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ECE 357
10/03/2019

Program 2: Recursive filesystem lister

<Source Code>

```
 1  #include <sys/types.h>
 2  #include <sys/stat.h>
 3  #include <stdio.h>
 4  #include <time.h>
 5  #include <dirent.h>
 6  #include <errno.h>
 7  #include <unistd.h>
 8  #include <string.h>
 9  #include <pwd.h>
10  #include <grp.h>
11  #include <stdlib.h>
12  #include <sys/param.h>
13  #include <stdbool.h>
14  #include <ctype.h>
15
16
17  void permission(struct stat st){
18      static char permission[10];
19      if((st.st_mode&S_IFMT)==S_IFDIR) permission[0] = 'd';
20      else if((st.st_mode&S_IFMT)==S_IFREG) permission[0] = '-';
21      else if((st.st_mode&S_IFMT)==S_IFLNK) permission[0] = 'l';
22      else if((st.st_mode&S_IFMT)==S_IFCHR) permission[0] = 'c';
23      else if((st.st_mode&S_IFMT)==S_IFBLK) permission[0] = 'b';
24      else if((st.st_mode&S_IFMT)==S_IFIFO) permission[0] = 'p';
25      else if((st.st_mode&S_IFMT)==S_IFSOCK) permission[0] = 's';
26
27      for(int i=1;i<10;i++) permission[i] = '-';
28      if(st.st_mode&S_IRUSR) permission[1] = 'r';
29      if(st.st_mode&S_IWUSR) permission[2] = 'w';
30      if(st.st_mode&S_ISUID){
31          if(st.st_mode&S_IXUSR) permission[3] = 's';
32          else if(!(st.st_mode&S_IXUSR)) permission[3] = 'S';
33      }
34      else if(!(st.st_mode&S_ISUID)&&(st.st_mode&S_IXUSR)) permission[3] = 'x';
```

```
35    if(st.st_mode&S_IRGRP) permission[4] = 'r';
36    if(st.st_mode&S_IWGRP) permission[5] = 'w';
37    if(st.st_mode&S_ISGID){
38       if(st.st_mode&S_IXGRP) permission[6] = 's';
39       else if(!(st.st_mode&S_IXGRP)) permission[6] = 'S';
40    }
41    else if(!(st.st_mode&S_ISGID)&&(st.st_mode&S_IXGRP)) permission[6] = 'x';
42    if(st.st_mode&S_IROTH) permission[7] = 'r';
43    if(st.st_mode&S_IWOTH) permission[8] = 'w';
44    if(st.st_mode&S_ISVTX){
45       if(st.st_mode&S_IXOTH) permission[9] = 't';
46       else if(!(st.st_mode&S_IXOTH)) permission[9] = 'T';
47    }
48    else if(!(st.st_mode&S_ISVTX)&&(st.st_mode&S_IXOTH)) permission[9] = 'x';
49
50    printf("%s\t", permission);
51 }
52
53 void username(struct stat st){
54    struct passwd *p;
55    if((p = getpwuid(st.st_uid))==NULL){
56       if(errno == 0) printf("%d\t", st.st_uid);
57       else perror("Error: getpwuid():\n");
58    }
59    else printf("%s\t", p->pw_name);
60 }
61
62 void groupname(struct stat st){
63    struct group *g;
64    if((g = getgrgid(st.st_gid))==NULL){
65       if(errno == 0) printf("%d\t", st.st_gid);
66       else perror("Error: getgrgid():\n");
67    }
68    else printf("%s\t", g->gr_name);
69 }
70
71 void size(struct stat st){
72    if(((st.st_mode&S_IFMT)==S_IFBLK)||((st.st_mode&S_IFMT)==S_IFCHR)){
73       printf("%d, %d\t", major(st.st_rdev), minor(st.st_rdev));
74    }
75    else printf("%lld\t", st.st_size);
76 }
77
```

```
78 void ttime(struct stat st){
79    char time[20];
80    time_t t = st.st_mtime;
81    struct tm lt;
82    localtime_r(&t, &lt);
83    strftime(time, 20, "%b %d %H:%M", &lt);
84    printf("%s\t", time);
85 }
86
87 void printls(struct stat st, char *path){
88    printf("%llu\t", st.st_ino);
89    printf("%lld\t", st.st_blocks/2);
90    permission(st);
91    printf("%d\t", st.st_nlink);
92    username(st);
93    groupname(st);
94    size(st);
95    ttime(st);
96    printf("%s", path);
97    if((st.st_mode&S_IFMT)==S_IFLNK){
98       char symlink[MAXPATHLEN] = {};
99       ssize_t length;
100      if((length = readlink(path, symlink, sizeof(symlink)-1))==-1){
101         perror("Error: failed to read symbolic link path\n");
