

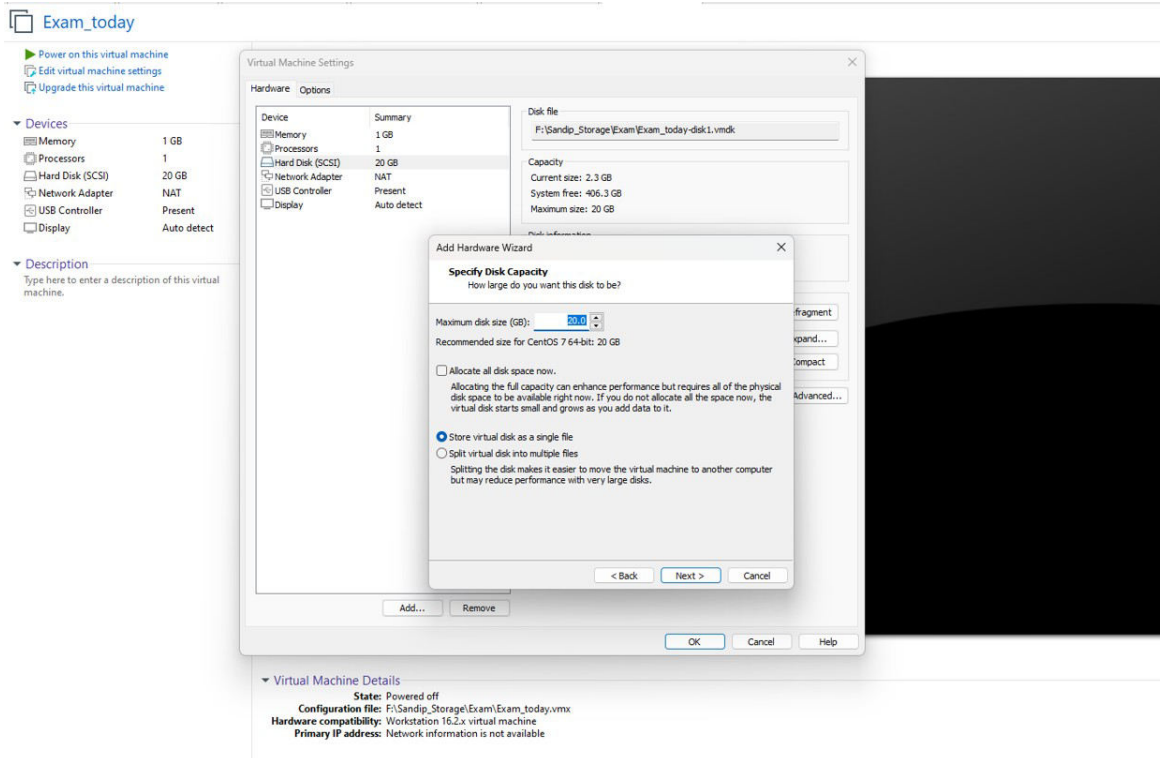
# STORAGE & BACKUP MANAGEMENT

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**PRN NO:- 230940127040**

Q.1 Set up a RAID 5 array with minimum number of disks on linux for disk striping and parity to provide secure data storage.

- lsblk
- yum install mdadm
- mdadm --create --verbose /dev/md0 --level=5 --raid-devices=3 /dev/sdb /dev/sdc /dev/sdd -- spare-devices=1 /dev/sde
- mdadm --detail /dev/md0
- fdisk /dev/md0
  - PRESS m
  - PRESS n
  - PRESS p
  - PRESS ENTER ENTER ENTER ( 3-4 TIMES ENTER)
  - PRESS m then w (Write and Exit)
- lsblk
- mkfs.ext4 /dev/md0p1
- lsblk
- mkdir /mnt/raid5
- mount /dev/md0p1 /mnt/raid5/
- mdadm --detail /dev/md0



## Exam\_today

- Power on this virtual machine
- Edit virtual machine settings
- Upgrade this virtual machine

### Devices

Memory	1 GB
Processors	1
Hard Disk (SCSI)	20 GB
Network Adapter	NAT
USB Controller	Present
Display	Auto detect

### Description

Type here to enter a description of this virtual machine.

Virtual Machine Settings

Hardware Options

Device	Summary
Memory	1 GB
Processors	1
Hard Disk (SCSI)	20 GB
New Hard Disk (SCSI)	20 GB
New Hard Disk (SCSI)	20 GB
New Hard Disk (SCSI)	20 GB
New Hard Disk (SCSI)	20 GB
New Hard Disk (SCSI)	20 GB
Network Adapter	NAT
USB Controller	Present
Display	Auto detect

Add... Remove

Disk file

Exam\_today-2.vmdk

Capacity

Current size: 2.6 MB

System free: 406.3 GB

Maximum size: 20 GB

Disk information

Disk space is not preallocated for this hard disk.

Hard disk contents are stored in a single file.

Disk utilities

Defragment files and consolidate free space. ☐ Defragment

Expand disk capacity.

Compact disk to reclaim unused space. ☐ Compact

### Virtual Machine Details

State: Powered off

Configuration file: F:\Sandip\_Storage\Exam\Exam\_today.vmx  
Hardware compatibility: Workstation 16.2.x virtual machine  
Primary IP address: Network information is not available

## Exam\_today

- Power on this virtual machine
- Edit virtual machine settings
- Upgrade this virtual machine

### Devices

Memory	1 GB
Processors	1
Hard Disk (SCSI)	20 GB
Network Adapter	NAT
USB Controller	Present
Display	Auto detect

### Description

Type here to enter a description of this virtual machine.

