #, # + 1, # + 2, # + 3
procedure skip_specials;
var i, j: integer;
begin repeat flag_byte ← pk_byte;
  if flag_byte ≥ 240 then
    case flag_byte of
      four_cases(pk_xxx1): begin t_print((pk_loc - 1) : 1, ^:␣Special:␣^^); i ← 0;
        for j ← pk_xxx1 to flag_byte do i ← 256 * i + pk_byte;
        for j ← 1 to i do t_print(xchr[pk_byte]);
        t_print_ln(^^^);
        end;
      pk_yyy: begin t_print((pk_loc - 1) : 1); t_print_ln(^:␣Num␣special:␣^, get_32 : 1);
        end;
      pk_post: t_print_ln((pk_loc - 1) : 1, ^:␣Postamble^);
      pk_no_op: t_print_ln((pk_loc - 1) : 1, ^:␣No␣op^);
      pk_pre, pk_undefined: abort(^Unexpected␣^, flag_byte : 1, ^!^);
    endcases;
until (flag_byte < 240) ∨ (flag_byte = pk_post);
end;

```

53* **Terminal communication.** There isn't any.

54* So there is no **procedure** *dialog*.

55* **The main program.** Now that we have all the pieces written, let us put them together.

```

begin initialize; open_pk_file; ⟨Read preamble 38⟩;
skip_specials;
while flag_byte ≠ pk_post do
  begin ⟨Unpack and write character 40⟩;
  skip_specials;
  end;
j ← 0;
while ¬eof(pk_file) do
  begin i ← pk_byte;
  if i ≠ pk_no_op then abort(`Bad_byte_at_end_of_file:`, i : 1);
  t_print_ln((pk_loc - 1) : 1, `:No_op`); incr(j);
  end;
t_print_ln(pk_loc : 1, `bytes_read_from_packed_file.`);
end.

```

56* **System-dependent changes.** Parse a Unix-style command line.

```

define argument_is(#) ≡ (strcmp(long_options[option_index].name, #) = 0)
⟨Define parse_arguments 56*⟩ ≡
procedure parse_arguments;
const n_options = 2; { Pascal won't count array lengths for us. }
var long_options: array [0 .. n_options] of getopt_struct;
    getopt_return_val: integer; option_index: c_int_type; current_option: 0 .. n_options;
begin ⟨Define the option table 57*⟩;
repeat getopt_return_val ← getopt_long_only(argc, argv, ``, long_options, address_of(option_index));
    if getopt_return_val = -1 then
        begin do_nothing;
        end
    else if getopt_return_val = `?` then
        begin usage(my_name);
        end
    else if argument_is(`help`) then
        begin usage_help(PKTYPE_HELP, nil);
        end
    else if argument_is(`version`) then
        begin print_version_and_exit(banner, nil, `Tomas_Rokicki`, nil);
        end; { Else it was just a flag; getopt has already done the assignment. }
until getopt_return_val = -1; { Now optind is the index of first non-option on the command line. }
if (optind + 1 ≠ argc) then
    begin write_ln(stderr, my_name, `: Need exactly one file argument.`); usage(my_name);
    end;
end;

```

This code is used in section 4*.

57* Here are the options we allow. The first is one of the standard GNU options.

```

⟨Define the option table 57*⟩ ≡
    current_option ← 0; long_options[current_option].name ← `help`;
    long_options[current_option].has_arg ← 0; long_options[current_option].flag ← 0;
    long_options[current_option].val ← 0; incr(current_option);

```

See also sections 58* and 59*.

This code is used in section 56*.

58* Another of the standard options.

```

⟨Define the option table 57*⟩ +≡
    long_options[current_option].name ← `version`; long_options[current_option].has_arg ← 0;
    long_options[current_option].flag ← 0; long_options[current_option].val ← 0; incr(current_option);

```

59* An element with all zeros always ends the list.

```

⟨Define the option table 57*⟩ +≡
    long_options[current_option].name ← 0; long_options[current_option].has_arg ← 0;
    long_options[current_option].flag ← 0; long_options[current_option].val ← 0;

```

60* Index. Pointers to error messages appear here together with the section numbers where each identifier is used.

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