

Laboratory Exercises:

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Complete the following laboratory exercises. All steps are numbered but not every step includes a question. You only need to record answers for those steps that include a question; use the number preceding the step as the question number when recording your answer. This lab expects files and users created in the Week 11 Laboratory to be present. If they are not, or if you have not completed the Week 11 Lab, you will not be able to complete this lab.

In these exercises you will:

- * modify user accounts using command-line utilities;
- * lock and unlock user accounts using command-line utilities;
- * remove a user account and create a new user account in its place using command-line utilities;
- * view the configuration and log entries created by the Systemd Journal Daemon as well as the configuration of the logrotate utility;
- * compile and install a program from source code;
- * use the rpm and yum commands to install, view, and remove an RPM package on your system;
- * use the dpkg and apt-get commands to install, view, and remove a Debian deb package on your system;
- * use common compression utilities to compress and uncompress information.

01. At the command prompt, type `usermod -l bozo2 bozo` and press Enter to change the login name for the user bozo to bozo2. Next, type `cat /etc/passwd` at the command prompt and press Enter. Was the login name changed from bozo to bozo2? Was the UID changed? Was the home directory changed?

=> login name changed

UID not changed

Home directory not changed

```

pulse:x:171:171:PulseAudio System Daemon:/var/run/pulse:/sbin/nologin
setroubleshoot:x:991:987:/:/var/lib/setroubleshoot:/sbin/nologin
avahi:x:70:70:Avahi mDNS/DNS-SD Stack:/var/run/avahi-daemon:/sbin/nologin
chrony:x:990:986:/:/var/lib/chrony:/sbin/nologin
rpc:x:32:32:Rpcbind Daemon:/var/lib/rpcbind:/sbin/nologin
usbmuxd:x:113:113:usbmuxd user:/:/sbin/nologin
gdm:x:42:42:/:/var/lib/gdm:/sbin/nologin
openvpn:x:989:985:OpenVPN:/etc/openvpn:/sbin/nologin
nm-openvpn:x:988:984:Default user for running openvpn spawned by NetworkManager:
:/sbin/nologin
radvd:x:75:75:radvd user:/:/sbin/nologin
unbound:x:987:983:Unbound DNS resolver:/etc/unbound:/sbin/nologin
qemu:x:107:107:qemu user:/:/sbin/nologin
rpcuser:x:29:29:RPC Service User:/var/lib/nfs:/sbin/nologin
nfsnobody:x:65534:65534:Anonymous NFS User:/var/lib/nfs:/sbin/nologin
gnome-initial-setup:x:986:980:/:/run/gnome-initial-setup:/sbin/nologin
nm-openconnect:x:985:979:NetworkManager user for OpenConnect:/:/sbin/nologin
sshd:x:74:74:Privilege-separated SSH:/var/empty/ssh:/sbin/nologin
tss:x:59:59:Account used by the trousers package to sandbox the tcsd daemon:/dev
/null:/sbin/nologin
tcpdump:x:72:72:/:/sbin/nologin
user1:x:1000:1000:user1:/home/user1:/bin/bash
dailyuser:x:1001:1001:/:/home/dailyuser:/bin/bash
bozo2:x:1002:1002:/:/home/bozo:/bin/bash
[root@localhost ~]#

```

02. At the command prompt, type `usermod -l bozo bozo2` and press Enter to change the login name for the user bozo2 back to bozo.

=> steps

03. At the command prompt, type `usermod -u 666 bozo` and press Enter to change the UID of the user bozo to 666. Next, type `cat /etc/passwd` at the command prompt and press Enter. Was the UID changed?

=> ~~Not~~ **Not**, UID is same

```

pulse:x:171:171:PulseAudio System Daemon:/var/run/pulse:/sbin/nologin
setroubleshoot:x:991:987:/:/var/lib/setroubleshoot:/sbin/nologin
avahi:x:70:70:Avahi mDNS/DNS-SD Stack:/var/run/avahi-daemon:/sbin/nologin
chrony:x:990:986:/:/var/lib/chrony:/sbin/nologin
rpc:x:32:32:Rpcbind Daemon:/var/lib/rpcbind:/sbin/nologin
usbmuxd:x:113:113:usbmuxd user:/:/sbin/nologin
gdm:x:42:42:/:/var/lib/gdm:/sbin/nologin
openvpn:x:989:985:OpenVPN:/etc/openvpn:/sbin/nologin
nm-openvpn:x:988:984:Default user for running openvpn spawned by NetworkManager:
:/sbin/nologin
radvd:x:75:75:radvd user:/:/sbin/nologin
unbound:x:987:983:Unbound DNS resolver:/etc/unbound:/sbin/nologin
qemu:x:107:107:qemu user:/:/sbin/nologin
rpcuser:x:29:29:RPC Service User:/var/lib/nfs:/sbin/nologin
nfsnobody:x:65534:65534:Anonymous NFS User:/var/lib/nfs:/sbin/nologin
gnome-initial-setup:x:986:980:/:/run/gnome-initial-setup:/sbin/nologin
nm-openconnect:x:985:979:NetworkManager user for OpenConnect:/:/sbin/nologin
sshd:x:74:74:Privilege-separated SSH:/var/empty/ssh:/sbin/nologin
tss:x:59:59:Account used by the trousers package to sandbox the tcsd daemon:/dev
/null:/sbin/nologin
tcpdump:x:72:72:/:/sbin/nologin
user1:x:1000:1000:user1:/home/user1:/bin/bash
dailyuser:x:1001:1001:/:/home/dailyuser:/bin/bash
bozo:x:666:1002:/:/home/bozo:/bin/bash
[root@localhost ~]#

```

04. At the command prompt, type `usermod -f 14 bozo` and press Enter to disable bozo's user account 14 days after the password expires. Next, type `cat /etc/shadow` at the command prompt and press Enter. Which field was changed?

=> 14 added in bozo property

```
setroubleshoot:!!:16966::::::
avahi:!!:16966::::::
chrony:!!:16966::::::
rpc:!!:16966:0:99999:7:::
usbmuxd:!!:16966::::::
gdm:!!:16966::::::
openvpn:!!:16966::::::
nm-openvpn:!!:16966::::::
radvd:!!:16966::::::
unbound:!!:16966::::::
qemu:!!:16966::::::
rpcuser:!!:16966::::::
nfsnobody:!!:16966::::::
gnome-initial-setup:!!:16966::::::
nm-openconnect:!!:16966::::::
sshd:!!:16966::::::
tss:!!:16966::::::
tcpdump:!!:16966::::::
user1:$6$7M.QM3b4d8e.jkCmM$EKZP7sUhc6/QU1U3vF8b9thC7moSgyoAs0j5PEASFKRz3uD2HOV.Rp
PamNkts2UviPxT0EjRFs4nyCE2tvoES1::0:99999:7:::
dailyuser:$6$i0S.YQrt$xcYxuA.WGGiyq3R8Fwmt9oKm.Ku.OnayXEkhgwwgL16N9qHQ3.jA4vgK8i
Q2vAUUjVAkRKZ.XvDY3qSqCUd5U0:17122:0:99999:7:::
bozo:$6$3ml88w/6$Mfw2PYTXS0bQJC52Jm6aKY8eLEmZ1BBX3ZU136.YkI65AcTskJoUf x1PF/10x2w
sfb4TbILJuA/U16aiORVAI1:17122:0:99999:7:14::
[root@localhost ~]#
```

05. At the command prompt, type `usermod -e "01/01/2020" bozo` and press Enter to expire bozo's user account on January 1, 2020. Next type `cat /etc/shadow` at the command prompt and press Enter. Which field was changed? What does the number represent in this field?

