CLOUD COMPUTING

LAB 05

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BSE V-A

2023-BSE-031

Task 1 - Discover missing command & install Java using apt suggestion

Steps

1. Run the java command to see what the system suggests:

```
komal_31@ubuntu:~$ java
Command 'java' not found, but can be installed with:
sudo apt install openjdk-17-jre-headless  # version 17.0.16+8~us1-0ubuntu1~24.04.1, or
sudo apt install openjdk-21-jre-headless  # version 21.8+9~us1-0ubuntu1~24.04.1
sudo apt install default-jre              # version 2:1.17-75
sudo apt install openjdk-11-jre-headless  # version 11.0.28+6-1ubuntu1~24.04.1
sudo apt install openjdk-25-jre-headless  # version 25+36-1~24.04.2
sudo apt install openjdk-8-jre-headless   # version 8u462-ga~us1-0ubuntu2~24.04.2
sudo apt install openjdk-19-jre-headless  # version 19.0.2+7-4
sudo apt install openjdk-20-jre-headless  # version 20.0.2+9-1
sudo apt install openjdk-22-jre-headless  # version 22~22ea-1
```

2. Use the suggested apt command (copy the exact package name suggested by the system).
   sudo apt install <suggested-package> -y

```
Adding debian:UCA_Global_G2_Root.pem
Adding debian:USERTrust_ECC_Certification_Authority.pem
Adding debian:USERTrust_RSA_Certification_Authority.pem
Adding debian:vTrus_ECC_Root_CA.pem
Adding debian:vTrus_Root_CA.pem
Adding debian:XRamp_Global_CA_Root.pem
done.
Scanning processes...
Scanning linux images...

Running kernel seems to be up-to-date.

No services need to be restarted.

No containers need to be restarted.

No user sessions are running outdated binaries.

No VM guests are running outdated hypervisor (qemu) binaries on this host.
komal_31@ubuntu:~$
```

3. Verify Java is installed and check version:

   java –version

```
komal_31@ubuntu:~$ java --version
openjdk 11.0.28 2025-07-15
OpenJDK Runtime Environment (build 11.0.28+6-post-Ubuntu-1ubuntu124.04.1)
OpenJDK 64-Bit Server VM (build 11.0.28+6-post-Ubuntu-1ubuntu124.04.1, mixed mode, sharing)
```

4. Remove the Java package using apt remove (use the same package name you installed):

   sudo apt remove <suggested-package> -y

```
komal_31@ubuntu:~$ sudo apt remove openjdk-11-jre-headless -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following packages were automatically installed and are no longer required:
  alsa-topology-conf alsa-ucm-conf ca-certificates-java java-common libasound2-data libasound2t64 libavahi-client3
  libavahi-common-data libavahi-common3 libcups2t64 libgraphite2-3 libharfbuzz0b liblcms2-2 libpcsclite1
Use 'sudo apt autoremove' to remove them.
The following packages will be REMOVED:
  openjdk-11-jre-headless
0 upgraded, 0 newly installed, 1 to remove and 25 not upgraded.
After this operation, 176 MB disk space will be freed.
(Reading database ... 88474 files and directories currently installed.)
Removing openjdk-11-jre-headless:amd64 (11.0.28+6-1ubuntu1~24.04.1) ...
```

5. Confirm java is no longer available (run java again) — it should again indicate "not found" or suggest installation:

java

```
komal_31@ubuntu:~$ java
-bash: /usr/bin/java: No such file or directory
```

6. Clear the shell's command hash cache so the shell forgets cached command locations (run as your regular user — no sudo required):

hash -r

java

```
komal_31@ubuntu:~$ hash -r
komal_31@ubuntu:~$ java
Command 'java' not found, but can be installed with:
sudo apt install openjdk-17-jre-headless  # version 17.0.16+8~us1-0ubuntu1~24.04.1, or
sudo apt install openjdk-21-jre-headless  # version 21.0.8+9~us1-0ubuntu1~24.04.1
sudo apt install default-jre              # version 2:1.17-75
sudo apt install openjdk-11-jre-headless  # version 11.0.28+6-1ubuntu1~24.04.1
sudo apt install openjdk-25-jre-headless  # version 25+36-1~24.04.2
sudo apt install openjdk-8-jre-headless   # version 8u462-ga~us1-0ubuntu2~24.04.2
sudo apt install openjdk-19-jre-headless  # version 19.0.2+7-4
sudo apt install openjdk-20-jre-headless  # version 20.0.2+9-1
sudo apt install openjdk-22-jre-headless  # version 22~22ea-1
```