Virtual Machine Settings

Hardware Options

Device	Summary
Memory	1 GB
Processors	1
Hard Disk (SCSI)	20 GB
New Hard Disk (SCSI)	20 GB
New Hard Disk (SCSI)	20 GB
New Hard Disk (SCSI)	20 GB
New Hard Disk (SCSI)	20 GB
New Hard Disk (SCSI)	20 GB
Network Adapter	NAT
USB Controller	Present
Display	Auto detect

Add... Remove

Disk file

Exam\_today-2.vmdk

Capacity

Current size: 2.6 MB

System free: 406.3 GB

Maximum size: 20 GB

Disk information

Disk space is not preallocated for this hard disk.

Hard disk contents are stored in a single file.

Disk utilities

Defragment files and consolidate free space. ☐ Defragment

Expand disk capacity.

Compact disk to reclaim unused space. ☐ Compact

### Virtual Machine Details

State: Powered off

Configuration file: F:\Sandip\_Storage\Exam\Exam\_today.vmx  
Hardware compatibility: Workstation 16.2.x virtual machine  
Primary IP address: Network information is not available

## Exam\_today

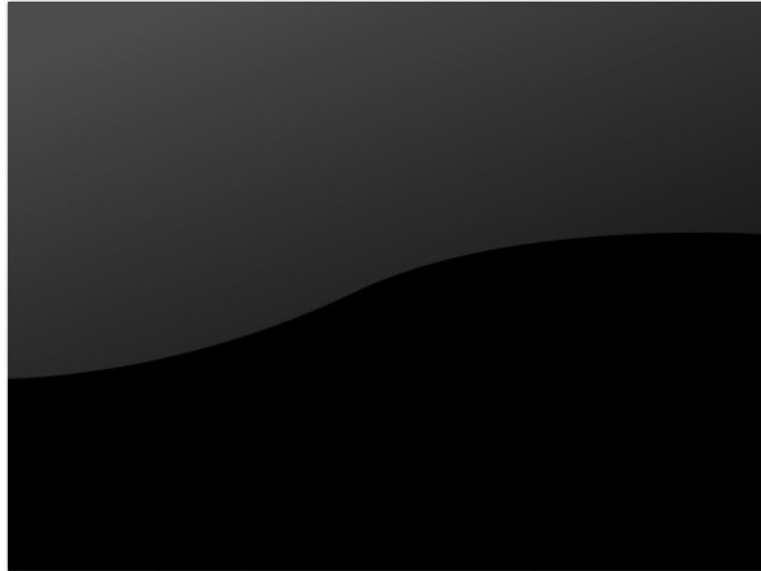
- ▶ Power on this virtual machine
- ⚙ Edit virtual machine settings
- 🔄 Upgrade this virtual machine

### Devices

Memory	1 GB
Processors	1
Hard Disk (SCSI)	20 GB
Hard Disk 2 (SCSI)	20 GB
Hard Disk 4 (SCSI)	20 GB
Hard Disk 3 (SCSI)	20 GB
Hard Disk 5 (SCSI)	20 GB
Network Adapter	NAT
USB Controller	Present
Display	Auto detect

### Description

Type here to enter a description of this virtual machine.



### Virtual Machine Details

**State:** Powered off  
**Configuration file:** F:\Sandip\_Storage\Exam\Exam\_today.vmx  
**Hardware compatibility:** Workstation 16.2x virtual machine  
**Primary IP address:** Network information is not available

```
ISCSI_SERVER x ISCSI_Client x RAID-1-PRACTICE x RAID-0-PRACTICE x RAID-5-PRACTICE x Exam_today x

CentOS Linux 7 (Core)
Kernel 3.10.0-1160.105.1.el7.x86_64 on an x86_64

localhost login: root
Password:
Last login: Sat Jan 6 15:00:47 on tty1
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: ens33: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
    link/ether 00:0c:29:13:94:9a brd ff:ff:ff:ff:ff:ff
[root@localhost ~]# ifup ens33
Connection successfully activated (D-Bus active path: /org/freedesktop/NetworkManager/ActiveConnection/1)
[root@localhost ~]# _
```

```

[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# lsblk
NAME        MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
sda           8:0    0 20G  0 disk
├─sda1         8:1    0   1G  0 part /boot
├─sda2         8:2    0  19G  0 part
│   ├─centos-root 253:0    0  17G  0 lvm  /
│   └─centos-swap 253:1    0    2G  0 lvm  [SWAP]
sdb           8:16    0  20G  0 disk
sdc           8:32    0  20G  0 disk
sdd           8:48    0  20G  0 disk
sde           8:64    0  20G  0 disk
[root@localhost ~]#

```

```

[root@localhost ~]# yum install pciutils -y
Loaded plugins: fastestmirror
Determining fastest mirrors
 * base: centos.mirror.net.in
 * extras: centos.mirror.net.in
 * updates: centos.mirror.net.in
base                                     | 3.6 kB  00:00:00
extras                                 | 2.9 kB  00:00:00
updates                                | 2.9 kB  00:00:00
updates/7/x86_64/primary.db            | 24 MB  00:00:11
Resolving Dependencies
--> Running transaction check
--> Package pciutils.x86_64 0:3.5.1-3.el7 will be installed
--> Finished Dependency Resolution

Dependencies Resolved

=====
Package                Arch                Version                Repository              Size
=====
Installing:
pciutils                x86_64              3.5.1-3.el7            base                    93 k
=====

Transaction Summary
-----
Install 1 Package

Total download size: 93 k
Installed size: 196 k
Downloading packages:
pciutils-3.5.1-3.el7.x86_64.rpm        | 93 kB  00:00:05
Running transaction check
Running transaction test
Transaction test succeeded
Running transaction
Installing : pciutils-3.5.1-3.el7.x86_64
Verifying  : pciutils-3.5.1-3.el7.x86_64
1/1
1/1

Installed:
pciutils.x86_64 0:3.5.1-3.el7

Complete!
[root@localhost ~]#

