Report 1

Question 1: `mkdir ~/11712121`

- **mkdir** - make directories
- **~/11712121**: DIRECTORY
  - **~**: Home path
- Create the empty folder 11712121 in Home path, if they do not already exist.

```
eveneko@eveneko-server  ~  mkdir ~/11712121
eveneko@eveneko-server  ~  ls
11712121                                        Desktop
```

Question 2: `ls -la ~`

- **ls** - list directory contents
- **-a, --all**: do not ignore entries starting with.
- **-l**: use a long listing format
- Long format list (permissions, ownership, size and modification date) of all files
- show a list of information about all the file in the ~(Home path)

```
eveneko@eveneko-server  ~  ls -la ~
total 556
drwxr-xr-x 62 eveneko eveneko   4096 2月  19 17:47  .
drwxr-xr-x  9 root    root      4096 11月 18 20:00  ..
drwxrwxr-x  2 eveneko eveneko   4096 2月  19 17:37  11712121
-rw-------  1 eveneko eveneko    186 1月   6 09:13  2020-01-06-01-13-54.011-VBoxSVC-4108.log
drwxr-xr-x  2 eveneko eveneko   4096 11月 13 14:32  .android
drwxrwxr-x  7 eveneko eveneko   4096 1月  19 02:38  Astor
-rw-------  1 eveneko eveneko   1329 11月  6 18:09  .bash_history
-rw-r--r--  1 eveneko eveneko    220 11月  4 22:02  .bash_logout
-rw-r--r--  1 eveneko eveneko   3771 11月  4 22:02  .bashrc
drwxrwxr-x  2 eveneko eveneko   4096 11月  8 20:03  bminer
drwx------ 29 eveneko eveneko   4096 12月 18 05:05  .cache
drwx------ 25 eveneko eveneko   4096 12月 18 01:54  .config
drwx------  3 root    root      4096 11月  4 22:41  .dbus
drwxr-xr-x  2 eveneko eveneko   4096 12月 18 03:12  Desktop
drwxr-xr-x  8 eveneko eveneko   4096 1月  11 20:44  Documents
drwxr-xr-x  5 eveneko eveneko   4096 12月 18 03:36  Downloads
drwxr-xr-x  2 eveneko eveneko   4096 11月  8 21:14  .ethash
drwxr-xr-x  8 eveneko eveneko   4096 11月 13 15:00  Eveneko.github.io
drwx------  2 eveneko eveneko   4096 12月 18 02:03  .gconf
drwxr-xr-x  3 eveneko eveneko   4096 12月 18 01:59  .gem
-rw-r--r--  1 eveneko eveneko     95 11月 20 21:58  .gitconfig
drwx------  3 eveneko eveneko   4096 11月  4 23:21  .gnupg
drwx------  2 root    root      4096 11月  4 22:41  .gvfs
-rw-------  1 eveneko eveneko  10166 1月  20 18:25  .ICEauthority
```

Question 3: `cd ~/11712121`

- **cd** - Change Directory
- Change directory to ~/11712121

```
eveneko@eveneko-server > ~ > cd ~/11712121
eveneko@eveneko-server > ~/11712121 >
```

Question 4: `man grep`

- **man** - an interface to the on-line reference manuals
- **grep, egrep, fgrep, rgrep** - print lines matching a pattern
- **grep** searches for PATTERN in each FILE. A FILE of "-" stands for standard input. If no FILE is given, recursive searches examine the working directory, and nonrecursive searches read standard input. By default, grep prints the matching lines.
- search for `grep`'s help manual

```
GREP(1)                                 User Commands                                 GREP(1)

NAME
       grep, egrep, fgrep, rgrep – print lines matching a pattern

SYNOPSIS
       grep [OPTIONS] PATTERN [FILE...]
       grep [OPTIONS] -e PATTERN ... [FILE...]
       grep [OPTIONS] -f FILE ... [FILE...]

DESCRIPTION
       grep  searches  for PATTERN in each FILE.  A FILE of "-" stands for standard input.  If no FILE is given, recursive searches examine the working
       directory, and nonrecursive searches read standard input.  By default, grep prints the matching lines.

       In addition, the variant programs egrep, fgrep and rgrep are the same as grep -E, grep -F, and grep -r, respectively.  These  variants  are
       deprecated, but are provided for backward compatibility.

OPTIONS
   Generic Program Information
       --help Output a usage message and exit.

       -V, --version
              Output the version number of grep and exit.

   Matcher Selection
Manual page grep(1) line 1 (press h for help or q to quit)
```