=> 18262 represent number of days measured from date1 (1970-01-01)

```
setroubleshoot:!!:16966::::::
avahi:!!:16966::::::
chrony:!!:16966::::::
rpc:!!:16966:0:99999:7:::
usbmuxd:!!:16966::::::
gdm:!!:16966::::::
openvpn:!!:16966::::::
nm-openvpn:!!:16966::::::
radvd:!!:16966::::::
unbound:!!:16966::::::
qemu:!!:16966::::::
rpcuser:!!:16966::::::
nfsnobody:!!:16966::::::
gnome-initial-setup:!!:16966::::::
nm-openconnect:!!:16966::::::
sshd:!!:16966::::::
tss:!!:16966::::::
tcpdump:!!:16966::::::
user1:$6$7M.QM3b4d8e.jkCmM$EKZP7sUhc6/QU1U3vF8b9thC7moSgyoAs0j5PEASFKRz3uD2HOV.Rp
PamNkts2UviPxT0EjRFs4nyCE2tvoES1::0:99999:7:::
dailyuser:$6$i0S.YQrt$xcYxuA.WGGiyq3R8Fwmt9oKm.Ku.OnayXEkhgwwgL16N9qHQ3.jA4vgK8i
Q2vAUUjVAkRKZ.XvDY3qSqCUd5U0:17122:0:99999:7:::
bozo:$6$3ml88w/6$Mfw2PYTXS0bQJC52Jm6aKY8eLEmZ1BBX3ZU136.YkI65AcTskJoUf x1PF/10x2w
sfb4TbILJuA/U16aiORVAI1:17122:0:99999:7:14:18262:
[root@localhost ~]#
```

06. At the command prompt, type `chage -m 2 bozo` and press Enter to require that the user bozo wait at least two days before making password changes. Next, type `cat /etc/shadow` at the command prompt and press Enter. Which field was changed?

=>

```
setroubleshoot:!!:16966:::
avahi:!!:16966:::
chrony:!!:16966:::
rpc:!!:16966:0:99999:7::
usbmuxd:!!:16966:::
gdm:!!:16966:::
openvpn:!!:16966:::
nm-openvpn:!!:16966:::
radvd:!!:16966:::
unbound:!!:16966:::
qemu:!!:16966:::
rpcuser:!!:16966:::
nfsnobody:!!:16966:::
gnome-initial-setup:!!:16966:::
nm-openconnect:!!:16966:::
sshd:!!:16966:::
tss:!!:16966:::
tcpdump:!!:16966:::
user1:$6$7M.QM3b4d8ejkCmM$EKZP7sUhc6/QU1U3vF8b9thC7moSgyoAs0j5PEASFKRz3uD2HOV.Rp
PamNkts2UviPXt0EjRFs4nyCE2tvoES1::0:99999:7::
dailyuser:$6$i0S.YQrt$xcYxuA.WGGiyg3R8Fwmt9oKm.Ku.OnayXEkhgwwgL16N9qHQ3.jA4vgK8i
Q2vAUUjUakRKZ.XvDY3qSqCVd5U0:17122:0:99999:7::
bozo:$6$3m188w/6$Mfw2PYTXS0bQJC52Jm6aKY8eLEmZ1BBX3ZU136.YkI65AcTskJoUf x1PF/10x2w
sfb4TbILJuA/Vi6aiORVA11:17122:2:99999:7:14:18262:
[root@localhost ~]#
```

~~17122~~ denotes date of account creation

After it, 2 added to set password expire date

07. At the command prompt, type `chage -M 40 bozo` and press Enter to require that the user bozo change passwords every 40 days. Next, type `cat /etc/shadow` at the command prompt and press Enter. Which field was changed?

=> 40 added after 2(waiting time before password change)

10. At the command prompt, type `passwd -l bozo` and press Enter to lock bozo's user account.

=>

11. At the command prompt, type `cat /etc/shadow` and press Enter. What has been changed regarding the original encrypted password recorded in Step 41?

=> **lock identifier !!**

12. Switch to a command-line terminal (tty5) by pressing Ctrl+Alt+F5 and attempt to log in to the terminal using the user name of bozo and the password of LNXrocks!. Were you successful?

=> Not, Login incorrect

13. Switch back to the command-line terminal (tty4) by pressing Ctrl+Alt+F4.

14. At the command prompt, type `passwd -u bozo` and press Enter to unlock bozo's user account.

=>

15. At the command prompt, type `cat /etc/shadow` and press Enter. Compare the encrypted password for bozo's user account with the one recorded in Step 41.

=> lock identifier !! removed

16. Switch to another command-line terminal (tty5) by pressing Ctrl+Alt+F5 and attempt to log in to the terminal using the user name of bozo and the password of LNXrocks!. Were you successful?

=>

Yes. Failed attempts also counted

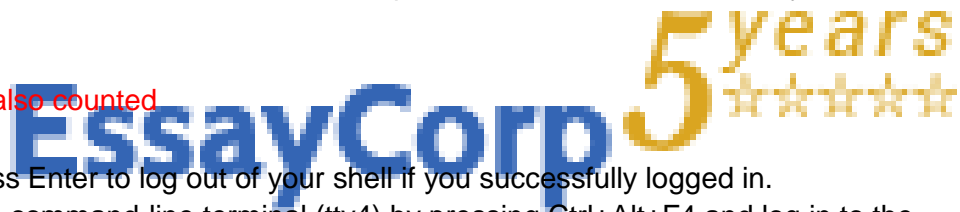
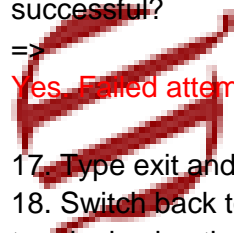
17. Type `exit` and press Enter to log out of your shell if you successfully logged in.

18. Switch back to the command-line terminal (tty4) by pressing Ctrl+Alt+F4 and log in to the terminal using the user name of root and the password of LNXrocks!.

