

# Unix-like Operating Systems

Commands: `awk` and `sed`.

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- What is the meaning of the `-n` option at command `sed`?
  - It suppresses automatic printing of pattern space (input lines).

```
cat -n /etc/passwd | sed ' '
```

```
cat -n /etc/passwd | sed -n ' '
```

- What is the meaning of the following `sed` commands?
  - `p ...` print the current pattern space (input lines),

```
cat -n /etc/passwd | sed 'p'
```

```
cat -n /etc/passwd | sed -n 'p'
```

- `d ...` delete pattern space (input lines),

```
cat -n /etc/passwd | sed 'd'
```

- `s ...` replace a portion matched regular expression.

```
ls -l / | sed 's/root/ROOT/g'
```

## sed – print/delete

- How to print the first 10 lines of the file `/etc/passwd` by command `sed`?

```
cat -n /etc/passwd | sed -n '1,10p'
```

```
cat -n /etc/passwd | sed '11,$d'
```

- How to print the last 10 lines of the file `/etc/passwd` by command `sed`?

```
cat -n /etc/passwd | \  
sed -n "$(( $(wc -l </etc/passwd) - 9 )) , \ $p"
```

- How to print line of the file `/etc/passwd`, that represents info about an user account "root" (see `man 5 passwd`)?

```
sed -En '/^root:/p' /etc/passwd
```

- How to print lines of the file `/etc/passwd`, that don't represent info about an user account "root"?

```
sed -E '/^root:/d' /etc/passwd
```



# sed – text replacement

- Use the output of command `ls -l /etc`. How to replace the first character at line, which define the file type (d, -, l), by string (dir:, file:, link:).

- ```
ls -l /etc | \  
sed -E 's/^d/dir:/' | \  
sed -E 's/^-/file:/' | \  
sed -E 's/^l/link:/'
```

- ```
ls -l /etc | \  
sed 's/^d/dir:/;s/^-/file:/;s/^l/link:/'
```

- ```
cat types.sed  
s/^d/dir:/  
s/^-/file:/  
s/^l/link:/
```

```
ls -l /etc | sed -Ef types.sed
```

# sed – text replacement

- Use the output of command `ls -l /`. How to replace all strings "root" by strings "ADMIN"?

```
ls -l / | sed 's/root/ADMIN/g'
```

- Use the output of command `ls -l /`. How to print only the second column by the command sed?

```
ls -l / | \
sed -E 's/^[^ ][^ ]* ) [ ]*([^\n]*) .*$/\2/'
```

- Explain the behaviour of command `awk`.
- Example

```
ls -l /etc | \
awk '
    BEGIN { print "Regular files and directories" ;
           f = 0;
           d = 0;
    }
    /^-/ { f++; print f, $0; }
    /^d/ { d++; print d, $0 ;}
    END   { print "Number of files:", f ;
           print "Number of directories:", d;
    },'
```

- How to print the first 10 lines of the file `/etc/passwd` by command `awk`?

```
cat -n /etc/passwd | awk 'NR<=10'
```

```
cat -n /etc/passwd | awk 'NR==1,NR==10'
```

```
cat -n /etc/passwd | \  
awk '{ if (NR <= 10) { print $0;} }'
```

- How to print the last 10 lines of the file `/etc/passwd` by command `awk`?

```
cat -n /etc/passwd | \  
awk "NR > $(( $(wc -l </etc/passwd) - 10 ))"
```



- How to print lines containing string "root" from the file /etc/group by command awk?

```
awk '/root/' /etc/group
```

- How to print lines not containing string "root" from the file /etc/group by command awk?

```
awk '!/root/' /etc/group
```

- Use output of command `getent passwd`.
- How to print lines that represent account info about users whose names are Jan or Peter or Eliska?
  - Trivial solution

```
getent passwd | \  
awk '/Jan/ ; /Peter/ ; /Eliska/'
```

- How to print lines that represent account info about users whose names are Jan or Peter or Eliska?
  - Correct solution

```
getent passwd | \
awk -F: \
'$5 ~ /^Jan / ; $5 ~ /^Peter / ; $5 ~ /^Eliska /'
```

```
cat names.awk
#!/usr/bin/awk
BEGIN { FS=":" }
$5 ~ /^Jan /
$5 ~ /^Peter /
$5 ~ /^Eliska /
```

```
getent passwd | awk -f names.awk
```

# awk – actions

- How to print the name and the size of every regular file in /etc/?

```
ls -l /etc | \
awk '/^-/ { printf("%s: %d B\n", $9,$5); }'
```

- How to print the user name and the path to home directory for every user that has account on this system?