```

```

Installed:
  pciutils.x86_64 0:3.5.1-3.el7

Complete!
[root@localhost ~]# lspci
00:00.0 Host bridge: Intel Corporation 440BX/ZX/DX - 82443BX/ZX/DX Host bridge (rev 01)
00:01.0 PCI bridge: Intel Corporation 440BX/ZX/DX - 82443BX/ZX/DX AGP bridge (rev 01)
00:07.0 ISA bridge: Intel Corporation 82371AB/EB/MB PIIX4 ISA (rev 08)
00:07.1 IDE interface: Intel Corporation 82371AB/EB/MB PIIX4 IDE (rev 01)
00:07.3 Bridge: Intel Corporation 82371AB/EB/MB PIIX4 ACPI (rev 08)
00:07.7 System peripheral: VMware Virtual Machine Communication Interface (rev 19)
00:0f.0 VGA compatible controller: VMware SVGA II Adapter
00:10.0 SCSI storage controller: Broadcom / LSI 53c1030 PCI-X Fusion-MPT Dual Ultra320 SCSI (rev 01)
00:11.0 PCI bridge: VMware PCI bridge (rev 02)
00:15.0 PCI bridge: VMware PCI Express Root Port (rev 01)
00:15.1 PCI bridge: VMware PCI Express Root Port (rev 01)
00:15.2 PCI bridge: VMware PCI Express Root Port (rev 01)
00:15.3 PCI bridge: VMware PCI Express Root Port (rev 01)
00:15.4 PCI bridge: VMware PCI Express Root Port (rev 01)
00:15.5 PCI bridge: VMware PCI Express Root Port (rev 01)
00:15.6 PCI bridge: VMware PCI Express Root Port (rev 01)
00:15.7 PCI bridge: VMware PCI Express Root Port (rev 01)
00:16.0 PCI bridge: VMware PCI Express Root Port (rev 01)
00:16.1 PCI bridge: VMware PCI Express Root Port (rev 01)
00:16.2 PCI bridge: VMware PCI Express Root Port (rev 01)
00:16.3 PCI bridge: VMware PCI Express Root Port (rev 01)
00:16.4 PCI bridge: VMware PCI Express Root Port (rev 01)
00:16.5 PCI bridge: VMware PCI Express Root Port (rev 01)
00:16.6 PCI bridge: VMware PCI Express Root Port (rev 01)
00:16.7 PCI bridge: VMware PCI Express Root Port (rev 01)
00:17.0 PCI bridge: VMware PCI Express Root Port (rev 01)
00:17.1 PCI bridge: VMware PCI Express Root Port (rev 01)
00:17.2 PCI bridge: VMware PCI Express Root Port (rev 01)
00:17.3 PCI bridge: VMware PCI Express Root Port (rev 01)
00:17.4 PCI bridge: VMware PCI Express Root Port (rev 01)
00:17.5 PCI bridge: VMware PCI Express Root Port (rev 01)
00:17.6 PCI bridge: VMware PCI Express Root Port (rev 01)
00:17.7 PCI bridge: VMware PCI Express Root Port (rev 01)
00:18.0 PCI bridge: VMware PCI Express Root Port (rev 01)
00:18.1 PCI bridge: VMware PCI Express Root Port (rev 01)
00:18.2 PCI bridge: VMware PCI Express Root Port (rev 01)
00:18.3 PCI bridge: VMware PCI Express Root Port (rev 01)
00:18.4 PCI bridge: VMware PCI Express Root Port (rev 01)
00:18.5 PCI bridge: VMware PCI Express Root Port (rev 01)
00:18.6 PCI bridge: VMware PCI Express Root Port (rev 01)
00:18.7 PCI bridge: VMware PCI Express Root Port (rev 01)
02:00.0 USB controller: VMware USB1.1 UHCI Controller
02:01.0 Ethernet controller: Intel Corporation 82545EM Gigabit Ethernet Controller (Copper) (rev 01)
02:03.0 USB controller: VMware USB2 EHCI Controller
[root@localhost ~]#

```

```

00:18.2 PCI bridge: VMware PCI Express Root Port (rev 01)
00:18.3 PCI bridge: VMware PCI Express Root Port (rev 01)
00:18.4 PCI bridge: VMware PCI Express Root Port (rev 01)
00:18.5 PCI bridge: VMware PCI Express Root Port (rev 01)
00:18.6 PCI bridge: VMware PCI Express Root Port (rev 01)
00:18.7 PCI bridge: VMware PCI Express Root Port (rev 01)
02:00.0 USB controller: VMware USB1.1 UHCI Controller
02:01.0 Ethernet controller: Intel Corporation 82545EM Gigabit Ethernet Controller (Copper) (rev 01)
02:03.0 USB controller: VMware USB2 EHCI Controller
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#