19. At the command prompt, type `chsh -s /bin/false bozo` and press Enter to change bozo's shell to /bin/false. What message did you receive? Was the shell changed? Type `cat /etc/passwd` at a command prompt to verify that the shell was changed to /bin/false for bozo's user account.

=> **basic utility prompted to installed**

After installation, default bash changed for user bozo



```

pulse:x:171:171:PulseAudio System Daemon:/var/run/pulse:/sbin/nologin
setroubleshoot:x:991:987:/:/var/lib/setroubleshoot:/sbin/nologin
avahi:x:70:70:Avahi mDNS/DNS-SD Stack:/var/run/avahi-daemon:/sbin/nologin
chrony:x:990:986:/:/var/lib/chrony:/sbin/nologin
rpc:x:32:32:Rpcbind Daemon:/var/lib/rpcbind:/sbin/nologin
usbmuxd:x:113:113:usbmuxd user:/:/sbin/nologin
gdm:x:42:42:/:/var/lib/gdm:/sbin/nologin
openvpn:x:989:985:OpenVPN:/etc/openvpn:/sbin/nologin
nm-openvpn:x:988:984:Default user for running openvpn spawned by NetworkManager:
:/sbin/nologin
radvd:x:75:75:radvd user:/:/sbin/nologin
unbound:x:987:983:Unbound DNS resolver:/etc/unbound:/sbin/nologin
qemu:x:107:107:qemu user:/:/sbin/nologin
rpcuser:x:29:29:RPC Service User:/var/lib/nfs:/sbin/nologin
nfsnobody:x:65534:65534:Anonymous NFS User:/var/lib/nfs:/sbin/nologin
gnome-initial-setup:x:986:980:/:/run/gnome-initial-setup:/sbin/nologin
nm-openconnect:x:985:979:NetworkManager user for OpenConnect:/:/sbin/nologin
sshd:x:74:74:Privilege-separated SSH:/var/empty/ssh:/sbin/nologin
tss:x:59:59:Account used by the trousers package to sandbox the tcsd daemon:/dev
/null:/sbin/nologin
tcpdump:x:72:72:/:/sbin/nologin
user1:x:1000:1000:user1:/home/user1:/bin/bash
dailyuser:x:1001:1001:/:/home/dailyuser:/bin/bash
bozo:x:666:1002:/:/home/bozo:/bin/false
[root@localhost ~]#

```

20. Switch to a command-line terminal (tty5) by pressing Ctrl+Alt+F5 and attempt to log in to the terminal using the user name of bozo and the password of LNXrocks!. Were you successful?

21. Switch back to the command-line terminal (tty4) by pressing Ctrl+Alt+F4.

22. At the command prompt, type `chsh -s /bin/bash bozo` and press Enter to change bozo's shell to /bin/bash.

23. Switch to a command-line terminal (tty5) by pressing Ctrl+Alt+F5 and attempt to log in to the terminal using the user name of bozo and the password of LNXrocks!. Were you successful?

24. Type `exit` and press Enter to log out of your shell.

25. Switch back to the command-line terminal (tty4) by pressing Ctrl+Alt+F4. Log in to the terminal using the user name of root and the password of LNXrocks!.

26. At the command prompt, type `ls -la /home/bozo` and press Enter. Who owns most files in this directory? Why?

=> bozo is owner of this directory by convention

```

qemu:x:107:107:qemu user:/:/sbin/nologin
rpcuser:x:29:29:RPC Service User:/var/lib/nfs:/sbin/nologin
nfsnobody:x:65534:65534:Anonymous NFS User:/var/lib/nfs:/sbin/nologin
gnome-initial-setup:x:986:980:/:run/gnome-initial-setup:/sbin/nologin
nm-openconnect:x:985:979:NetworkManager user for OpenConnect:/:/sbin/nologin
sshd:x:74:74:Privilege-separated SSH:/var/empty/ssh:/sbin/nologin
tss:x:59:59:Account used by the trousers package to sandbox the tcsd daemon:/dev
/null:/sbin/nologin
tcpdump:x:72:72:/:/sbin/nologin
user1:x:1000:1000:user1:/home/user1:/bin/bash
dailyuser:x:1001:1001:/:home/dailyuser:/bin/bash
bozo:x:666:1002:/:home/bozo:/bin/false
[root@localhost ~]# chsh -s /bin/bash bozo
Changing shell for bozo.
Shell changed.
[root@localhost ~]# ls -la /home/bozo
total 28
drwx-----. 3 bozo bozo 4096 Nov 17 12:55 .
drwxr-xr-x. 5 root root 4096 Nov 17 11:37 ..
-rw-----. 1 bozo bozo 29 Nov 17 12:55 .bash_history
-rw-r--r--. 1 bozo bozo 18 May 17 2016 .bash_logout
-rw-r--r--. 1 bozo bozo 193 May 17 2016 .bash_profile
-rw-r--r--. 1 bozo bozo 231 May 17 2016 .bashrc
drwxr-xr-x. 4 bozo bozo 4096 Jun 14 22:02 .mozilla
[root@localhost ~]#

```

27. At the command prompt, type `userdel bozo` and press Enter. Was the home directory removed for bozo as well?

=> No home directory not deleted.



28. At the command prompt, type `ls -la /home/bozo` and press Enter. Who owns most files in this directory? Why?

=> UID 1002, bozo is alias for UID.


```

[root@localhost ~]# chsh -s /bin/bash bozo
Changing shell for bozo.
Shell changed.
[root@localhost ~]# ls -la /home/bozo
total 28
drwx-----. 3 bozo bozo 4096 Nov 17 12:55 .
drwxr-xr-x. 5 root root 4096 Nov 17 11:37 ..
-rw-----. 1 bozo bozo  29 Nov 17 12:55 .bash_history
-rw-r--r--. 1 bozo bozo  18 May 17 2016 .bash_logout
-rw-r--r--. 1 bozo bozo 193 May 17 2016 .bash_profile
-rw-r--r--. 1 bozo bozo 231 May 17 2016 .bashrc
drwxr-xr-x. 4 bozo bozo 4096 Jun 14 22:02 .mozilla
[root@localhost ~]# userdel bozo
userdel: user bozo is currently used by process 4121
[root@localhost ~]# userdel bozo
[root@localhost ~]# ls -la /home/bozo
total 28
drwx-----. 3 666 1002 4096 Nov 17 12:55 .
drwxr-xr-x. 5 root root 4096 Nov 17 11:37 ..
-rw-----. 1 666 1002  40 Nov 17 12:58 .bash_history
-rw-r--r--. 1 666 1002  18 May 17 2016 .bash_logout
-rw-r--r--. 1 666 1002 193 May 17 2016 .bash_profile
-rw-r--r--. 1 666 1002 231 May 17 2016 .bashrc
drwxr-xr-x. 4 666 1002 4096 Jun 14 22:02 .mozilla
[root@localhost ~]# _

```

29. At the command prompt, type `useradd -m -u 666 bozoette` and press Enter. What do the `-m` and the `-u` options do in this command?