Question 5: `sudo mv ~/11712121 /home & ls /home`

- **mv** - move (rename) files
- Rename SOURCE to DEST, or move SOURCE(s) to DIRECTORY
- ls - list directory contents - list directory contents
- move folder ~/11712121 to /home and list its contents

```
eveneko@eveneko-server > ~/11712121 > sudo mv ~/11712121 /home
[sudo] password for eveneko:
eveneko@eveneko-server > ~/11712121 > ls /home
11712121   astor   eve   eveneko   macromogic   user   wasm   whexy
```

Question 6: `sudo rm -r /home/11712121`

- **rm** - remove files or directories
- **-r, -R, --recursive** remove directories and their contents recursively
- delete all the contents in /home/11712121 and this directory

```
eveneko@eveneko-server > ~/11712121 > sudo rm -r /home/11712121
eveneko@eveneko-server > ~/11712121 > ls
eveneko@eveneko-server > ~/11712121 > cd
eveneko@eveneko-server > ~ > ls /home
astor   eve   eveneko   macromogic   user   wasm   whexy
```

Question 7: `sudo cp /etc/apt/sources.list /etc/apt/sources.list.bak`

- **cp** - copy files and directories
- copy the content in `/etc/apt/sources.list` to `/etc/apt/sources.list.bak`

```
eveneko@eveneko-server   ~   sudo cp /etc/apt/sources.list /etc/apt/sources.list.bak
eveneko@eveneko-server   ~   ls /etc/apt
apt.conf.d   preferences.d  sources.list~        sources.list.bak  sources.list.save  trusted.gpg.d
auth.conf.d  sources.list   sources.list.backup  sources.list.d    trusted.gpg
```

Question 8: `cat /etc/shells`

- **cat** - concatenate files and print on the standard output
- print the contents in `/etc/shells` on shell, which means the shell you have

```
eveneko@eveneko-server   ~   cat /etc/shells
# /etc/shells: valid login shells
/bin/sh
/bin/bash
/bin/rbash
/bin/dash
/bin/zsh
/usr/bin/zsh
/usr/bin/tmux
/usr/bin/screen
```
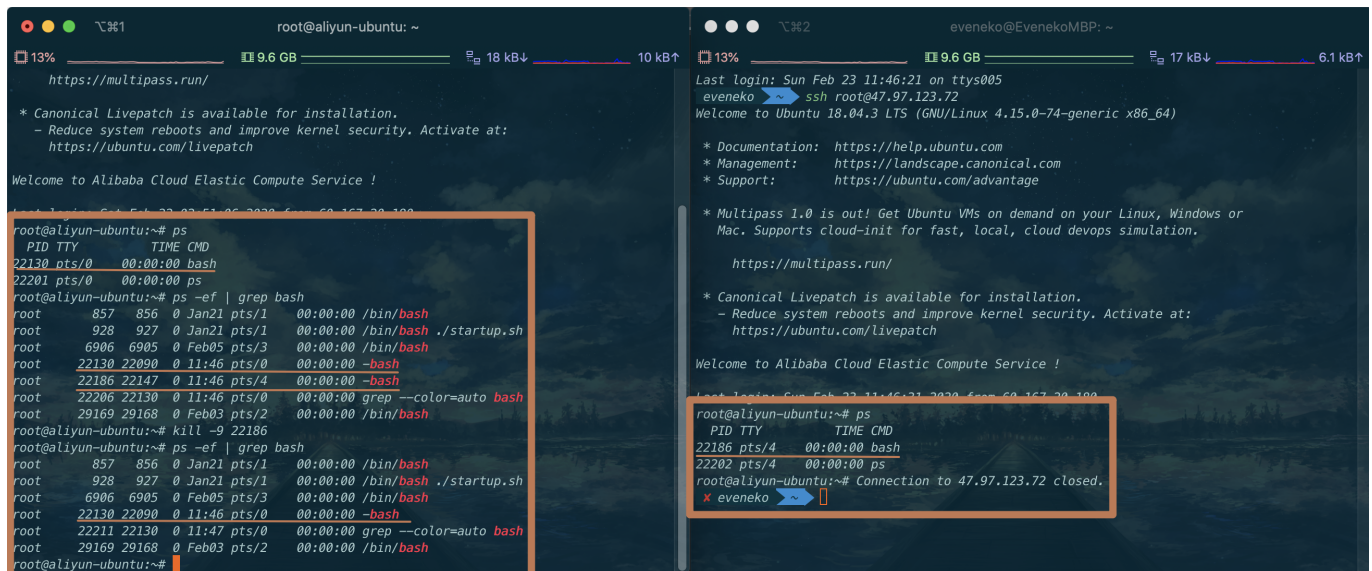
Question 9: `cat /etc/shells | grep bash`