```

```

[root@localhost ~]# yum install mdadm -y

```

```

Loaded plugins: fastestmirror
Loading mirror speeds from cached hostfile
 * base: centos.mirror.net.in
 * extras: centos.mirror.net.in
 * updates: centos.mirror.net.in
Resolving Dependencies
--> Running transaction check
--> Package mdadm.x86_64 0:4.1-9.el7.9 will be installed
--> Processing Dependency: libreport-fsfilesystem for package: mdadm-4.1-9.el7.9.x86_64
--> Running transaction check
--> Package libreport-fsfilesystem.x86_64 0:2.1.11-53.el7.centos will be installed
--> Finished Dependency Resolution

```

```

Dependencies Resolved

```

Package	Arch	Version	Repository	Size
Installing:				
mdadm	x86_64	4.1-9.el7.9	updates	439 k
Installing for dependencies:				
libreport-fsfilesystem	x86_64	2.1.11-53.el7.centos	base	41 k
Transaction Summary				
Install 1 Package (+1 Dependent package)				
Total download size: 480 k				
Installed size: 1.0 M				
Downloading packages:				
(1/2): libreport-fsfilesystem-2.1.11-53.el7.centos.x86_64.rpm				

```

Loaded plugins: fastestmirror
Loading mirror speeds from cached hostfile
 * base: centos.mirror.net.in
 * extras: centos.mirror.net.in
 * updates: centos.mirror.net.in
Resolving Dependencies
--> Running transaction check
--> Package mdadm.x86_64 0:4.1-9.el7_9 will be installed
--> Processing Dependency: libreport-filessystem for package: mdadm-4.1-9.el7_9.x86_64
--> Running transaction check
--> Package libreport-filessystem.x86_64 0:2.1.11-53.el7.centos will be installed
--> Finished Dependency Resolution

Dependencies Resolved

=====
Package Arch Version Repository Size
=====
Installing:
mdadm x86_64 4.1-9.el7_9 updates 439 k
Installing for dependencies:
libreport-filessystem x86_64 2.1.11-53.el7.centos base 41 k
=====

Transaction Summary
=====
Install 1 Package (+1 Dependent package)

Total download size: 480 k
Installed size: 1.0 M
Downloading packages:
(1/2): libreport-filessystem-2.1.11-53.el7.centos.x86_64.rpm | 41 kB 00:00:05
(2/2): mdadm-4.1-9.el7_9.x86_64.rpm | 439 kB 00:00:05
-----
Total 84 kB/s | 480 kB 00:00:05

Running transaction check
Running transaction test
Transaction test succeeded
Running transaction
Installing : libreport-filessystem-2.1.11-53.el7.centos.x86_64 1/2
Installing : mdadm-4.1-9.el7_9.x86_64 2/2
Verifying : mdadm-4.1-9.el7_9.x86_64 1/2
Verifying : libreport-filessystem-2.1.11-53.el7.centos.x86_64 2/2

Installed:
mdadm.x86_64 0:4.1-9.el7_9

Dependency Installed:
libreport-filessystem.x86_64 0:2.1.11-53.el7.centos

Complete!
[root@localhost ~]#

```

```

[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# lsblk
NAME MAJ:MIN RM SIZE RO TYPE MOUNTPOINT
sda 8:0 0 20G 0 disk
├─sda1 8:1 0 16 0 part /boot
└─sda2 8:2 0 19G 0 part
   └─centos-root 253:0 0 17G 0 lvm /
      └─centos-swap 253:1 0 2G 0 lvm [SWAP]
sdb 8:16 0 20G 0 disk
sdc 8:32 0 20G 0 disk
sdd 8:48 0 20G 0 disk
sde 8:64 0 20G 0 disk
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# mdadm --create --verbose /dev/md0 --level=5 --raid-devices=3 /dev/sdb /dev/sdc /dev/sdd
mdadm: layout defaults to left-symmetric
mdadm: layout defaults to left-symmetric
mdadm: chunk size defaults to 512K
mdadm: size set to 20954112K
mdadm: Defaulting to version 1.2 metadata
mdadm: array /dev/md0 started.
[root@localhost ~]#
[root@localhost ~]# \
\

```

```
[root@localhost ~]# fdisk -l
```

```
Disk /dev/sda: 21.5 GB, 21474836480 bytes, 41943040 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk label type: dos
Disk identifier: 0x000cd7d9
```

Device	Boot	Start	End	Blocks	Id	System
/dev/sda1	*	2048	2099199	1048576	83	Linux
/dev/sda2		2099200	41943039	19921920	8e	Linux LVM

```
Disk /dev/sdb: 21.5 GB, 21474836480 bytes, 41943040 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
```

```
Disk /dev/sdc: 21.5 GB, 21474836480 bytes, 41943040 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
```

```
Disk /dev/sdd: 21.5 GB, 21474836480 bytes, 41943040 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
```

```
Disk /dev/sde: 21.5 GB, 21474836480 bytes, 41943040 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
```

```
Disk /dev/mapper/centos-root: 18.2 GB, 18249416704 bytes, 35643392 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
```

```
Disk /dev/mapper/centos-swap: 2147 MB, 2147483648 bytes, 4194304 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
```

```
Disk /dev/md0: 42.9 GB, 42914021376 bytes, 83816448 sectors
Units = sectors of 1 * 512 = 512 bytes
```

```

[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# lsblk
NAME                MAJ:MIN RM  SIZE RO TYPE  MOUNTPOINT
sda                  8:0    0   20G  0 disk
├─sda1                8:1    0    1G  0 part  /boot
├─sda2                8:2    0   19G  0 part
│   ├─centos-root    253:0    0   17G  0 lvm    /
│   └─centos-swap    253:1    0    2G  0 lvm    [SWAP]
sdb                  8:16    0   20G  0 disk
├─md0                 9:0    0   40G  0 raid5
sdc                  8:32    0   20G  0 disk
├─md0                 9:0    0   40G  0 raid5
sdd                  8:48    0   20G  0 disk
├─md0                 9:0    0   40G  0 raid5
sde                  8:64    0   20G  0 disk
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# fdisk /dev/md0
Welcome to fdisk (util-linux 2.23.2).

Changes will remain in memory only, until you decide to write them.
Be careful before using the write command.

Device does not contain a recognized partition table
Building a new DOS disklabel with disk identifier 0xcc282fd2.

Command (m for help): n
Partition type:
   p   primary (0 primary, 0 extended, 4 free)
   e   extended
Select (default p): p
Partition number (1-4, default 1):
First sector (2048-83816447, default 2048):
Using default value 2048
Last sector, +sectors or +size{K,M,G} (2048-83816447, default 83816447):
Using default value 83816447
Partition 1 of type Linux and of size 40 GiB is set

Command (m for help): w
The partition table has been altered!

Calling ioctl() to re-read partition table.