102      }
103      else printf(" -> %s\n", symlink);
104   }
105   else printf("\n");
106}
107
108bool diff_mount(struct stat st, int v){
109   if(st.st_dev != v) return true;
110   return false;
111}
112
113bool checktime(time_t t, struct stat st){
114   time_t currenttime;
115   time(&currenttime);
116   if(t==0) return true;
117   else if(t>0){
118      if(st.st_mtime<currenttime-t) return true;
119   }
120   else if(t<0){
```

```
121        if(st.st_mtime>currenttime+t) return true;
122    }
123    return false;
124 }
125
126 void find(char argv[], int v, time_t t){
127    struct dirent *entry;
128    DIR *dir;
129    struct stat st;
130
131    if((dir = opendir(argv))==NULL){
132       fprintf(stderr, "Error: failed to open %s: %s\n", argv, strerror(errno));
133       return;
134    }
135    errno = 0;
136    while((entry = readdir(dir))){
137       char path[MAXPATHLEN];
138
139       snprintf(path, MAXPATHLEN, "%s/%s", argv, entry->d_name);
140       if(strcmp(entry->d_name, ".") != 0 && strcmp(entry->d_name, "..") != 0){
141          if(lstat(path,&st)==-1){
142             fprintf(stderr, "Error: failed to get status of %s:%s\n", argv, strerror(errno));
143             return;
144          }
145          if(checktime(t,st)) printls(st,path);
146          if((st.st_mode&S_IFMT)==S_IFDIR){
147             if(v==-1) find(path, v, t);
148             else if(diff_mount(st,v)) printf("note: not crossing mount point at %s\n", path);
149             else if(!diff_mount(st,v)) find(path,v, t);
150          }
151       }
152    }
153    if(errno != 0) fprintf(stderr, "Error: failed to read %s:%s\n", argv, strerror(errno));
154    if(closedir(dir)==-1){
155       fprintf(stderr, "Error: failed to close %s:%s\n", argv, strerror(errno));
156    }
157 }
158
159 int main(int argc, char *argv[]){
160    int cmd;
161    int v = -1;
162    int argcount = 2;
163    time_t t = 0;
```

```
164    opterr = 0;
165    struct stat st;
166    lstat(argv[argc-1],&st);
167
168    while((cmd=getopt(argc,argv,"m:v"))!=-1){
169        switch(cmd){
170        case 'm':
171            for(int i=0;i<strlen(optarg);i++){
172                if(((isdigit(optarg[i]))==0)&&(optarg[0]!='-')){
173                    fprintf(stderr, "Error: %c is not a valid number\n", optarg[i]);
174                    return 0;
175                }
176            }
177            t = atoi(optarg);
178            argcount += 2;
179            break;
180        case 'v':
181            v = st.st_dev;
182            argcount++;
183            break;
184        case '?':
185            printf("usage: find [-m time| -v] path\n");
186            exit(errno);
187        }
188    }
189    if(argc<=1||argc!=argcount){
190        fprintf(stderr, "Error: not enough arguments\n");
191        printf("usage: find [-m time| -v] path\n");
192        exit(errno);
193    }
194    else if(argc>1 && argc==argcount){
195        printf("inode#\tblock#\tfile
permission\tnlink\towner\tgroup\tsize\ttime\t\tpathname\n");
196        if((st.st_mode&S_IFMT) == S_IFDIR){
197            printls(st, argv[argc-1]);
198            find(argv[argc-1], v, t);
199            return 0;
200        }
201        else printls(st, argv[argc-1]);
202        printf("\n");
203    }
204    return 0;
205}
```

```
Last login: Thu Oct  3 22:53:04 on ttys000
[Theos-MacBook-Pro:~ tioteo$ ComOS
[Theos-MacBook-Pro:ComOS tioteo$ cd program2
[Theos-MacBook-Pro:program2 tioteo$ find . -ls
 4503380        0 drwxr-xr-x   16 tioteo          staff              512 Oct  3 22:56 .