=> `-m` create user home directory
`-u` set uid

```

pulse:x:171:171:PulseAudio System Daemon:/var/run/pulse:/sbin/nologin
setroubleshoot:x:991:987:/:/var/lib/setroubleshoot:/sbin/nologin
avahi:x:70:70:Avahi mDNS/DNS-SD Stack:/var/run/avahi-daemon:/sbin/nologin
chrony:x:990:986:/:/var/lib/chrony:/sbin/nologin
rpc:x:32:32:Rpcbind Daemon:/var/lib/rpcbind:/sbin/nologin
usbmuxd:x:113:113:usbmuxd user:/:/sbin/nologin
gdm:x:42:42:/:/var/lib/gdm:/sbin/nologin
openvpn:x:989:985:OpenVPN:/etc/openvpn:/sbin/nologin
nm-openvpn:x:988:984:Default user for running openvpn spawned by NetworkManager:
/:/sbin/nologin
radvd:x:75:75:radvd user:/:/sbin/nologin
unbound:x:987:983:Unbound DNS resolver:/etc/unbound:/sbin/nologin
qemu:x:107:107:qemu user:/:/sbin/nologin
rpcuser:x:29:29:RPC Service User:/var/lib/nfs:/sbin/nologin
nfsnobody:x:65534:65534:Anonymous NFS User:/var/lib/nfs:/sbin/nologin
gnome-initial-setup:x:986:980:/:/run/gnome-initial-setup:/sbin/nologin
nm-openconnect:x:985:979:NetworkManager user for OpenConnect:/:/sbin/nologin
sshd:x:74:74:Privilege-separated SSH:/var/empty/ssh:/sbin/nologin
tss:x:59:59:Account used by the trousers package to sandbox the tcsd daemon:/dev
/null:/sbin/nologin
tcpdump:x:72:72:/:/sbin/nologin
user1:x:1000:1000:user1:/home/user1:/bin/bash
dailyuser:x:1001:1001:/:/home/dailyuser:/bin/bash
bozoette:x:666:1002:/:/home/bozoette:/bin/bash
[root@localhost ~]# _

```



30. At the command prompt, type `passwd bozoette` and press Enter. Enter the password of LNXrocks! and press Enter. Enter the password of LNXrocks! again to confirm, and press Enter.

31. At the command prompt, type `cat /etc/passwd` and press Enter. What is bozoette's home directory? What is bozoette's UID?

=> bozoette home directory is /home/bozoette

bozoette UID is 1002

```
pulse:x:171:171:PulseAudio System Daemon:/var/run/pulse:/sbin/nologin
setroubleshoot:x:991:987:/:/var/lib/setroubleshoot:/sbin/nologin
avahi:x:70:70:Avahi mDNS/DNS-SD Stack:/var/run/avahi-daemon:/sbin/nologin
chrony:x:990:986:/:/var/lib/chrony:/sbin/nologin
rpc:x:32:32:Rpcbind Daemon:/var/lib/rpcbind:/sbin/nologin
usbmuxd:x:113:113:usbmuxd user:/:/sbin/nologin
gdm:x:42:42:/:/var/lib/gdm:/sbin/nologin
openvpn:x:989:985:OpenVPN:/etc/openvpn:/sbin/nologin
nm-openvpn:x:988:984:Default user for running openvpn spawned by NetworkManager:
:/sbin/nologin
radvd:x:75:75:radvd user:/:/sbin/nologin
unbound:x:987:983:Unbound DNS resolver:/etc/unbound:/sbin/nologin
qemu:x:107:107:qemu user:/:/sbin/nologin
rpcuser:x:29:29:RPC Service User:/var/lib/nfs:/sbin/nologin
nfsnobody:x:65534:65534:Anonymous NFS User:/var/lib/nfs:/sbin/nologin
gnome-initial-setup:x:986:980:/:run/gnome-initial-setup:/sbin/nologin
nm-openconnect:x:985:979:NetworkManager user for OpenConnect:/:/sbin/nologin
sshd:x:74:74:Privilege-separated SSH:/var/empty/sshd:/sbin/nologin
tss:x:59:59:Account used by the trousers package to sandbox the tcsd daemon:/dev
/null:/sbin/nologin
tcpdump:x:72:72:/:/sbin/nologin
user1:x:1000:1000:user1:/home/user1:/bin/bash
dailyuser:x:1001:1001:/:home/dailyuser:/bin/bash
bozoette:x:666:1002:/:home/bozoette:/bin/bash
[root@localhost ~]#
```

32. At the command prompt, type `ls -la /home/bozo` and press Enter. Who owns most files in this directory? Why? Can bozoette manage these files?

=> yes

User identity pointed to new user with same UID bozoette

```

-2          /etc/login.defs      -r
2123       /etc/passwd          renice
-3         /etc/shadow        -s
6000      exit                sleep
666       fg                  su
-9        grep                 top
-a        /home/bozo          -u
at        jobs                 useradd
bash      kill                  userdel
/bin/bash killall               /var/spool/cron/root
/bin/false -l                  visudo
bozo     -la                    Z
bozoette less
[root@localhost ~]# ls -a /home/bozo
. . . . .bash_history .bash_logout .bash_profile .bashrc .mozilla
[root@localhost ~]# ls -la /home/bozo
total 28
drwx-----. 3 bozoette bozoette 4096 Nov 17 12:55 .
drwxr-xr-x. 6 root      root      4096 Nov 17 13:00 ..
-rw-----. 1 bozoette bozoette   40 Nov 17 12:58 .bash_history
-rw-r--r--. 1 bozoette bozoette   18 May 17 2016 .bash_logout
-rw-r--r--. 1 bozoette bozoette  193 May 17 2016 .bash_profile
-rw-r--r--. 1 bozoette bozoette   231 May 17 2016 .bashrc
drwxr-xr-x. 4 bozoette bozoette 4096 Jun 14 22:02 .mozilla
[root@localhost ~]# _

```

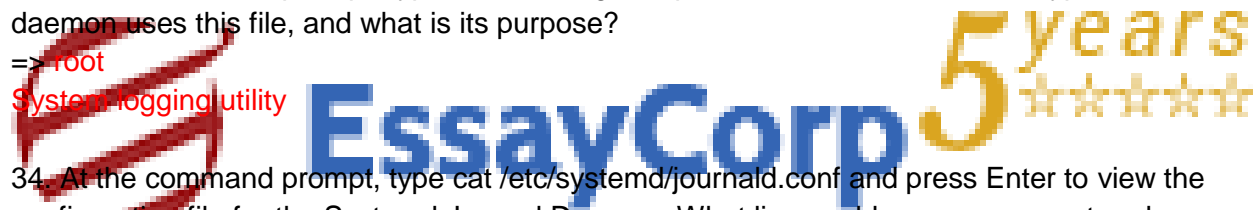
33. At the command prompt, type `ls -l /dev/log` and press Enter. What is the file type? Which daemon uses this file, and what is its purpose?