```

```

First sector (2048-83816447, default 2048):
Using default value 2048
Last sector, +sectors or +size{K,M,G} (2048-83816447, default 83816447):
Using default value 83816447
Partition 1 of type Linux and of size 40 GiB is set

Command (m for help): w
The partition table has been altered!

Calling ioctl() to re-read partition table.
Syncing disks.
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# lsblk
NAME                MAJ:MIN RM  SIZE RO TYPE  MOUNTPOINT
sda                  8:0    0   20G  0 disk
├─sda1                8:1    0    1G  0 part  /boot
├─sda2                8:2    0   19G  0 part
│   ├─centos-root    253:0    0   17G  0 lvm    /
│   └─centos-swap    253:1    0    2G  0 lvm    [SWAP]
sdb                  8:16    0   20G  0 disk
├─md0                 9:0    0   40G  0 raid5
├─md0p1              259:1    0   40G  0 md
sdc                  8:32    0   20G  0 disk
├─md0                 9:0    0   40G  0 raid5
├─md0p1              259:1    0   40G  0 md
sdd                  8:48    0   20G  0 disk
├─md0                 9:0    0   40G  0 raid5
├─md0p1              259:1    0   40G  0 md
sde                  8:64    0   20G  0 disk
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#

```



```

[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# mkfs_ext4 /dev/md0p1
mkfs 1.42.9 (28-Dec-2013)
Filesystem label=
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
Stride=128 blocks, Stripe width=256 blocks
2621440 inodes, 18476800 blocks
523840 blocks (5.88%) reserved for the super user
First data block=0
Maximum filesystem blocks=2157969408
320 block groups
32768 blocks per group, 32768 fragments per group
8192 inodes per group
Superblock backups stored on blocks:
    32768, 98304, 163840, 229376, 294912, 819200, 884736, 1605632, 2654208,
    4096000, 7962624

Allocating group tables: done
Writing inode tables: done
Creating journal (32768 blocks): done
Writing superblocks and filesystem accounting information: done

[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#

```

```

Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes

Disk /dev/sdc: 21.5 GB, 21474836480 bytes, 41943040 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes

Disk /dev/sdd: 21.5 GB, 21474836480 bytes, 41943040 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes

Disk /dev/sde: 21.5 GB, 21474836480 bytes, 41943040 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes

Disk /dev/mapper/centos-root: 18.2 GB, 18249416704 bytes, 35643392 sectors
Units = sectors of 1 * 512 = 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes

Disk /dev/mapper/centos-swap: 2147 MB, 2147483648 bytes, 4194304 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes

Disk /dev/md0: 42.9 GB, 42914021376 bytes, 83816448 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 524288 bytes / 1048576 bytes
Disk label type: dos
Disk identifier: 0xcc282fd2

```

Device	Boot	Start	End	Blocks	Id	System
/dev/md0p1		2048	83816447	41907200	83	Linux

```

[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# lsblk -l

```

NAME	MAJ:MIN	RM	SIZE	RO	TYPE	MOUNTPOINT
sda	8:0	0	20G	0	disk	
sda1	8:1	0	1G	0	part	/boot
sda2	8:2	0	19G	0	part	
centos-root	253:0	0	17G	0	lvm	/
centos-swap	253:1	0	2G	0	lvm	[SWAP]
sdb	8:16	0	20G	0	disk	
md0	9:0	0	40G	0	raid5	
md0p1	259:1	0	40G	0	md	
sdc	8:32	0	20G	0	disk	
md0	9:0	0	40G	0	raid5	
md0p1	259:1	0	40G	0	md	
sdd	8:48	0	20G	0	disk	
md0	9:0	0	40G	0	raid5	
md0p1	259:1	0	40G	0	md	
sde	8:64	0	20G	0	disk	

```

[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#

```

```

[root@localhost ~]# lsblk -l
NAME        MAJ:MIN RM SIZE RO TYPE MOUNTPOINT
sda          8:0    0 20G 0 disk
sda1         8:1    0  1G 0 part /boot
sda2         8:2    0 19G 0 part
centos-root 253:0    0 17G 0 lvm /
centos-swap 253:1    0  2G 0 lvm [SWAP]
sdb          8:16   0 20G 0 disk
md0          9:0    0 40G 0 raid5
md0p1       259:1    0 40G 0 md
sdc          8:32   0 20G 0 disk
md0          9:0    0 40G 0 raid5
md0p1       259:1    0 40G 0 md
sdd          8:48   0 20G 0 disk
md0          9:0    0 40G 0 raid5
md0p1       259:1    0 40G 0 md
sde          8:64   0 20G 0 disk
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# mkdir /mnt/raid1
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#