- `|` is the pipe, can only process correct information from the previous command
- print lines matching the pattern `bash` in `/etc/shells`

```
eveneko@eveneko-server   ~   cat /etc/shells | grep bash
/bin/bash
/bin/rbash
```

Question 10: Open two terminals, find their PIDs by `ps` and kill one of them

- **ps** - report a snapshot of the current processes.
- `ps -ef | grep bash` search lines matching bash among the current processes.
- **kill** - send a signal to a process
- `kill xx` equals `kill -15 xx`, this signal means terminate(useless to kill bash)
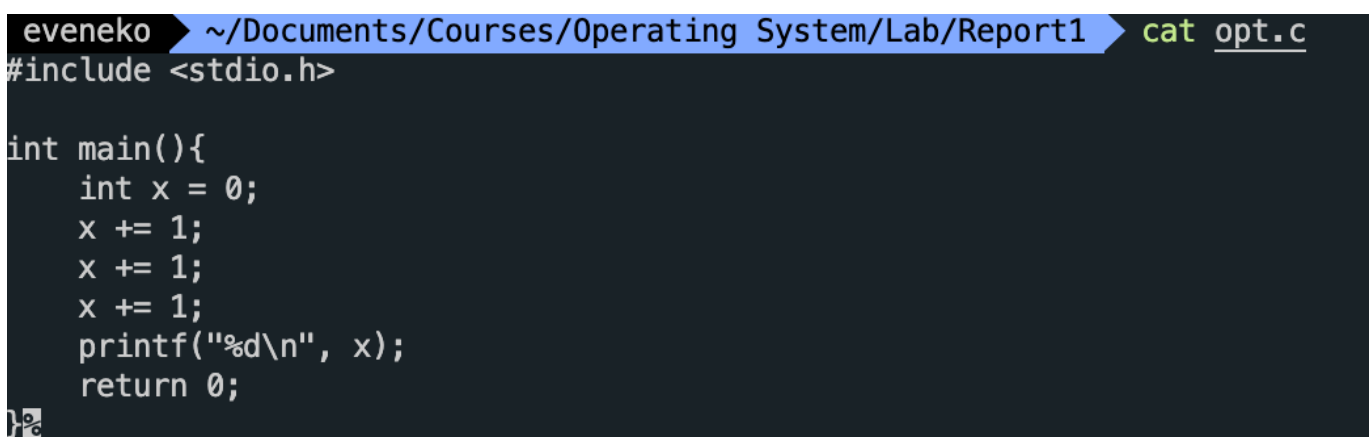- `kill -9 xx` - ILL (non-catchable, non-ignorable kill)
- kill the `bash` process

Question 11

```c
#include <stdio.h>

int main(){
    int x = 0;
    x += 1;
    x += 1;
    x += 1;
    printf("%d\n", x);
    return 0;
}
```

- gcc
  - -S Stop after the stage of compilation proper; do not assemble.
  - -o filename Place output in file file. If no parameters, gcc will do all things and output an execute file a.out
  - -O optimization flags