=> root

System logging utility

34. At the command prompt, type `cat /etc/systemd/journald.conf` and press Enter to view the configuration file for the Systemd Journal Daemon. What line could you uncomment and configure to set a maximum size for the journald database?

=> SystemMaxFileSize



```
GNU nano 2.5.3 File: /etc/systemd/journald.conf
# See journald.conf(5) for details.

[Journal]
#Storage=auto
#Compress=yes
#Seal=yes
#SplitMode=uid
#SyncIntervalSec=5m
#RateLimitInterval=30s
#RateLimitBurst=1000
#SystemMaxUse=
#SystemKeepFree=
#SystemMaxFileSize=
#SystemMaxFiles=100
#RuntimeMaxUse=
#RuntimeKeepFree=
#RuntimeMaxFileSize=
#RuntimeMaxFiles=100
#MaxRetentionSec=
#MaxFileSec=1month

[ Read 41 lines ]
^G Get Help ^O Write Out ^W Where Is ^K Cut Text ^J Justify ^C Cur Pos
^X Exit ^R Read File ^\ Replace ^U Uncut Text ^T To Spell ^_ Go To Line
```

35. At the command prompt, type `journalctl _COMM=` and press the Tab key twice. Which keyword could you use to view log entries from the GNOME display manager? Next, type `journalctl _COMM=gdm` and press Enter to view log entries from the GNOME display manager. Are entries shown for multiple days? Press Ctrl-c or q to return to your command prompt.

=>no

36. At the command prompt, type `journalctl --COMM=gdm --since "5:00"` and press Enter to view log entries from the GNOME display manager since 5:00am.

=>Not working

37. At the command prompt, type `which crond` and press Enter. What is the path to the cron daemon executable file? Next, type `journalctl /sbin/crond --since "5:00"` and press Enter. What entries are shown? If there are no responses type `journalctl /sbin/crond .` What is the most recent time and date the crond ran?

=> which crond = /usr/sbin/crond

```

[root@localhost ~]# which crond
/usr/sbin/crond
[root@localhost ~]# journalctl /sbin/crond --since "5:00"
-- Logs begin at Thu 2016-11-17 00:15:56 IST, end at Thu 2016-11-17 14:34:53 IST
Nov 17 05:01:01 localhost.localdomain CROND[2235]: (root) CMD (run-parts /etc/cr
Nov 17 06:01:01 localhost.localdomain CROND[2280]: (root) CMD (run-parts /etc/cr
Nov 17 09:01:01 localhost.localdomain CROND[3821]: (root) CMD (run-parts /etc/cr
-- Reboot --
Nov 17 09:26:48 localhost.localdomain crond[865]: (CRON) INFO (Syslog will be us
Nov 17 09:26:48 localhost.localdomain crond[865]: (CRON) INFO (RANDOM_DELAY will
Nov 17 09:26:49 localhost.localdomain crond[865]: (CRON) INFO (running with inot
-- Reboot --
Nov 17 10:08:56 localhost.localdomain crond[863]: (CRON) INFO (Syslog will be us
Nov 17 10:08:56 localhost.localdomain crond[863]: (CRON) INFO (RANDOM_DELAY will
Nov 17 10:08:57 localhost.localdomain crond[863]: (CRON) INFO (running with inot
-- Reboot --
Nov 17 10:11:43 localhost.localdomain crond[871]: (CRON) INFO (Syslog will be us
Nov 17 10:11:43 localhost.localdomain crond[871]: (CRON) INFO (RANDOM_DELAY will
Nov 17 10:11:44 localhost.localdomain crond[871]: (CRON) INFO (running with inot
Nov 17 12:01:01 localhost.localdomain CROND[2890]: (root) CMD (run-parts /etc/cr
Nov 17 13:01:01 localhost.localdomain CROND[4259]: (root) CMD (run-parts /etc/cr
Nov 17 14:01:01 localhost.localdomain CROND[4322]: (root) CMD (run-parts /etc/cr
Nov 17 14:34:53 localhost.localdomain crond[4359]: (CRON) DEATH (can't lock /var
lines 1-20/20 (END)

```

38. At the command prompt, type `ls /var/log` and press Enter. Observe the entries. Are there log files within `/var/log` created by daemons that do not log entries via journald?

=>yes

```

drwxr-xr-x. 2 root root 4096 Feb 4 2016 cluster
drwxr-xr-x. 2 lp sys 4096 Nov 17 00:19 cups
-rw-r--r--. 1 root root 262537 Nov 17 14:25 dnf.librepo.log
-rw-r--r--. 1 root root 20914 Nov 17 14:25 dnf.log
-rw-r--r--. 1 root root 686 Nov 17 14:25 dnf.rpm.log
-rw-r--r--. 1 root root 272 Nov 17 10:11 firewalld
drwx--x--x. 2 root gdm 4096 Apr 21 2016 gdm
drwxr-xr-x. 2 root root 4096 May 25 19:36 glusterfs
-rw-r--r--. 1 root root 6082 Nov 17 13:25 hawkey.log
drwx-----. 2 root root 4096 Feb 4 2016 httpd
drwxr-sr-x+ 3 root systemd-journal 4096 Nov 17 00:15 journal
-rw-r--r--. 1 root root 292876 Nov 17 13:00 lastlog
drwx-----. 3 root root 4096 Jun 14 22:08 libvirt
drwx-----. 2 root root 4096 Feb 5 2016 ppp
-rw-r--r--. 1 root root 1040 May 30 09:53 README
drwx-----. 3 root root 4096 Jun 14 22:06 samba
drwx-----. 2 root root 4096 Apr 21 2016 speech-dispatcher
drwxr-x---. 2 root root 4096 May 13 2016 sssd
-rw-----. 1 root root 0 Jun 14 22:03 tallylog
-rw-rw-r--. 1 root utmp 19200 Nov 17 12:58 wtmp
-rw-r--r--. 1 root gdm 58984 Nov 17 10:12 Xorg.0.log
-rw-r--r--. 1 root gdm 57777 Nov 17 10:11 Xorg.0.log.old
-rw-r--r--. 1 root user1 59143 Nov 17 10:12 Xorg.1.log
-rw-r--r--. 1 root user1 57612 Nov 17 10:11 Xorg.1.log.old
[root@localhost ~]#

```

39. At the command prompt, type `ls /var/log/cups` and press Enter. What files are in this directory?

=> `access_log` and `page_log`

40. At the command prompt, type `cat /etc/cron.daily/logrotate` and press Enter to observe the logrotate command that is run each day.