Task 2 - Install & remove Java using apt-get (explicitly)

Steps

1. Install Java using apt-get (choose a common package, e.g., default-jre — or the same package you used in Task 1):

sudo apt-get update

sudo apt-get install default-jre -y

```
komal_31@ubuntu:~$ sudo apt-get update
Hit:1 http://archive.ubuntu.com/ubuntu noble InRelease
Get:2 http://archive.ubuntu.com/ubuntu noble-updates InRelease [126 kB]
Get:3 http://security.ubuntu.com/ubuntu noble-security InRelease [126 kB]
Get:4 http://archive.ubuntu.com/ubuntu noble-backports InRelease [126 kB]
Get:5 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 Packages [1,585 kB]
Get:6 http://security.ubuntu.com/ubuntu noble-security/main amd64 Packages [1,305 kB]
Get:7 http://archive.ubuntu.com/ubuntu noble-updates/main Translation-en [299 kB]
Get:8 http://security.ubuntu.com/ubuntu noble-security/main Translation-en [215 kB]
Get:9 http://security.ubuntu.com/ubuntu noble-security/main amd64 Components [21.5 kB]
Get:10 http://security.ubuntu.com/ubuntu noble-security/main amd64 c-n-f Metadata [9,336 B]
Get:11 http://security.ubuntu.com/ubuntu noble-security/restricted amd64 Packages [2,135 kB]
Get:12 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 Components [175 kB]
Get:13 http://security.ubuntu.com/ubuntu noble-security/restricted Translation-en [485 kB]
Get:14 http://security.ubuntu.com/ubuntu noble-security/restricted amd64 Components [212 B]
Get:15 http://security.ubuntu.com/ubuntu noble-security/universe amd64 Packages [906 kB]
Get:26 http://archive.ubuntu.com/ubuntu noble-backports/restricted amd64 Components [212 B]
Get:27 http://archive.ubuntu.com/ubuntu noble-backports/universe amd64 Components [11.0 kB]
Get:28 http://archive.ubuntu.com/ubuntu noble-backports/multiverse amd64 Components [212 B]
Fetched 12.2 MB in 25s (486 kB/s)
Reading package lists... Done
komal_31@ubuntu:~$ sudo apt-get install default-jre -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  adwaita-icon-theme at-spi2-common at-spi2-core dconf-gsettings-backend dconf-service default-jre-headless fontconfig
  fonts-dejavu-extra gsettings-desktop-schemas gtk-update-icon-cache hicolor-icon-theme humanity-icon-theme
  libatk-bridge2.0-0t64 libatk-wrapper-java libatk-wrapper-java-jni libatk1.0-0t64 libatspi2.0-0t64 libcairo-gobject2
  libcairo2 libcolord2 libdatrie1 libdconf1 libdrm-amdgpu1 libdrm-intel1 libepoxy0 libgbm1 libgdk-pixbuf-2.0-0
  libgdk-pixbuf2.0-bin libgdk-pixbuf2.0-common libgif7 libgl1 libgl1-mesa-dri libglvnd0 libglx-mesa0 libglx0
  libgtk-3-0t64 libgtk-3-bin libgtk-3-common libice6 libllvm20 libpango-1.0-0 libpangocairo-1.0-0 libpangoft2-1.0-0
```

2. Verify Java version again:

    java –version

```
komal_31@ubuntu:~$ java --version
openjdk 21.0.8 2025-07-15
OpenJDK Runtime Environment (build 21.0.8+9-Ubuntu-0ubuntu124.04.1)
OpenJDK 64-Bit Server VM (build 21.0.8+9-Ubuntu-0ubuntu124.04.1, mixed mode, sharing)
```