 5818138       16 -rw-r--r--    1 tioteo          staff             7479 Oct  3 22:25 ./temp.c
 5869933       16 -rw-r--r--    1 tioteo          staff             6148 Oct  3 22:52 ./.DS_Store
 5449260      744 -rw-r--r--    1 tioteo          staff           376904 Sep 25 15:56 ./pset2.pdf
 5869931        0 drwxr-xr-x    4 tioteo          staff              128 Sep 30 08:38 ./pset
 5449232     1200 -rwxr-xr-x    1 tioteo          staff           557019 Sep 25 15:56 ./pset/pset2.pages
 4503390       40 -rw-r--r--    1 tioteo          staff            16469 Sep 19 15:50 ./pset/pset-w02.pdf
 5869939        0 drwxr-xr-x    3 tioteo          staff               96 Oct  1 00:56 ./test1
 5908162        8 -rw-r--r--    1 tioteo          staff               21 Oct  1 00:56 ./test1/t1
 6133625       32 -rwxr-xr-x    1 tioteo          staff            14312 Oct  3 22:53 ./1
 5620829        8 -rw-r--r--    1 tioteo          staff              520 Sep 28 22:36 ./readdir.c
 4503368      344 -rw-r--r--    1 tioteo          staff           172210 Sep 19 15:50 ./lecture-w02.pdf
 5637051        8 -rw-r--r--    1 tioteo          staff             1717 Oct  3 22:23 ./stat.c
 5652952       16 -rw-r--r--    1 tioteo          staff             6879 Oct  3 17:52 ./test.c
 5869942        0 drwxr-xr-x    3 tioteo          staff               96 Sep 30 08:40 ./test3
 5870003        0 -rw-r--r--    1 tioteo          staff                0 Sep 30 08:40 ./test3/t3
 5869940        0 drwxr-xr-x    5 tioteo          staff              160 Oct  1 00:55 ./test2
 5869954       16 -rw-r--r--    1 tioteo          staff             6148 Sep 30 13:24 ./test2/.DS_Store
 5908044        8 -rw-r--r--    1 tioteo          staff               12 Oct  1 00:55 ./test2/t2
 5869944        0 drwxr-xr-x    3 tioteo          staff               96 Sep 30 13:24 ./test2/test4
 5869995        0 -rw-r--r--    1 tioteo          staff                0 Sep 30 08:40 ./test2/test4/t4
 5655221       16 -rw-r--r--    1 tioteo          staff             6200 Oct  3 22:54 ./find.c
 6133735      488 -rwxr-xr-x    1 tioteo          staff           190414 Oct  3 22:56 ./program2.pages
[Theos-MacBook-Pro:program2 tioteo$ gcc -o find find.c
[Theos-MacBook-Pro:program2 tioteo$ ./find .
 inode#  block#  file permission nlink   owner   group   size    time            pathname
 4503380 0       drwxr-xr-x      17      tioteo  staff   544     Oct 03 22:56     .