=>

41. At the command prompt, type `less /etc/logrotate.conf` and press Enter to view the configuration file for the logrotate command. How many copies of old log files are kept by default? When finished, press `q` to quit the less utility.

=>4

42. At the command prompt, type `ls /etc/logrotate.d` and press Enter. How many files are in this directory? Will entries in these files override the same entries in `/etc/logrotate.conf`?

=> 15

43. At the command prompt, type `cat /etc/logrotate.d/cups` and press Enter. How many copies of old log files are kept for the log files in the `/var/log/cups` directory? Will the log files be rotated if they contain no contents?

=>

44. At the command prompt, download the source files for the Joe text editor by typing `wget http://dickens.rice.iit.edu/456/Files/joe-4.0.tar.gz` and pressing Enter (You should have previously installed wget.)

45. At the command prompt, type `ls -F` and press Enter to confirm that the `joe-4.0.tar.gz` file is in your home directory.

=>Found

46. As you observe the file's presence, does the filename of the joe tarball indicate the architecture for which the source code was designed? Explain.

=>gzipped

47. At the command prompt, type `tar -zxvf joe-4.0.tar.gz` and press Enter to uncompress and extract the contents of the tarball. Next, type `ls -F` at the command prompt and press Enter. What directory was created?

=>New directory created joe-4.0

48. At the command prompt, type `cd joe-4.0` and press Enter. Next, type `ls -F` at the command prompt and press Enter. Is there an executable configure program? Are there README and INSTALL files present?

=>Yes. Available

49. At the command prompt, type `less README` and press Enter. Scroll through the output on the terminal screen. What does the joe program do? When finished, press `q` to quit the less utility.

=> terminal based screen editor

50. At the command prompt, type `less INSTALL` and press Enter. Scroll through the output on the terminal screen. What does this file contain? When finished, press `q` to quit the less utility.

=> **Description of Install steps(file changes, conventions, parameters etc)**

51. At the command prompt, type `./configure` and press Enter. What does this program do?

Near the bottom of the output, can you see whether the Makefile was created successfully?

=>

```
config.status: creating syntax/sieve.jsf
config.status: creating syntax/skill.jsf
config.status: creating syntax/sml.jsf
config.status: creating syntax/spec.jsf
config.status: creating syntax/sql.jsf
config.status: creating syntax/tcl.jsf
config.status: creating syntax/tex.jsf
config.status: creating syntax/troff.jsf
config.status: creating syntax/typescript.jsf
config.status: creating syntax/verilog.jsf
config.status: creating syntax/vhdl.jsf
config.status: creating syntax/whitespace.jsf
config.status: creating syntax/xml.jsf
config.status: creating syntax/yaml.jsf
config.status: creating syntax/filename.jsf
config.status: creating joe/autoconf.h
config.status: executing depfiles commands
[root@localhost joe-4.0]# ls -F
acinclude.m4  config.guess*  COPYING      install-sh*  missing*     syntax/
aclocal.m4   config.log     cygbuild*   joe/         NEWS.md
autojoe*     config.status*  depcomp*    Makefile     po/
ChangeLog   config.sub*    docs/       Makefile.am  rc/
charmmaps/  configure*    INSTALL     Makefile.in  README.md
compile*    configure.ac  INSTALL.AMIGA  man/         setup.hint
[root@localhost joe-4.0]# _
```

52. At the command prompt, type `make` and press Enter. This step should take about three to five minutes, depending on the speed of your computer. What does the make program do?

Which program compiles the different parts of the program?

=> **gcc**

```

mv -f .deps/builtins.Tpo .deps/builtins.Po
gcc -DHAVE_CONFIG_H -I. -DJOERC="\usr/local/etc/joe/" -DJOEDATA="\usr/local/share/joe/" -g -O2 -MT vt.o -MD -MP -MF .deps/vt.Tpo -c -o vt.o vt.c
mv -f .deps/vt.Tpo .deps/vt.Po
gcc -g -O2 -o joe b.o blocks.o bw.o cmd.o hash.o help.o kbd.o macro.o main.o menu.o path.o poshist.o pw.o queue.o qw.o rc.o regex.o scrn.o tab.o termcap.o tty.o tw.o ublock.o uedit.o uerror.o ufile.o uformat.o uisrch.o umath.o undo.o usearch.o ushell.o utag.o va.o vfile.o vs.o w.o utils.o syntax.o utf8.o selinux.o i18n.o charmap.o mouse.o lattr.o gettext.o builtin.o builtins.o vt.o -lm -lutil
gcc -DHAVE_CONFIG_H -I. -DJOERC="\usr/local/etc/joe/" -DJOEDATA="\usr/local/share/joe/" -g -O2 -MT termidx.o -MD -MP -MF .deps/termidx.Tpo -c -o termidx.o termidx.c
mv -f .deps/termidx.Tpo .deps/termidx.Po
gcc -g -O2 -o termidx termidx.o -lm -lutil
gcc -DHAVE_CONFIG_H -I. -DJOERC="\usr/local/etc/joe/" -DJOEDATA="\usr/local/share/joe/" -g -O2 -MT stringify.o -MD -MP -MF .deps/stringify.Tpo -c -o stringify.o stringify.c
mv -f .deps/stringify.Tpo .deps/stringify.Po
gcc -g -O2 -o stringify stringify.o -lm -lutil
make[2]: Leaving directory '/root/joe-4.0/joe'
make[1]: Leaving directory '/root/joe-4.0/joe'
make[1]: Entering directory '/root/joe-4.0'
make[1]: Nothing to be done for 'all-am'.
make[1]: Leaving directory '/root/joe-4.0'
[root@localhost joe-4.0]# _