3. Remove Java using apt-get remove:

    sudo apt-get remove default-jre -y

```
komal_31@ubuntu:~$ sudo apt-get remove default-jre -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following packages were automatically installed and are no longer required:
  adwaita-icon-theme alsa-topology-conf alsa-ucm-conf at-spi2-common at-spi2-core ca-certificates-java
  dconf-gsettings-backend dconf-service default-jre-headless fontconfig fonts-dejavu-extra gsettings-desktop-schemas
  gtk-update-icon-cache hicolor-icon-theme humanity-icon-theme java-common libasound2-data libasound2t64
  libatk-bridge2.0-0t64 libatk-wrapper-java libatk-wrapper-java-jni libatk1.0-0t64 libatspi2.0-0t64 libavahi-client3
  libavahi-common-data libavahi-common3 libcairo-gobject2 libcairo2 libcolord2 libcups2t64 libdatrie1 libdconf1
  libdrm-amdgpu1 libdrm-intel1 libepoxy0 libgbm1 libgdk-pixbuf-2.0-0 libgdk-pixbuf2.0-bin libgdk-pixbuf2.0-common
  libgif7 libgl1 libgl1-mesa-dri libglvnd0 libglx-mesa0 libglx0 libgraphite2-3 libgtk-3-0t64 libgtk-3-bin
  libgtk-3-common libharfbuzz0b libice6 liblcms2-2 libllvm20 libpango-1.0-0 libpangocairo-1.0-0 libpangoft2-1.0-0
  libpciaccess0 libpcsclite1 libpixman-1-0 librsvg2-2 librsvg2-common libsm6 libthai-data libthai0 libvulkan1
  libwayland-client0 libwayland-cursor0 libwayland-egl1 libwayland-server0 libx11-xcb1 libxaw7 libxcb-dri3-0
  libxcb-glx0 libxcb-present0 libxcb-randr0 libxcb-render0 libxcb-shape0 libxcb-shm0 libxcb-sync1 libxcb-xfixes0
  libxcomposite1 libxcursor1 libxdamage1 libxfixes3 libxft2 libxi6 libxinerama1 libxkbfile1 libxmu6 libxrandr2
  libxrender1 libxshmfence1 libxt6t64 libxtst6 libxv1 libxxf86dga1 libxxf86vm1 mesa-libgallium mesa-vulkan-drivers
  openjdk-21-jre openjdk-21-jre-headless session-migration ubuntu-mono x11-common x11-utils
Use 'sudo apt autoremove' to remove them.
The following packages will be REMOVED:
  default-jre
0 upgraded, 0 newly installed, 1 to remove and 25 not upgraded.
After this operation, 6,144 B disk space will be freed.
(Reading database ... 101897 files and directories currently installed.)
Removing default-jre (2:1.21-75+exp1) ...
```

4. Clear the terminal hash cache and confirm java is missing:

    hash -r

    java

```
komal_31@ubuntu:~$ hash -r
komal_31@ubuntu:~$ java
Command 'java' not found, but can be installed with:
sudo apt install openjdk-17-jre-headless  # version 17.0.16+8~us1-0ubuntu1~24.04.1, or
sudo apt install openjdk-21-jre-headless  # version 21.0.8+9~us1-0ubuntu1~24.04.1
sudo apt install default-jre              # version 2:1.17-75
sudo apt install openjdk-11-jre-headless  # version 11.0.28+6-1ubuntu1~24.04.1
sudo apt install openjdk-25-jre-headless  # version 25+36-1~24.04.2
sudo apt install openjdk-8-jre-headless   # version 8u462-ga~us1-0ubuntu2~24.04.2
sudo apt install openjdk-19-jre-headless  # version 19.0.2+7-4
sudo apt install openjdk-20-jre-headless  # version 20.0.2+9-1
sudo apt install openjdk-22-jre-headless  # version 22~22ea-1
```

