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1. Introduction. This short program sorts the mini-indexes of listings prepared by CTWILL.

More precisely, suppose you have said `ctwill foo.w`, getting a file `foo.tex`, and that you’ve then said `tex foo.tex`, getting files `foo.dvi` and `foo.ref`. If you’re happy with `foo.dvi` except for the alphabetic order of the mini-indexes, you can then say

```
refsort <foo.ref >foo.sref
```

after which `tex foo` will produce `foo.dvi` again, this time with the mini-indexes in order.

Still more precisely, this program reads from standard input a file consisting of groups of unsorted lines and writes to standard output a file consisting of groups of sorted lines. Each input group begins with an identification line whose first character is `!`; the remaining characters are a page number. The other lines in the group all have the form

$$+_ \alpha _ \{ \kappa \} \omega$$

where α is a string containing no spaces, $_$ is a single character, κ is a string of letters, digits, and $_$ ’s, and ω is an arbitrary string. The output groups contain the same lines without the initial `+_`, sorted alphabetically with respect to the κ fields, followed by a closing line that says ‘`\donewithpage`’ followed by the page number copied from the original identification line.

Exception: In the case of a “custom” identifier, $_ \{ \kappa \}$ takes the alternative form $\$ _ \kappa _ \$$ instead.

We define limits on the number and size of mini-index entries that should be plenty big enough.

```
#define max_key 30    ▷ greater than the length of the longest identifier ◁
#define max_size 100  ▷ greater than the length of the longest mini-index entry ◁
#define max_items 300 ▷ the maximum number of items in a single mini-index ◁
```

2. Here's the layout of the C program:

```
#define abort(c,m)
    {
        fprintf(stderr,"%s!\n%s",m,buf); return c;
    }

#include "stdio.h"
#include "strings.h"
#include "ctype.h"

typedef struct {
    char key[max_key];
    char entry[max_size];
} item;
item items[max_items];    ▷ all items of current group ◁
item *sorted[max_items];  ▷ pointers to items in alphabetic order ◁
char cur_page[10];        ▷ page number, as a string ◁
char buf[max_size];       ▷ current line of input ◁
char *input_status;       ▷ Λ if end of input reached, else buf ◁

main()
{
    register char *p, *q;
    register int n;        ▷ current number of items ◁
    register item *x, **y;

    input_status ← fgets(buf, max_size, stdin);
    while (input_status) {
        ◁ Check that buf contains a valid page-number line 3 ◁;
        ◁ Read and sort additional lines, until buf terminates a group 4 ◁;
        ◁ Output the current group 5 ◁;
    }
    return 0;    ▷ normal exit ◁
}
```

3. ◁ Check that *buf* contains a valid page-number line 3 ◁ ≡
if (**buf* ≠ '!') *abort*(-1, "missing '!');
if (*strlen*(*buf* + 1) > 11) *abort*(-2, "page_number_too_long");
for (*p* ← *buf* + 1, *q* ← *cur_page*; **p* ≠ '\n'; *p*++) **q*++ ← **p*;
**q* ← '\0';

This code is used in section 2.

4. ◁ Read and sort additional lines, until *buf* terminates a group 4 ◁ ≡
n ← 0;
while (1) {
input_status ← *fgets*(*buf*, *max_size*, *stdin*);
if (*input_status* ≡ Λ ∨ **buf* ≠ '+') **break**;
x ← &*items*[*n*]; ◁ Copy *buf* to item *x* 6 ◁;
 ◁ Sort the new item into its proper place 8 ◁;
if (++*n* > *max_items*) *abort*(-11, "too_many_lines_in_group");
}

This code is used in section 2.

5. ⟨Output the current group 5⟩ ≡

```
{
  register int k;
  for (y ← sorted; y < sorted + n; y++) printf("%s\n", (*y)→entry);
  printf("\\donewithpage%s\n", cur_page);
}
```

This code is used in section 2.

