The PKtype processor

(Version 2.3, 23 April 2020)

Editor's Note: The present variant of this C/WEB source file has been modified for use in the TEX Live system.

The following sections were changed by the change file: 2, 4, 5, 6, 8, 10, 31, 32, 33, 34, 35, 36, 52, 53, 54, 55, 56, 57, 58, 59, 60.

The preparation of this report was supported in part by the National Science Foundation under grants IST-8201926 and MCS-8300984, and by the System Development Foundation.

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 ≡ 0 .. 255
define text_char ≡ 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.* ⟨ Globals in the outer block 11 ⟩ +≡
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 ← *kpse_open_file*(*cmdline*(1), *kpse_pk_format*); *cur_loc* ← 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.

⟨ Globals in the outer block 11 ⟩ +≡
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 ≡ get_byte
  define pk_loc ≡ cur_loc
function get_byte: integer;  { returns the next byte, unsigned }
  var b: eight_bits;
  begin if eof(pk_file) then get_byte ← 0
  else begin read(pk_file, b); incr(cur_loc); get_byte ← 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 ← b else signed_byte ← 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 ← cur_loc + 2; get_two_bytes ← 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 ← cur_loc + 2;
    if a < 128 then signed_pair ← a ∗ 256 + b
    else signed_pair ← (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 ← cur_loc + 3;
    get_three_bytes ← (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 ← cur_loc + 3;
    if a < 128 then signed_trio ← (a ∗ 256 + b) ∗ 256 + c
    else signed_trio ← ((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 ← cur_loc + 4;
  if a < 128 then signed_quad ← ((a ∗ 256 + b) ∗ 256 + c) ∗ 256 + d
  else signed_quad ← (((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* ≡ *get_two_bytes*
define *get_32* ≡ *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.

The following sections were changed by the change file: 2, 4, 5, 6, 8, 10, 31, 32, 33, 34, 35, 36, 52, 53, 54, 55, 56, 57, 58, 59, 60.

⟨ Create normally packed raster 50 ⟩ Used in section 48.
⟨ Define *parse_arguments* 56* ⟩ Used in section 4*.
⟨ Define the option table 57*, 58*, 59* ⟩ Used in section 56*.
⟨ Get raster by bits 49 ⟩ Used in section 48.
⟨ Globals in the outer block 11, 31*, 33*, 37, 39, 41, 47, 51 ⟩ Used in section 4*.
⟨ Packed number procedure 23 ⟩ Used in section 46.
⟨ Read and translate raster description 48 ⟩ Used in section 40.
⟨ Read extended short character preamble 43 ⟩ Used in section 40.
⟨ Read long character preamble 42 ⟩ Used in section 40.
⟨ Read preamble 38 ⟩ Used in section 55*.
⟨ Read short character preamble 44 ⟩ Used in section 40.
⟨ Set initial values 12, 13 ⟩ Used in section 4*.
⟨ Types in the outer block 9, 10*, 30 ⟩ Used in section 4*.
⟨ Unpack and write character 40 ⟩ Used in section 55*.