```

53. At the command prompt, type make install and press Enter. What does the make install command do?

=> Installation of different binary files (copying in /usr/local/bin)
Removal of .exe files (made during process)

```

make[1]: Entering directory '/root/joe-4.0/joe'
make[2]: Entering directory '/root/joe-4.0/joe'
/usr/bin/mkdir -p '/usr/local/bin'
/usr/bin/install -c joe termidx stringify '/usr/local/bin'
make[2]: Nothing to be done for 'install-data-am'.
make[2]: Leaving directory '/root/joe-4.0/joe'
make[1]: Leaving directory '/root/joe-4.0/joe'
make[1]: Entering directory '/root/joe-4.0'
make[2]: Entering directory '/root/joe-4.0'
make install-exec-hook
make[3]: Entering directory '/root/joe-4.0'
rm -f /usr/local/bin/jmacs /usr/local/bin/jstar /usr/local/bin/rjoe /usr/local/bin/jpico
rm -f /usr/local/bin/jmacs.exe /usr/local/bin/jstar.exe /usr/local/bin/rjoe.exe /usr/local/bin/jpico.exe
for i in jmacs jstar rjoe jpico ; do ln -s joe /usr/local/bin/$i ; done
make[3]: Leaving directory '/root/joe-4.0'
/usr/bin/mkdir -p '/usr/local/share/joe/charmaps'
/usr/bin/install -c -m 644 charmaps/klinton '/usr/local/share/joe/charmaps'
/usr/bin/mkdir -p '/usr/local/share/doc/joe'
/usr/bin/install -c -m 644 README.md docs/README.old docs/man.md ChangeLog docs/hacking.md NEWS.md '/usr/local/share/doc/joe'
make[2]: Leaving directory '/root/joe-4.0'
make[1]: Leaving directory '/root/joe-4.0'
[root@localhost joe-4.0]# _

```

54. At the command prompt, type cd and press Enter to return to your home directory. Next, type rm -Rf joe-4.0 to remove the source code directory for joe.

=>

55. At the command prompt, type which joe and press Enter. Which directory contains the joe executable program? Is a central database updated with this information as it was when an RPM is installed? Why or why not?

=> /usr/local/bin/joe

joe is available in systempath

56. Type joe at the command prompt and press Enter. Observe the joe interface. What do you do to get command help? When finished, close the joe program using Ctrl-C.

=> Ctrl+K for help

57. At the command prompt, type rpm -qa | less and press Enter to view the RPM packages installed on your computer. Are there many of them? Briefly scroll through the list and press q when finished to exit the less utility.

=>

58. At the command prompt, type rpm -q tripwire and press Enter. Is Tripwire installed on your computer?

=>no

59. At the command prompt, type yum install tripwire and press Enter. What architecture is indicated in the filename for this RPM? Press y when prompted to continue the installation.

=> Architecture X86_64

```
shadow-utils-4.2.1-8.fc24.x86_64
libibverbs-1.2.0-1.fc24.x86_64
[root@localhost joe-4.0]# rpm -q tripwire
package tripwire is not installed
[root@localhost joe-4.0]# yum install tripwire
Yum command has been deprecated, redirecting to '/usr/bin/dnf install tripwire'.
See 'man dnf' and 'man yum2dnf' for more information.
To transfer transaction metadata from yum to DNF, run:
'dnf install python-dnf-plugins-extras-migrate && dnf-2 migrate'

Last metadata expiration check: 2:07:34 ago on Thu Nov 17 13:24:50 2016.
Dependencies resolved.
=====
Package           Arch           Version        Size
=====
Installing:
tripwire           x86_64         2.4.3.1-10.fc24 1.0 M
Transaction Summary
=====
Install 1 Package

Total download size: 1.0 M
Installed size: 4.4 M
Is this ok [y/N]: _
```

60. At the command prompt, type rpm -q tripwire and press Enter. Has the Tripwire package been installed successfully?

=> yes

61. At the command prompt, type rpm -qi tripwire and press Enter to view the information about the Tripwire package. What does the Tripwire program do? Does it explain what license Tripwire uses? If not, where could you find that information?

=> Licence is not visible. We can see more information at [Tripwire github repository](#)

62. At the command prompt, type `rpm -ql tripwire` and press Enter to view the locations of all files that belong to the Tripwire package. Which file is the executable program itself?

=>/usr/sbin
var/lib

Executable file: /usr/sbin/tripwire

```
/usr/sbin/siggen
/usr/sbin/tripwire
/usr/sbin/tripwire-setup-keyfiles
/usr/sbin/twadmin
/usr/sbin/twprint
/usr/share/doc/tripwire
/usr/share/doc/tripwire/COMMERCIAL
/usr/share/doc/tripwire/COPYING
/usr/share/doc/tripwire/ChangeLog
/usr/share/doc/tripwire/License-Issues
/usr/share/doc/tripwire/README.Fedora
/usr/share/doc/tripwire/TRADEMARK
/usr/share/doc/tripwire/policyguide.txt
/usr/share/doc/tripwire/tripwire.gif
/usr/share/man/man4/twconfig.4.gz
/usr/share/man/man4/twpolicy.4.gz
/usr/share/man/man5/twfiles.5.gz
/usr/share/man/man8/siggen.8.gz
/usr/share/man/man8/tripwire.8.gz
/usr/share/man/man8/twadmin.8.gz
/usr/share/man/man8/twintro.8.gz
/usr/share/man/man8/twprint.8.gz
/var/lib/tripwire
/var/lib/tripwire/report
[root@localhost joe-4.0]# _
```

63. At the command prompt, type `rpm -qc tripwire` and press Enter to view the configuration files for the Tripwire package. How many configuration files does the Tripwire package have?

=>
2

64. At the command prompt, type `rpm -e tripwire` and press Enter. What does this option to the rpm command do?

=>

65. At the command prompt, type `rpm -q tripwire` and press Enter. Is Tripwire installed?

66. Type `exit` and press Enter to log out of your shell. Close your virtual machine.

67. Open your ITMO556 Ubuntu virtual machine and log in to the terminal using the user name of `user1` and the password of `LNxrocks!`.

68. At the command prompt, type `sudo su -` and press Enter to start a root session; when prompted enter the password of `LNxrocks!`.

69. At the command prompt, type `dpkg -l | less` and press Enter to view the packages installed on your computer. Are there many of them? Briefly scroll through the list and press `q` when finished to exit the less utility.

70. At the command prompt, type `dpkg -s tripwire` and press Enter. Is Tripwire installed on your computer?

=> **No, it is not installed**

71. At the command prompt, type `apt-get install tripwire` and press Enter. Press y when prompted to continue the installation. When asked to select the mail server configuration, just select <Ok> by pressing Enter. On the next screen select No Configuration, press Tab to select <Ok>, and press enter to continue. When you are asked if you desire to create a passphrase, answer <No> as necessary and when the program is installed select <Ok> to exit the installation.

72. At the command prompt, type `dpkg -s tripwire` and press Enter. Has the Tripwire package been installed successfully?