Task 3 - apt update vs apt upgrade - run & explain

Steps

1. Update the package index (this downloads the latest lists of available packages):

    sudo apt update

```
komal_31@ubuntu:~$ sudo apt update
Hit:1 http://archive.ubuntu.com/ubuntu noble InRelease
Hit:2 http://security.ubuntu.com/ubuntu noble-security InRelease
Hit:3 http://archive.ubuntu.com/ubuntu noble-updates InRelease
Hit:4 http://archive.ubuntu.com/ubuntu noble-backports InRelease
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
25 packages can be upgraded. Run 'apt list --upgradable' to see them.
```

2. Upgrade installed packages (this installs available updates for currently installed packages):

    sudo apt upgrade

```
komal_31@ubuntu:~$ sudo apt upgrade
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Calculating upgrade... Done
The following packages will be upgraded:
  cloud-init coreutils distro-info-data fwupd landscape-common libfwupd2 libnss-sys
  libudev1 powermgmt-base python3-software-properties snapd software-properties-com
  systemd-hwe-hwdb systemd-resolved systemd-sysv systemd-timesyncd tcpdump ubuntu-d
25 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
Need to get 50.7 MB of archives.
After this operation, 3,360 kB of additional disk space will be used.
```

3. Write a short 3–5 sentence explanation describing the difference between apt update and apt upgrade. Put your text into a small file and capture it as a screenshot (do not upload the text file; provide the screenshot):

    nano ~/apt_update_vs_upgrade.md

write 3-5 sentences, save and exit

    Open the file or show it on screen

```
komal_31@ubuntu:~$ nano ~/apt_update_vs_upgrade.md
komal_31@ubuntu:~$ komal_31@ubuntu:~$ cat ~/apt_update_vs_upgrade.md
apt update refreshes the local package index — it does not change installed packages.
apt upgrade looks at the updated index and installs newer versions of already-installed packages.
Without apt update, apt upgrade would use outdated package lists and might not find the newest updates.
```

Task 4 - Install Visual Studio Code via snap on CLI and verify (DO NOT remove Code)

Steps

1. Install VS Code via snap (snap may require sudo):

    sudo snap install --classic code

```
komal_31@ubuntu:~$ sudo snap install --classic code
Download snap "code" (211) from channel "stable"
code 7d842fb8 from Visual Studio Code (vscode) installed
```

2. Verify snap shows the package is installed:

    snap list code

```
komal_31@ubuntu:~$ snap list code
Name  Version   Rev  Tracking       Publisher  Notes
code  7d842fb8  211  latest/stable  vscode     classic
```

3. Check the installed application's version. On some systems code --version is available; also check snap info:

    code –version

```
komal_31@ubuntu:~$ code --version
1.105.1
7d842fb85a0275a4a8e4d7e040d2625abbf7f084
x64
```

4. If the code binary is not in PATH, show where the snap placed it:

ls -l /snap/bin | grep code

```
komal_31@ubuntu:~$ ls -l /snap/bin | grep code
lrwxrwxrwx 1 root root 13 Nov  8 08:45 code -> /usr/bin/snap
lrwxrwxrwx 1 root root 13 Nov  8 08:45 code.url-handler -> /usr/bin/snap
```

Task 5 - Install XFCE GUI + XRDP - minimal desktop and remote access (GUI) and launch VS Code

Steps

1. From your host, open your preferred terminal (for example: Windows Command Prompt, PowerShell, macOS Terminal, or Linux Terminal) and connect to the VM using SSH. Example:

ssh student@<vm-ip-address>

2. Update the server (download package lists and apply upgrades):

sudo apt update && sudo apt upgrade -y

```
komal_31@ubuntu31:~$ sudo apt update && sudo apt upgrade -y
Hit:1 http://archive.ubuntu.com/ubuntu noble InRelease
Hit:2 http://security.ubuntu.com/ubuntu noble-security InRelease
Hit:3 http://archive.ubuntu.com/ubuntu noble-updates InRelease
Hit:4 http://archive.ubuntu.com/ubuntu noble-backports InRelease
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
All packages are up to date.
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Calculating upgrade... Done
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
```