6. Sorting. We convert the key to lowercase as we copy it, and we omit backslashes. We also convert `_` to `␣`. Then `_` will be alphabetically less than alphabetic letters, as desired.

```

⟨Copy buf to item x 6⟩ ≡
  if (*(buf + 1) ≠ '␣') abort(-3, "missing_␣blank_␣after_␣+");
  ⟨Scan past α 9⟩;
  if (*p ≠ '␣') abort(-4, "missing_␣blank_␣after_␣alpha");
  if (*(p + 1) ≡ '$') ⟨Process a custom-formatted identifier 7⟩
  else {
    if (*(p + 1) ≠ '\\') abort(-5, "missing_␣backslash");
    if (¬*(p + 2)) abort(-6, "missing_␣control_␣code");
    if (*(p + 3) ≠ '{') abort(-7, "missing_␣left_␣brace");
    for (p += 4, q ← x-key; *p ≠ '}' ∧ *p; p++) {
      if (*p ≠ '\\') {
        if (isupper(*p)) *q++ ← *p + ('a' - 'A');
        else if (*p ≡ '_') *q++ ← '␣';
        else *q++ ← *p;
      }
    }
    if (*p ≠ '}') abort(-8, "missing_␣right_␣brace");
  }
  if (q ≥ &x-key[max_key]) abort(-9, "key_␣too_␣long");
  *q ← '\\0'; ⟨Copy the buffer to x-entry 10⟩;
  if (p ≡ buf + max_size - 1) abort(-10, "entry_␣too_␣long");
  *(q - 1) ← '\\0';

```

This code is used in section 4.

```

7. ⟨Process a custom-formatted identifier 7⟩ ≡
  {
    if (*(p + 2) ≠ '\\') abort(-11, "missing_␣custom_␣backlash");
    for (p += 3, q ← x-key; *p ≠ '␣' ∧ *p; p++) {
      if (isupper(*p)) *q++ ← *p + ('a' - 'A');
      else *q++ ← *p;
    }
    if (*p ≠ '␣') abort(-12, "missing_␣custom_␣space");
    if (*(p + 1) ≠ '$') abort(-13, "missing_␣custom_␣dollarsign");
  }

```

This code is used in section 6.

```

8. ⟨Sort the new item into its proper place 8⟩ ≡
  for (y ← &sorted[n]; y > &sorted[0] ∧ strcmp((*(y - 1))-key, x-key) > 0; y--) *y ← *(y - 1);
  *y ← x;

```

This code is used in section 4.

9. A bugfix. The program specification had a subtle bug: There are cases where α includes spaces that should be removed in the output.

These cases occur when a space occurs after an odd number of doublequote characters. Ergo, the following routine replaced a simpler original loop.

```

⟨Scan past  $\alpha$  9⟩ ≡
{
  register int toggle ← 0;
  for ( $p \leftarrow buf + 2$ ; ( $*p \neq ' \_ '$   $\vee$  toggle)  $\wedge$   $*p$ ;  $p++$ )
    if ( $*p \equiv ' \"'$ ) toggle  $\oplus=$  1;
}

```

This code is used in section 6.

10. A corresponding change to the copying loop is also needed.

```

⟨Copy the buffer to  $x$ -entry 10⟩ ≡
{
  register int toggle ← 0;
  for ( $p \leftarrow buf + 2$ ,  $q \leftarrow x$ -entry; ( $*p \neq ' \_ '$   $\vee$  toggle)  $\wedge$   $*p$ ;  $p++$ ) {
    if ( $*p \equiv ' \"'$ ) toggle  $\oplus=$  1;
    if ( $*p \neq ' \_ '$ )  $*q++ \leftarrow *p$ ;
  }
  for (;  $*p$ ;  $p++$ )  $*q++ \leftarrow *p$ ;
}

```

This code is used in section 6.

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- ⟨ Check that *buf* contains a valid page-number line 3 ⟩ Used in section 2.
- ⟨ Copy the buffer to *x-entry* 10 ⟩ Used in section 6.
- ⟨ Copy *buf* to item *x* 6 ⟩ Used in section 4.
- ⟨ Output the current group 5 ⟩ Used in section 2.
- ⟨ Process a custom-formatted identifier 7 ⟩ Used in section 6.
- ⟨ Read and sort additional lines, until *buf* terminates a group 4 ⟩ Used in section 2.
- ⟨ Scan past α 9 ⟩ Used in section 6.
- ⟨ Sort the new item into its proper place 8 ⟩ Used in section 4.

REFSORT

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