=> yes

```
Processing triggers for systemd (215-17+deb8u5) ...Processing triggers for
libc-bin (2.19-18+deb8u6) ...root@cs-6301-devshell-vm-93facca6-6fc2-491c-
9038-93bd6c390806-1bb:~# dpkg -s tripwirePackage: tripwireStatus: install ok
installedPriority: optionalSection: utilsInstalled-Size: 10139Maintainer:
Alberto Gonzalez Iniesta <agi@inittab.org>Architecture: amd64Version:
2.4.2.2-4Depends: postfix | mail-transport-agentPre-Depends: debconf (>= 0.5)
| debconf-2.0Conffiles: /etc/tripwire/twcfg.txt
e64347084d60ba16521e5c4f50f95a7a /etc/tripwire/twpol.txt
9b03de0d52a06514f719e250bfc10cc3 /etc/cron.daily/tripwire
d1e8b20b26a33a6a0781d59bc312442eDescription: file and directory integrity
checker Tripwire is a tool that aids system administrators and users in
monitoring a designated set of files for any changes. Used with system files
on a regular (e.g., daily) basis, Tripwire can notify system administrators
of corrupted or tampered files, so damage control measures can be taken in a
timely manner.
```

73. At the command prompt, type `dpkg -L tripwire | less` and press Enter to view the locations of all files that belong to the Tripwire package. Which file is the executable program itself? Press q when finished to exit the less utility.

74. At the command prompt, type `dpkg --purge tripwire` and press Enter. What does this option to the dpkg command do?

=> **install ,update and remove system packages**

75. At the command prompt, type `dpkg -s tripwire` and press Enter. Is Tripwire installed?

=> **no**

76. Type exit and press Enter to log out of your root session, then type exit and press Enter to log out of your shell. Close your Ubuntu Virtual Machine.

77. Open your ITMO556 Fedora Virtual Machine. Switch to a command-line terminal (tty4) by pressing Ctrl+Alt+F4 and log in to the terminal using the user name of root and the password of LNXrocks!.

78. At the command prompt, type `cp /etc/services ~` and press Enter to make a copy of the `/etc/services` file in your current directory. Next, type `ls` at the command prompt and press Enter. How large is the services file?

=> 681813

```
[root@localhost ~]# ls -l
total 1496
-rw-----. 1 root root 1423 Nov 17 00:02 anaconda-ks.cfg
drwxrwxr-x. 9 user1 user1 4096 Nov 17 15:12 joe-4.0
-rw-r--r--. 1 root root 838783 Jul 7 2015 joe-4.0.tar.gz
-rw-r--r--. 1 root root 681813 Nov 17 16:06 services
[root@localhost ~]# ls -al
total 1544
dr-xr-x---. 6 root root 4096 Nov 17 16:06 .
dr-xr-xr-x. 18 root root 4096 Jun 14 22:02 ..
-rw-----. 1 root root 1423 Nov 17 00:02 anaconda-ks.cfg
-rw-----. 1 root root 833 Nov 17 12:25 .bash_history
-rw-r--r--. 1 root root 18 Feb 5 2016 .bash_logout
-rw-r--r--. 1 root root 176 Feb 5 2016 .bash_profile
-rw-r--r--. 1 root root 176 Feb 5 2016 .bashrc
drwx-----. 2 root root 4096 Nov 17 00:16 .cache
-rw-r--r--. 1 root root 100 Feb 5 2016 .cshrc
drwx-----. 3 root root 4096 Nov 17 09:07 .gnupg
drwxrwxr-x. 9 user1 user1 4096 Nov 17 15:12 joe-4.0
-rw-r--r--. 1 root root 838783 Jul 7 2015 joe-4.0.tar.gz
-rw-----. 1 root root 205 Nov 17 15:29 .joe_state
drwxr-----. 3 root root 4096 Nov 17 15:46 .pki
-rw-r--r--. 1 root root 681813 Nov 17 16:06 services
-rw-r--r--. 1 root root 129 Feb 5 2016 .tcshrc
[root@localhost ~]# yum install
```

79. original Linux compress utility is not installed by default. At the command prompt, type `yum install ncompress` command and press Enter to install the compress utility. Press y when prompted to continue the installation.

80. At the command prompt, type `compress -v services` and press Enter to compress the services file. What was the compression ratio? Next, type `ls` at the command prompt and press Enter. What extension does the services file have and how large is it?

=>file format = Z compression: 68.26%;

81. At the command prompt, type `uncompress -v services.Z` and press Enter to decompress the services file.

=>

82. Type `mkdir Desktop2` and press Enter to create a directory called Desktop2. Type `cp services Desktop2` and press Enter to copy the services file into the Desktop2 directory.

83. At the command prompt, type `compress -vr Desktop2` and press Enter to compress the contents of the Desktop2 subdirectory. Next, type `ls -lR Desktop2` at the command prompt and press Enter to view the contents of the Desktop2 directory. Which files were compressed? If there were symbolic links in this directory, how could you force the compress utility to compress these files as well?

=>services file compressed as services.Z

84. At the command prompt, type `uncompress -vr Desktop2` and press Enter to decompress the contents of the Desktop2 subdirectory. Next, type `ls -lR Desktop2` at the command prompt and press Enter to verify that these files were uncompressed.

=>

85. At the command prompt, type `ps def | compress >psfile.Z` and press Enter to compress the output of the `ps def` command to a file called `psfile.Z`. What was the compression ratio?

=> compression ratio is 63.76%

86. At the command prompt, type `zmore psfile.Z` and press Enter to view the compressed contents of the `psfile.Z` file.

87. At the command prompt, type `gzip -v services` and press Enter to compress the `services` file. What was the compression ratio? How does this ratio compare with the one obtained in Step 37? Why? Next, type `ls` at the command prompt and press Enter. What extension does the `services` file have and how large is it?

=> new extension is gz. Compression using gzip is 79.6%

Compression using ncompress utility was 68%

88. At the command prompt, type `gunzip -v services.gz` and press Enter to decompress the `services` file.

=>

89. At the command prompt, type `gzip -v -9 services` and press Enter to compress the `services` file. What was the compression ratio? Why?

=> Compression ratio is now same as 79.6% . 9 is for best compression (slowest too)

90. At the command prompt, type `gunzip -v services.gz` and press Enter to decompress the `services` file.

91. At the command prompt, type `gzip -v -1 services` (that is a numeral one, not a lower case L) and press Enter to compress the `services` file. What was the compression ratio? Why?

=> Now compression ratio is 76.5 % (fastest - speed differentiator)

92. At the command prompt, type `gunzip -v services.gz` and press Enter to decompress the `services` file.

93. At the command prompt, type `bzip2 -v services` and press Enter to compress the `services` file. What was the compression ratio? How does this compare with the ratios from Step 38 and Step 47? Why? Next, type `ls` at the command prompt and press Enter. What extension does the `services` file have and how large is it?

=> new extension for compressed file is bz2

Compression efficiency is 81.42%

94. At the command prompt, type `bunzip2 -v services.bz2` and press Enter to decompress the `services` file.

95. Type `exit` and press Enter to log out.

Exercises are adapted from Eckert, Jason W. *CompTIA Linux+ Guide to Linux Certification*, 4th Edition Cengage Course Technology, ISBN: 978-1-305-10716-8