3. Install XFCE and XFCE goodies (lightweight desktop):

sudo apt install xfce4 xfce4-goodies -y

```
komal_31@ubuntu31:~$ sudo apt install xfce4 xfce4-goodies -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
 7zip accountsservice accountsservice-ubuntu-schemas acl activity-log-manager adwaita-icon-theme alsa-topology-conf
 alsa-ucm-conf apg aspell aspell-en at-spi2-common at-spi2-core avahi-daemon avahi-utils bamfdaemon bluez bluez-obexd
 bubblewrap bzip2 cheese-common colord colord-data cpp cpp-13 cpp-13-x86-64-linux-gnu cpp-x86-64-linux-gnu
 cracklib-runtime cups cups-browsed cups-client cups-common cups-core-drivers cups-daemon cups-filters
 cups-filters-core-drivers cups-ipp-utils cups-pk-helper cups-ppdc cups-server-common dconf-cli
 dconf-gsettings-backend dconf-service desktop-base desktop-file-utils dictionaries-common dns-root-data dnsmasq-base
 docbook-xml elementary-xfce-icon-theme emacsen-common enchant-2 evolution-data-server evolution-data-server-common
 exo-utils fontconfig fonts-droid-fallback fonts-noto-mono fonts-quicksand fonts-ubuntu fonts-urw-base35 gcc-13-base
 gcr gcr4 geocode-glib-common ghostscript gir1.2-atk-1.0 gir1.2-dbusmenu-glib-0.4 gir1.2-freedesktop
 gir1.2-gdkpixbuf-2.0 gir1.2-gtk-3.0 gir1.2-handy-1 gir1.2-harfbuzz-0.0 gir1.2-ibus-1.0 gir1.2-notify-0.7
 gir1.2-pango-1.0 gir1.2-polkit-1.0 gir1.2-secret-1 gkbd-capplet glib-networking glib-networking-common
 glib-networking-services gnome-bluetooth gnome-bluetooth-3-common gnome-bluetooth-sendto gnome-control-center-faces
 gnome-desktop3-data gnome-keyring gnome-keyring-pkcs11 gnome-menus gnome-power-manager gnome-screensaver
```

4. Install and enable XRDP (Remote Desktop Protocol server):

sudo apt install xrdp -y

sudo systemctl enable --now xrdp

```
komal_31@ubuntu31:~$ sudo systemctl enable --now xrdp
Synchronizing state of xrdp.service with SysV service script with /usr/lib/systemd/systemd-sysv-install.
Executing: /usr/lib/systemd/systemd-sysv-install enable xrdp
```

5. Verify XRDP status:

sudo systemctl status xrdp

```
komal_31@ubuntu31:~$ sudo systemctl status xrdp
● xrdp.service - xrdp daemon
     Loaded: loaded (/usr/lib/systemd/system/xrdp.service; enabled; preset: enabled)
     Active: active (running) since Sat 2025-11-15 11:49:41 UTC; 1min 38s ago
       Docs: man:xrdp(8)
             man:xrdp.ini(5)
   Main PID: 30231 (xrdp)
      Tasks: 1 (limit: 4548)
     Memory: 872.0K (peak: 1.5M)
        CPU: 23ms
     CGroup: /system.slice/xrdp.service
             └─30231 /usr/sbin/xrdp
```

6. Configure XRDP to use XFCE session:

echo xfce4-session > ~/.xsession

```
komal_31@ubuntu31:~$ echo xfce4-session > ~/.xsession
komal_31@ubuntu31:~$ cat ~/.xsession
xfce4-session
```