Hint: Use command `getent passwd`.

```
getent passwd | \
awk 'BEGIN {FS=":"; OFS="..."}{print $1,$6}'
```

- How to print the user name of user that has an account on this system and has the longest name (the 5th column)?

```
getent passwd | \
awk -F: '{ l=length($5);
           if (l>m) { m=l; u=$5; } }
END{ print u; }'
```

- What is the meaning of the following `awk` functions?
  - `length(str)`  
... length of the string `str`,
  - `substr(str, from, len)`  
... the `len`-character substring of `str` starting at `from`,
  - `sub(ere, repl[, in])`  
... replace the first substring matching regular expression `ere` in the string `in`, by the string `repl`,
  - `gsub(ere, repl[, in])`  
... replace all substring matching regular expression `ere`,
  - `split(str, arr[, fs])`  
... split the string `str` into the array `arr` according to the separators array `fs`.

- Assume that the file `m.txt` has the following contents:

|   |   |   |
|---|---|---|
| 1 | 2 | 3 |
| 8 | 7 | 9 |
| 3 | 7 | 2 |

- How to change the order of columns, such that the column  $i$  ( $0 \leq i < n$ ) will be swap with column  $(n - i)$  (reverse column order).

|   |   |   |
|---|---|---|
| 3 | 2 | 1 |
| 9 | 7 | 8 |
| 2 | 7 | 3 |

```
awk '{ for (i=NF; i>0; i--) printf("%d\t", $i);  
      printf("\n"); }' m.txt
```

- Use output of command `ps -ef`. How to print info about processes which are running under the user `root`.

```
ps -ef | awk '/^ *root /'
```

```
ps -ef | nawk '{ if ($1 == "root") {print $0}; }'
```

- Use output of command `ps -eo user,rss,comm`. How to print the number of processes running under the effective identity "root" and the number of memory (RSS) allocated by these processes.
- Example of output

```
$> ps -eo user,rss,comm | awk -f ps1a.awk  
root: nproc=85 rss=602264 KB
```

- Solution A

```
$> cat ps1a.awk  
/^ *root /{  
    nproc=nproc+1  
    rss=rss+$2;  
}  
END {  
    printf("root: nproc=%d rss=%d KB\n", nproc, rss)  
}
```

- Solution B

```
$> cat ps1b.awk
BEGIN {
    user="root";
    nproc=0;
    rss=0;
}
{
    if ( $1 == user )
    {
        nproc=nproc+1;
        rss=rss+$2;
    }
}
END {
    printf("%s: nproc=%d rss=%d KB\n", user, nproc, rss)
    printf("\n");
}
```



- Use the output from the command `ps -eo user,rss,comm`.  
How to print the following information about the processes of user whose name is given?

```
user_name:  nproc=number_of_running_processes  
rss=size_of_RSS_memory_alocatted_by_these_processes,  
list=list_of_these_processes
```

- Example of output

```
$> ps -eo user,rss,comm | awk -f ps2.awk  
root: nproc=83 rss=582952 KB  
      proclist: sched, /usr/sbin/init, ...
```

## • Solution A

```
> cat ps2.awk
BEGIN {
    user="root";
    nproc=0;
    rss=0;
}
{
    if ( $1 == user )
    {
        proclist[nproc]=$3;
        nproc=nproc+1;
        rss=rss+$2;
    }
}
END {
    printf("%s: nproc=%d rss=%d KB\n", user, nproc, rss)
    printf("        proclist: ");
    for (i=0; i<nproc; i++) {
        printf("%s, ", proclist[i]);
    };
    printf("\n");
}
```

## • Solution B

```
> cat ps3.awk
BEGIN {
    nproc=0;  rss=0;
}
{
    if ( $1 == user )
    {
        proclist[nproc]=$3;
        nproc=nproc+1;
        rss=rss+$2;
    }
}
END {
    printf("%s: nproc=%d rss=%d KB\n", user, nproc, rss)
    printf("          proclist: ");
    for (i=0; i<nproc; i++) {
        printf("%s, ", proclist[i]);
    };
    printf("\n");
}
```

```
$> ps -eo user,rss,comm | nawk -v user=root -f ps3.awk
```