 5818138 8       -rw-r--r--      1       tioteo  staff   7479    Oct 03 22:25     ./temp.c
 5869933 8       -rw-r--r--      1       tioteo  staff   6148    Oct 03 22:52     ./.DS_Store
 5449260 372     -rw-r--r--      1       tioteo  staff   376904  Sep 25 15:56     ./pset2.pdf
 5869931 0       drwxr-xr-x      4       tioteo  staff   128     Sep 30 08:38     ./pset
 5449232 600     -rwxr-xr-x      1       tioteo  staff   557019  Sep 25 15:56     ./pset/pset2.pages
 4503390 20      -rw-r--r--      1       tioteo  staff   16469   Sep 19 15:50     ./pset/pset-w02.pdf
 5869939 0       drwxr-xr-x      3       tioteo  staff   96      Oct 01 00:56     ./test1
 5908162 4       -rw-r--r--      1       tioteo  staff   21      Oct 01 00:56     ./test1/t1
 6133625 16      -rwxr-xr-x      1       tioteo  staff   14312   Oct 03 22:53     ./1
 5620829 4       -rw-r--r--      1       tioteo  staff   520     Sep 28 22:36     ./readdir.c
 4503368 172     -rw-r--r--      1       tioteo  staff   172210  Sep 19 15:50     ./lecture-w02.pdf
 5637051 4       -rw-r--r--      1       tioteo  staff   1717    Oct 03 22:23     ./stat.c
 5652952 8       -rw-r--r--      1       tioteo  staff   6879    Oct 03 17:52     ./test.c
 5869942 0       drwxr-xr-x      3       tioteo  staff   96      Sep 30 08:40     ./test3
 5870003 0       -rw-r--r--      1       tioteo  staff   0       Sep 30 08:40     ./test3/t3
 6133876 16      -rwxr-xr-x      1       tioteo  staff   14312   Oct 03 22:56     ./find
 5869940 0       drwxr-xr-x      5       tioteo  staff   160     Oct 01 00:55     ./test2
 5869954 8       -rw-r--r--      1       tioteo  staff   6148    Sep 30 13:24     ./test2/.DS_Store
 5908044 4       -rw-r--r--      1       tioteo  staff   12      Oct 01 00:55     ./test2/t2
 5869944 0       drwxr-xr-x      3       tioteo  staff   96      Sep 30 13:24     ./test2/test4
 5869995 0       -rw-r--r--      1       tioteo  staff   0       Sep 30 08:40     ./test2/test4/t4
 5655221 8       -rw-r--r--      1       tioteo  staff   6200    Oct 03 22:54     ./find.c
 6133735 244     -rwxr-xr-x      1       tioteo  staff   190414  Oct 03 22:56     ./program2.pages
```

```
●●●                                          program2 — -bash — 204×54

Last login: Thu Oct  3 23:02:28 on ttys000
⌈Theos-MacBook-Pro:~ tioteo$ ComOS
⌈Theos-MacBook-Pro:ComOS tioteo$ cd program2
⌈Theos-MacBook-Pro:program2 tioteo$ gcc -o find find.c
⌈Theos-MacBook-Pro:program2 tioteo$ ./find -m -10 .
inode# block# file permission nlink   owner   group   size    time        pathname
4503380 0       drwxr-xr-x     17      tioteo  staff   544     Oct 03 23:05     .