```

```

[root@localhost ~]# mkdir /mnt/raid5
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# mount /dev/md0p1 /mnt/raid5
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# |

```

```

[root@localhost ~]# mkdir /mnt/raid5
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# mount /dev/md0p1 /mnt/raid5
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# df -h
Filesystem                Size      Used Avail Use% Mounted on
devtmpfs                   475M          0  475M   0% /dev
tmpfs                      487M          0  487M   0% /dev/shm
tmpfs                      487M       7.7M  479M   2% /run
tmpfs                      487M          0  487M   0% /sys/fs/cgroup
/dev/mapper/centos-root    17G       1.6G   16G  10% /
/dev/sda1                 1014M      168M   847M  17% /boot
tmpfs                      98M          0   98M   0% /run/user/0
/dev/md0p1                 40G       49M   38G   1% /mnt/raid5
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# |

```

```

[root@localhost ~]# mkdir /mnt/raid5
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# mount /dev/md0p1 /mnt/raid5
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# df -h
Filesystem                Size      Used Avail Use% Mounted on
devtmpfs                   475M          0  475M   0% /dev
tmpfs                      487M          0  487M   0% /dev/shm
tmpfs                      487M       7.7M  479M   2% /run
tmpfs                      487M          0  487M   0% /sys/fs/cgroup
/dev/mapper/centos-root    17G       1.6G   16G  10% /
/dev/sda1                 1014M      168M   847M  17% /boot
tmpfs                      98M          0   98M   0% /run/user/0
/dev/md0p1                 40G       49M   38G   1% /mnt/raid5
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# lsblk
NAME        MAJ:MIN RM SIZE RO TYPE MOUNTPOINT
sda          8:0    0 20G  0 disk
├─sda1       8:1    0  1G  0 part /boot
├─sda2       8:2    0  19G  0 part
│   └─centos-root 253:0    0  17G  0 lvm  /
│       └─centos-swap 253:1    0  2G  0 lvm  [SWAP]
sdb          8:16   0 20G  0 disk
├─md0        9:0    0 40G  0 raid5
│   └─md0p1   259:1    0 40G  0 md   /mnt/raid5
sdc          8:32   0 20G  0 disk
├─md0        9:0    0 40G  0 raid5
│   └─md0p1   259:1    0 40G  0 md   /mnt/raid5
sdd          8:48   0 20G  0 disk
├─md0        9:0    0 40G  0 raid5
│   └─md0p1   259:1    0 40G  0 md   /mnt/raid5
sde          8:64   0 20G  0 disk
[root@localhost ~]#

```

Q.2 create a one volume group from three physical volumes of 1GB in size,create one logical volume of 2GB with ext4 file system later reduce the size of volume group with 500MB.

Power on this virtual machine  
Edit virtual machine settings  
Upgrade this virtual machine

▼ Devices

Memory	1 GB
Processors	1
Hard Disk (SCSI)	20 GB
Network Adapter	NAT
USB Controller	Present
Display	Auto detect

▼ Description

Type here to enter a description of this virtual machine.

Virtual Machine Settings

Hardware Options

Device	Summary
Memory	1 GB
Processors	1
Hard Disk (SCSI)	20 GB
Network Adapter	NAT
USB Controller	Present
Display	Auto detect

Summary

Disk file  
F:\Sandp\_storage\exam\_2\exam2-disk1.vmdk

Capacity

20 GB

Defragment  
Expand...  
Compact  
Advanced...

Add Hardware Wizard

Specify Disk Capacity

How large do you want this disk to be?

Maximum disk size (GB): 20.0

Recommended size for CentOS 7 64-bit: 20 GB

☐ Allocate all disk space now.  
Allocating the full capacity can enhance performance but requires all of the physical disk space to be available right now. If you do not allocate all the space now, the virtual disk starts small and grows as you add data to it.

☒ Store virtual disk as a single file

☐ Split virtual disk into multiple files  
Splitting the disk makes it easier to move the virtual machine to another computer but may reduce performance with very large disks.

< Back Next > Cancel

Add... Remove

OK Cancel Help

Power on this virtual machine  
Edit virtual machine settings  
Upgrade this virtual machine

▼ Devices

Memory	1 GB
Processors	1
Hard Disk (SCSI)	20 GB
Network Adapter	NAT
USB Controller	Present
Display	Auto detect

▼ Description

Type here to enter a description of this virtual machine.

Virtual Machine Settings

Hardware Options

Device	Summary
Memory	1 GB
Processors	1
Hard Disk (SCSI)	20 GB
New Hard Disk (SCSI)	20 GB
New Hard Disk (SCSI)	20 GB
New Hard Disk (SCSI)	20 GB
Network Adapter	NAT
USB Controller	Present
Display	Auto detect

Disk file  
exam2-1.vmdk

Capacity

Current size: 2.6 MB  
System free: 405.9 GB  
Maximum size: 20 GB

Disk information

Disk space is not preallocated for this hard disk.  
Hard disk contents are stored in a single file.

Disk utilities

Defragment files and consolidate free space. ☐ Defragment

Expand disk capacity. ☐ Expand...

Compact disk to reclaim unused space. ☐ Compact

Advanced...