- do not optimize and get assembly code opt0.s

  - ```
    gcc -S opt.c -O0 -o opt0.s
    ```

- open the optimizer to get assembly code opt1.s

    - `gcc -S opt.c -O1 -o opt1.s`

- O1 optimization:

    - `-fdefer-pop`: Delay the pop time of the stack
    - `-fmerge-constants`: Try to merge the same constants across compilation units
    - `-fthread-jumps`: Optimize the order of branches
    - `-floop-optimize`: Perform loop optimization to remove constant expressions from the loop
    - `-fif-conversion`: Try to convert a conditional jump to the equivalent unbranched version.
    - `-fdelayed-branch`: This technique attempts to rearrange instructions based on instruction cycle time.
    - `-fguess-branch-probability`: The compiler uses a random pattern to guess the likelihood that a branch will be executed
    - `-fcprop-registers`: Because the registers are assigned to variables in the function, the compiler performs a second check to reduce scheduling dependencies (both segments require the same registers) and removes unnecessary register copy operations.

- Obviously, in the program, x plus 3 instead of x plus three 1.

    - o0: `addl $1, %eax`
    - o1: `movl $3, %esi`

```
eveneko   ~/Documents/Courses/Operating System/Lab/Report1   gcc -S opt.c -O0 -o opt0.s
eveneko   ~/Documents/Courses/Operating System/Lab/Report1   gcc -S opt.c -O1 -o opt1.s
```

opt0.s
```
Report1 > opt0.s
1        .section    __TEXT,__text,regular,pure_instructions
2        .build_version macos, 10, 15    sdk_version 10, 15
3        .globl  _main                   ## -- Begin function main
4        .p2align    4, 0x90
5    _main:                              ## @main
6        .cfi_startproc
7    ## %bb.0:
8        pushq   %rbp
9        .cfi_def_cfa_offset 16
10       .cfi_offset %rbp, -16
11       movq    %rsp, %rbp
12       .cfi_def_cfa_register %rbp
13       subq    $16, %rsp
14       movl    $0, -4(%rbp)
15       movl    $0, -8(%rbp)
16       movl    -8(%rbp), %eax
17       addl    $1, %eax
18       movl    %eax, -8(%rbp)
19       movl    -8(%rbp), %eax
20       addl    $1, %eax
21       movl    %eax, -8(%rbp)
22       movl    -8(%rbp), %eax
23       addl    $1, %eax
24       movl    %eax, -8(%rbp)
25       movl    -8(%rbp), %esi
26       leaq    L_.str(%rip), %rdi
27       movb    $0, %al
28       callq   _printf
29       xorl    %esi, %esi
30       movl    %eax, -12(%rbp)         ## 4-byte Spill
31       movl    %esi, %eax
32       addq    $16, %rsp
33       popq    %rbp
34       retq
35       .cfi_endproc
36                                       ## -- End function
37       .section    __TEXT,__cstring,cstring_literals
38   L_.str:                             ## @.str
39       .asciz  "%d\n"
40
41
42   .subsections_via_symbols
43
```

opt1.s
```
Report1 > opt1.s
1        .section    __TEXT,__text,regular,pure_instructions
2        .build_version macos, 10, 15    sdk_version 10, 15
3        .globl  _main                   ## -- Begin function main
4        .p2align    4, 0x90
5    _main:                              ## @main
6        .cfi_startproc
7    ## %bb.0:
8        pushq   %rbp
9        .cfi_def_cfa_offset 16
10       .cfi_offset %rbp, -16
11       movq    %rsp, %rbp
12       .cfi_def_cfa_register %rbp
13       leaq    L_.str(%rip), %rdi
14       movl    $3, %esi
15       xorl    %eax, %eax
16       callq   _printf
17       xorl    %eax, %eax
18       popq    %rbp
19       retq
20       .cfi_endproc
21                                       ## -- End function
22       .section    __TEXT,__cstring,cstring_literals
23   L_.str:                             ## @.str
24       .asciz  "%d\n"
25
26
27   .subsections_via_symbols
28
```

/Users/eveneko/Documents/Courses/Operating System/Lab/Report1/Report1.pdf   Ln 1, Col 1   Tab Size: 4   UTF-8   LF   Plain Text