Theos-MacBook-Pro:program2 tioteo$
⌈Theos-MacBook-Pro:program2 tioteo$ █
```

```
●●●                                          program2 — -bash — 204×54

Last login: Thu Oct  3 23:04:53 on ttys000
⌈Theos-MacBook-Pro:~ tioteo$ ComOS
⌈Theos-MacBook-Pro:ComOS tioteo$ cd program2
⌈Theos-MacBook-Pro:program2 tioteo$ gcc -o find find.c
⌈Theos-MacBook-Pro:program2 tioteo$ find /dev -ls
    308      9 dr-xr-xr-x    3 root        wheel           4327 Sep 29 09:27 /dev
    309      0 crw-------    1 tioteo      staff              0 Sep 29 09:27 /dev/console
    310      0 crw-rw-rw-    1 root        wheel     0x2000000 Oct  3 15:55 /dev/tty
    311      0 crw-rw-rw-    1 root        wheel     0x3000002 Oct  3 23:08 /dev/null
    312      0 crw-rw-rw-    1 root        wheel     0x3000003 Sep 29 09:27 /dev/zero
    313      0 crw-------    1 root        wheel     0x6000000 Sep 29 09:27 /dev/klog
    314      0 crw-------    1 root        wheel     0x7000000 Sep 29 09:27 /dev/oslog
    315      0 crw-------    1 root        wheel     0x8000000 Sep 29 09:27 /dev/oslog_stream
    316      0 dr-xr-xr-x    1 root        wheel              0 Sep 29 09:27 /dev/fd
   1013      0 crw--w----    1 tioteo      tty      0x10000000 Oct  3 23:08 /dev/fd/0
   1013      0 crw--w----    1 tioteo      tty      0x10000000 Oct  3 23:08 /dev/fd/1
   1013      0 crw--w----    1 tioteo      tty      0x10000000 Oct  3 23:08 /dev/fd/2
4503380      0 drw-r--r--   17 tioteo      staff            544 Oct  3 23:05 /dev/fd/3
find: /dev/fd/3: Not a directory
4503380      0 drw-r--r--   17 tioteo      staff            544 Oct  3 23:05 /dev/fd/4
find: /dev/fd/4: Not a directory
    316      0 dr--r--r--    1 root        wheel              0 Sep 29 09:27 /dev/fd/5
    317      0 lr-xr-xr-x    1 root        wheel              0 Sep 29 09:27 /dev/stdin -> fd/0
    318      0 lr-xr-xr-x    1 root        wheel              0 Sep 29 09:27 /dev/stdout -> fd/1
    319      0 lr-xr-xr-x    1 root        wheel              0 Sep 29 09:27 /dev/stderr -> fd/2
    320      0 crw-r--r--    1 root        wheel     0x9000004 Sep 29 09:27 /dev/auditsessions
    321      0 crw-------    1 root        wheel     0xa000000 Sep 29 09:27 /dev/auditpipe
    322      0 crw-------    1 root        wheel     0xb000000 Sep 29 09:27 /dev/pf
    323      0 crw-------    1 root        wheel     0xb000001 Sep 29 09:27 /dev/pfm
    324      0 crw-rw-rw-    1 root        wheel     0x4000000 Sep 29 09:27 /dev/ttyp0
    325      0 crw-rw-rw-    1 root        wheel     0x5000000 Sep 29 09:27 /dev/ptyp0
    326      0 crw-rw-rw-    1 root        wheel     0x4000001 Sep 29 09:27 /dev/ttyp1
    327      0 crw-rw-rw-    1 root        wheel     0x5000001 Sep 29 09:27 /dev/ptyp1
    328      0 crw-rw-rw-    1 root        wheel     0x4000002 Sep 29 09:27 /dev/ttyp2
    329      0 crw-rw-rw-    1 root        wheel     0x5000002 Sep 29 09:27 /dev/ptyp2
    330      0 crw-rw-rw-    1 root        wheel     0x4000003 Sep 29 09:27 /dev/ttyp3
    331      0 crw-rw-rw-    1 root        wheel     0x5000003 Sep 29 09:27 /dev/ptyp3