Add... Remove

OK Cancel Help

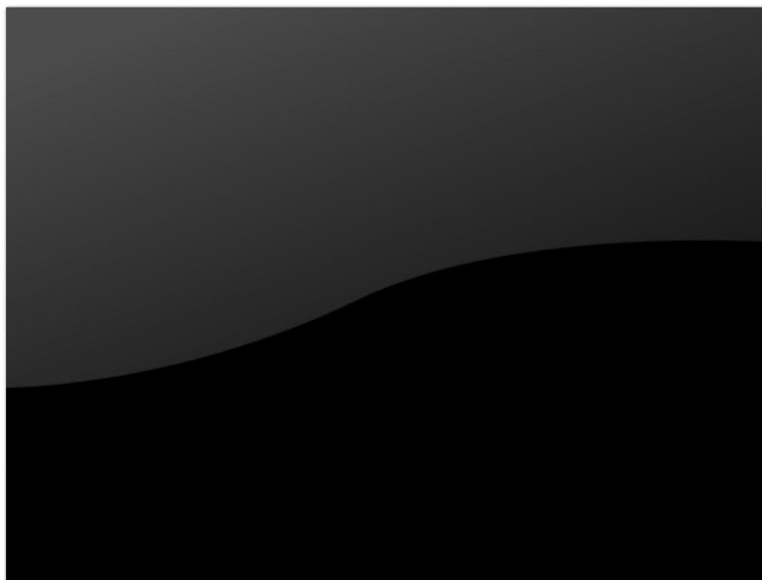
[Power on this virtual machine](#)  
[Edit virtual machine settings](#)  
[Upgrade this virtual machine](#)

▼ Devices

Memory	1 GB
Processors	1
Hard Disk (SCSI)	20 GB
Hard Disk 2 (SCSI)	20 GB
Hard Disk 3 (SCSI)	20 GB
Hard Disk 4 (SCSI)	20 GB
Network Adapter	NAT
USB Controller	Present
Display	Auto detect

▼ Description

Type here to enter a description of this virtual machine.



```
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# lsblk
NAME        MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
sda          8:0    0  20G  0 disk
├─sda1       8:1    0   1G  0 part /boot
├─sda2       8:2    0  19G  0 part
│   └─centos-root 253:0  0   17G  0 lvm  /
│       └─centos-swap 253:1  0    2G  0 lvm  [SWAP]
sdb          8:16   0  20G  0 disk
sdc          8:32   0  20G  0 disk
sdd          8:48   0  20G  0 disk
[root@localhost ~]#
```

```
[root@localhost ~]# vgcreate NPSCSA /dev/sda /dev/sdb /dev/sdc
Device /dev/sda excluded by a filter.
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# lsblk
NAME        MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
sda          8:0    0  20G  0 disk
├─sda1       8:1    0   1G  0 part /boot
├─sda2       8:2    0  19G  0 part
│   └─centos-root 253:0  0   17G  0 lvm  /
│       └─centos-swap 253:1  0    2G  0 lvm  [SWAP]
sdb          8:16   0  20G  0 disk
sdc          8:32   0  20G  0 disk
sdd          8:48   0  20G  0 disk
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# pvcreate /dev/sdb /dev/sdc /dev/sdc
Device /dev/sdc excluded by a filter.
Physical volume "/dev/sdb" successfully created.
Physical volume "/dev/sdc" successfully created.
[root@localhost ~]#
[root@localhost ~]#
```

```

[root@localhost ~]# vgcreate HPCSA /dev/sda /dev/sdb /dev/sdc
Device /dev/sda excluded by a filter.
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# lsblk
NAME        MAJ:MIN RM SIZE RO TYPE MOUNTPOINT
sda          8:0    0 20G 0 disk
├─sda1       8:1    0  1G 0 part /boot
├─sda2       8:2    0 19G 0 part
│   └─centos-root 253:0    0 17G 0 lvm /
│   └─centos-swap 253:1    0  2G 0 lvm [SWAP]
sdb          8:16    0 20G 0 disk
sdc          8:32    0 20G 0 disk
sdd          8:48    0 20G 0 disk
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# pvcreate /dev/sdb /dev/sdc /dev/sdc
Device /dev/sdc excluded by a filter.
Physical volume "/dev/sdb" successfully created.
Physical volume "/dev/sdc" successfully created.
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# vgcreate HPCSA /dev/sdb /dev/sdc /dev/sdd
Physical volume "/dev/sdd" successfully created.
Volume group "HPCSA" successfully created
[root@localhost ~]#

```

```

[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# vgcreate HPCSA /dev/sda /dev/sdb /dev/sdc
Device /dev/sda excluded by a filter.
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# lsblk
NAME        MAJ:MIN RM SIZE RO TYPE MOUNTPOINT
sda          8:0    0 20G 0 disk
├─sda1       8:1    0  1G 0 part /boot
├─sda2       8:2    0 19G 0 part
│   └─centos-root 253:0    0 17G 0 lvm /
│   └─centos-swap 253:1    0  2G 0 lvm [SWAP]
sdb          8:16    0 20G 0 disk
sdc          8:32    0 20G 0 disk
sdd          8:48    0 20G 0 disk
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# pvcreate /dev/sdb /dev/sdc /dev/sdc
Device /dev/sdc excluded by a filter.
Physical volume "/dev/sdb" successfully created.
Physical volume "/dev/sdc" successfully created.
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# vgcreate HPCSA /dev/sdb /dev/sdc /dev/sdd
Physical volume "/dev/sdd" successfully created.
Volume group "HPCSA" successfully created
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#