    332      0 crw-rw-rw-    1 root        wheel     0x4000004 Sep 29 09:27 /dev/ttyp4
    333      0 crw-rw-rw-    1 root        wheel     0x5000004 Sep 29 09:27 /dev/ptyp4
    334      0 crw-rw-rw-    1 root        wheel     0x4000005 Sep 29 09:27 /dev/ttyp5
    335      0 crw-rw-rw-    1 root        wheel     0x5000005 Sep 29 09:27 /dev/ptyp5
    336      0 crw-rw-rw-    1 root        wheel     0x4000006 Sep 29 09:27 /dev/ttyp6
    337      0 crw-rw-rw-    1 root        wheel     0x5000006 Sep 29 09:27 /dev/ptyp6
    338      0 crw-rw-rw-    1 root        wheel     0x4000007 Sep 29 09:27 /dev/ttyp7
    339      0 crw-rw-rw-    1 root        wheel     0x5000007 Sep 29 09:27 /dev/ptyp7
    340      0 crw-rw-rw-    1 root        wheel     0x4000008 Sep 29 09:27 /dev/ttyp8
    341      0 crw-rw-rw-    1 root        wheel     0x5000008 Sep 29 09:27 /dev/ptyp8
    342      0 crw-rw-rw-    1 root        wheel     0x4000009 Sep 29 09:27 /dev/ttyp9
    343      0 crw-rw-rw-    1 root        wheel     0x5000009 Sep 29 09:27 /dev/ptyp9
    344      0 crw-rw-rw-    1 root        wheel     0x400000a Sep 29 09:27 /dev/ttypa
    345      0 crw-rw-rw-    1 root        wheel     0x500000a Sep 29 09:27 /dev/ptypa
    346      0 crw-rw-rw-    1 root        wheel     0x400000b Sep 29 09:27 /dev/ttypb
    347      0 crw-rw-rw-    1 root        wheel     0x500000b Sep 29 09:27 /dev/ptypb
    348      0 crw-rw-rw-    1 root        wheel     0x400000c Sep 29 09:27 /dev/ttypc
```

```
  627     0 crw-------   1 root      wheel          0x22000000 Sep 29 09:27 /dev/autofs_control
  629     0 crw-rw-rw-   1 root      wheel          0x23000000 Sep 29 09:27 /dev/uart.BLTH
  631     0 crw-rw-rw-   1 root      wheel          0x13000001 Sep 29 09:27 /dev/cu.Bluetooth-Incoming-Port
  633     0 crw-rw-rw-   1 root      wheel          0x13000000 Sep 29 09:27 /dev/tty.Bluetooth-Incoming-Port
  637     0 crw-rw-rw-   1 root      wheel          0x24000000 Sep 29 09:29 /dev/nsmb0
  643     0 crw-------   1 root      wheel          0x17000004 Sep 29 13:03 /dev/bpf4
 1013     0 crw--w----   1 tioteo    tty            0x10000000 Oct  3 23:08 /dev/ttys000
 1015     0 crw--w----   1 tioteo    tty            0x10000001 Oct  3 23:07 /dev/ttys001
[Theos-MacBook-Pro:program2 tioteo$ ./find /dev
inode#  block#  file permission nlink   owner   group   size    time           pathname
308     4       dr-xr-xr-x      3       root    wheel   4327    Sep 29 09:27    /dev
309     0       crw-------      1       tioteo  staff   0, 0    Sep 29 09:27    /dev/console
310     0       crw-rw-rw-      1       root    wheel   2, 0    Oct 03 15:55    /dev/tty
311     0       crw-rw-rw-      1       root    wheel   3, 2    Oct 03 23:08    /dev/null
312     0       crw-rw-rw-      1       root    wheel   3, 3    Sep 29 09:27    /dev/zero
313     0       crw-------      1       root    wheel   6, 0    Sep 29 09:27    /dev/klog
314     0       crw-------      1       root    wheel   7, 0    Sep 29 09:27    /dev/oslog
315     0       crw-------      1       root    wheel   8, 0    Sep 29 09:27    /dev/oslog_stream
316     0       dr-xr-xr-x      1       root    wheel   0       Sep 29 09:27    /dev/fd
1013    0       crw--w----      1       tioteo  tty     16, 0   Oct 03 23:08    /dev/fd/0
1013    0       crw--w----      1       tioteo  tty     16, 0   Oct 03 23:08    /dev/fd/1
1013    0       crw--w----      1       tioteo  tty     16, 0   Oct 03 23:08    /dev/fd/2
308     4       dr--r--r--      3       root    wheel   4327    Sep 29 09:27    /dev/fd/3
Error: failed to open /dev/fd/3: Not a directory
316     0       dr--r--r--      1       root    wheel   0       Sep 29 09:27    /dev/fd/4
Error: failed to open /dev/fd/4: Not a directory
Error: failed to read /dev/fd:Not a directory
317     0       lr-xr-xr-x      1       root    wheel   0       Sep 29 09:27    /dev/stdin -> fd/0
318     0       lr-xr-xr-x      1       root    wheel   0       Sep 29 09:27    /dev/stdout -> fd/1
319     0       lr-xr-xr-x      1       root    wheel   0       Sep 29 09:27    /dev/stderr -> fd/2
320     0       crw-r--r--      1       root    wheel   9, 4    Sep 29 09:27    /dev/auditsessions
321     0       crw-------      1       root    wheel   10, 0   Sep 29 09:27    /dev/auditpipe
322     0       crw-------      1       root    wheel   11, 0   Sep 29 09:27    /dev/pf
323     0       crw-------      1       root    wheel   11, 1   Sep 29 09:27    /dev/pfm
324     0       crw-rw-rw-      1       root    wheel   4, 0    Sep 29 09:27    /dev/ttyp0
325     0       crw-rw-rw-      1       root    wheel   5, 0    Sep 29 09:27    /dev/ptyp0
326     0       crw-rw-rw-      1       root    wheel   4, 1    Sep 29 09:27    /dev/ttyp1
327     0       crw-rw-rw-      1       root    wheel   5, 1    Sep 29 09:27    /dev/ptyp1
328     0       crw-rw-rw-      1       root    wheel   4, 2    Sep 29 09:27    /dev/ttyp2
329     0       crw-rw-rw-      1       root    wheel   5, 2    Sep 29 09:27    /dev/ptyp2
330     0       crw-rw-rw-      1       root    wheel   4, 3    Sep 29 09:27    /dev/ttyp3
331     0       crw-rw-rw-      1       root    wheel   5, 3    Sep 29 09:27    /dev/ptyp3
332     0       crw-rw-rw-      1       root    wheel   4, 4    Sep 29 09:27    /dev/ttyp4
333     0       crw-rw-rw-      1       root    wheel   5, 4    Sep 29 09:27    /dev/ptyp4
334     0       crw-rw-rw-      1       root    wheel   4, 5    Sep 29 09:27    /dev/ttyp5
335     0       crw-rw-rw-      1       root    wheel   5, 5    Sep 29 09:27    /dev/ptyp5
336     0       crw-rw-rw-      1       root    wheel   4, 6    Sep 29 09:27    /dev/ttyp6
337     0       crw-rw-rw-      1       root    wheel   5, 6    Sep 29 09:27    /dev/ptyp6
338     0       crw-rw-rw-      1       root    wheel   4, 7    Sep 29 09:27    /dev/ttyp7
339     0       crw-rw-rw-      1       root    wheel   5, 7    Sep 29 09:27    /dev/ptyp7
340     0       crw-rw-rw-      1       root    wheel   4, 8    Sep 29 09:27    /dev/ttyp8
341     0       crw-rw-rw-      1       root    wheel   5, 8    Sep 29 09:27    /dev/ptyp8
342     0       crw-rw-rw-      1       root    wheel   4, 9    Sep 29 09:27    /dev/ttyp9
343     0       crw-rw-rw-      1       root    wheel   5, 9    Sep 29 09:27    /dev/ptyp9
```