```

```

[root@localhost ~]#
[root@localhost ~]# pvs
PV          VG      Fmt  Attr PSize  PFree
/dev/sda2   centos  lvm2 a--  <19.00g  0
/dev/sdb    HPCSA   lvm2 a--  <20.00g <20.00g
/dev/sdc    HPCSA   lvm2 a--  <20.00g <20.00g
/dev/sdd    HPCSA   lvm2 a--  <20.00g <20.00g
[root@localhost ~]#

```

```

[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# pvdisplay
--- Physical volume ---
PV Name           /dev/sda2
VG Name           centos
PV Size           <19.00 GiB / not usable 3.00 MiB
Allocatable       yes (but full)
PE Size           4.00 MiB
Total PE          4863
Free PE           0
Allocated PE      4863
PV UUID           tE23TB-FBVR-FRUB-0hLP-hF7k-IPsp-dpyXwJ

--- Physical volume ---
PV Name           /dev/sdb
VG Name           HPCSA
PV Size           20.00 GiB / not usable 4.00 MiB
Allocatable       yes
PE Size           4.00 MiB
Total PE          5119
Free PE           5119
Allocated PE      0
PV UUID           pp9axF-nuxo-DobC-XCCz-JZuC-wF9f-1pxraR

--- Physical volume ---
PV Name           /dev/sdc
VG Name           HPCSA
PV Size           20.00 GiB / not usable 4.00 MiB
Allocatable       yes
PE Size           4.00 MiB
Total PE          5119
Free PE           5119
Allocated PE      0
PV UUID           Ttiem-KDZi-SfLU-qmww-6abf-Tujb-ZQtv8a

--- Physical volume ---
PV Name           /dev/sdd
VG Name           HPCSA
PV Size           20.00 GiB / not usable 4.00 MiB
Allocatable       yes
PE Size           4.00 MiB
Total PE          5119
Free PE           5119
Allocated PE      0
PV UUID           3pyacF-H0jd-hlCj-cHrC-kN6w-nPvS-vL2kik

```

```

Allocatable       yes (but full)
PE Size           4.00 MiB
Total PE          4863
Free PE           0
Allocated PE      4863
PV UUID           tE23TB-FBVR-FRUB-0hLP-hF7k-IPsp-dpyXwJ

--- Physical volume ---
PV Name           /dev/sdb
VG Name           HPCSA
PV Size           20.00 GiB / not usable 4.00 MiB
Allocatable       yes
PE Size           4.00 MiB
Total PE          5119
Free PE           5119
Allocated PE      0
PV UUID           pp9axF-nuxo-DobC-XCCz-JZuC-wF9f-1pxraR

--- Physical volume ---
PV Name           /dev/sdc
VG Name           HPCSA
PV Size           20.00 GiB / not usable 4.00 MiB
Allocatable       yes
PE Size           4.00 MiB
Total PE          5119
Free PE           5119
Allocated PE      0
PV UUID           Ttiem-KDZi-SfLU-qmww-6abf-Tujb-ZQtv8a

--- Physical volume ---
PV Name           /dev/sdd
VG Name           HPCSA
PV Size           20.00 GiB / not usable 4.00 MiB
Allocatable       yes
PE Size           4.00 MiB
Total PE          5119
Free PE           5119
Allocated PE      0
PV UUID           3pyacF-H0jd-hlCj-cHrC-kN6w-nPvS-vL2kik

```

```

[root@localhost ~]# vgs
VG      #PV #LV #SN Attr   VSize   VFree
HPCSA   3   0   0 wz--n- <59.99g <59.99g
centos   1   2   0 wz--n- <19.00g    0
[root@localhost ~]#
[root@localhost ~]#

```





```
PV Name      /dev/sda2
VG Name      centos
PV Size      <19.00 GiB / not usable 3.00 MiB
Allocatable  yes (but full)
PE Size      4.00 MiB
Total PE     4863
Free PE      0
Allocated PE 4863
PV UUID      tE23TB-FBVR-FRUB-0hLP-hF7k-IPsp-dpyXwJ

--- Physical volume ---
PV Name      /dev/sdb
VG Name      EXAM
PV Size      20.00 GiB / not usable 4.00 MiB
Allocatable  yes
PE Size      4.00 MiB
Total PE     5119
Free PE      5119
Allocated PE 0
PV UUID      i1LP1F-jF6N-bFLP-GksD-AXrV-fd0W-HM9SIR

--- Physical volume ---
PV Name      /dev/sdc
VG Name      EXAM
PV Size      20.00 GiB / not usable 4.00 MiB
Allocatable  yes
PE Size      4.00 MiB
Total PE     5119
Free PE      5119
Allocated PE 0
PV UUID      I1R9Kg-10EP-0WWa-AfcR-QcYq-fRbU-R03cRO

--- Physical volume ---
PV Name      /dev/sdd
VG Name      EXAM
PV Size      20.00 GiB / not usable 4.00 MiB
Allocatable  yes
PE Size      4.00 MiB
Total PE     5119
Free PE      5119
Allocated PE 0
PV UUID      unlcrt-TODD-fXwQ-hssa-cNrd-dwDc-kfKt8n

[root@localhost ~]#
```

```
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# lvcreate -n hpcsa_lab --size 2G EXAM
Logical volume "hpcsa_lab" created.
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
```

```

[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# lvs
LV          VG      Attr              LSize   Pool Origin Data%  Meta%   Move Log Cpy%Sync Convert
hpcsa_lab   HPCSA   -wi-a----- 3.00g
root        centos  -wi-sa----- <17.00g
swap        centos  -wi-a----- 2.00g
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#

```

[illegible]