- Save screenshot as: task5_xsession.png

7. After you are in the GUI (local console or RDP session), launch Visual Studio Code (installed in Task 4) from the GUI menu or a terminal inside the GUI. Example command from a GUI terminal:
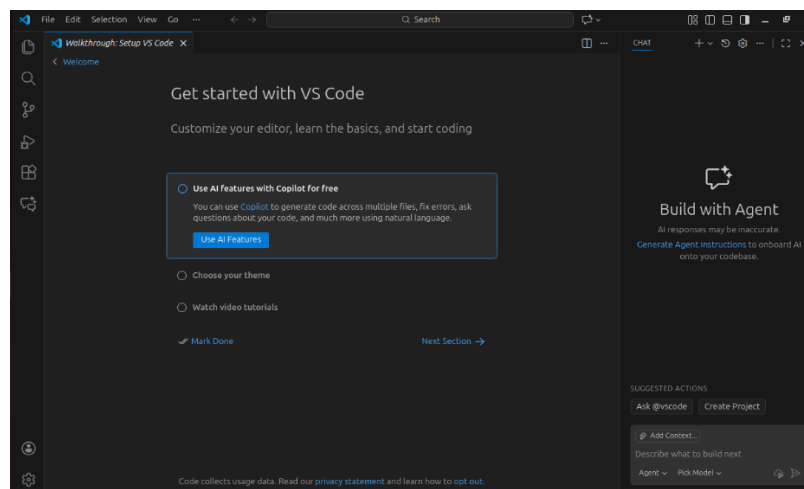
   code

Task 6 - Install lightdm-gtk-greeter and GUI verification - start GUI, open VS Code, take snapshot, then end (GUI)

Steps (inside the host terminal / via SSH)

1. Fix GUI login screen issues (if lightdm / greeter problems appear)

- Install LightDM and greeter using Host Terminal:

sudo apt install lightdm lightdm-gtk-greeter -y

```
komal_31@ubuntu31:~$ sudo apt install lightdm lightdm-gtk-greeter -y
[sudo] password for komal_31:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
lightdm is already the newest version (1.30.0-0ubuntu14).
lightdm set to manually installed.
The following NEW packages will be installed:
  lightdm-gtk-greeter
0 upgraded, 1 newly installed, 0 to remove and 18 not upgraded.
Need to get 94.3 kB of archives.
After this operation, 607 kB of additional disk space will be used.
Get:1 http://archive.ubuntu.com/ubuntu noble/universe amd64 lightdm-gtk-greeter amd64 2.0.9-0ubuntu3 [94.3 kB]
```

- Create LightDM config to use XFCE:

sudo mkdir -p /etc/lightdm/lightdm.conf.d

echo -e "[Seat:*]\ngreeter-session=lightdm-gtk-greeter\nuser-session=xfce\nautologin-user-timeout=0" | sudo tee /etc/lightdm/lightdm.conf.d/99-xfce.conf

```
komal_31@ubuntu31:~$ sudo mkdir -p /etc/lightdm/lightdm.conf.d
komal_31@ubuntu31:~$ echo -e "[Seat:*]\ngreeter-session=lightdm-gtk-greeter\nuser-session=xfce\nautologin-user-timeout=0
" | sudo tee /etc/lightdm/lightdm.conf.d/99-xfce.conf
[Seat:*]
greeter-session=lightdm-gtk-greeter
user-session=xfce
autologin-user-timeout=0
```

- Clean up problematic session files and permissions:

sudo rm -f /var/lib/lightdm/.Xauthority

sudo rm -f ~/.Xauthority

sudo rm -rf ~/.cache/sessions

sudo chown -R $USER:$USER /home/$USER

```
komal_31@ubuntu31:~$ sudo rm -f /var/lib/lightdm/.Xauthority
komal_31@ubuntu31:~$ sudo rm -f ~/.Xauthority
komal_31@ubuntu31:~$ sudo rm -rf ~/.cache/sessions
komal_31@ubuntu31:~$ sudo chown -R $USER:$USER /home/$USER
komal_31@ubuntu31:~$ ls -ld /home/$USER
drwxr-x--- 7 komal_31 komal_31 4096 Nov 15 12:32 /home/komal_31
```

- Restart LightDM:

sudo systemctl restart lightdm

```
komal_31@ubuntu31:~$ sudo systemctl restart lightdm
komal_31@ubuntu31:~$
```

2. Control GUI login at boot — ENABLE first, then DISABLE (observe and understand terminal/GUI behavior after each reboot)Enable GUI Login Screen (Boot to GUI)

- o Re-enable LightDM and set the graphical target as default:
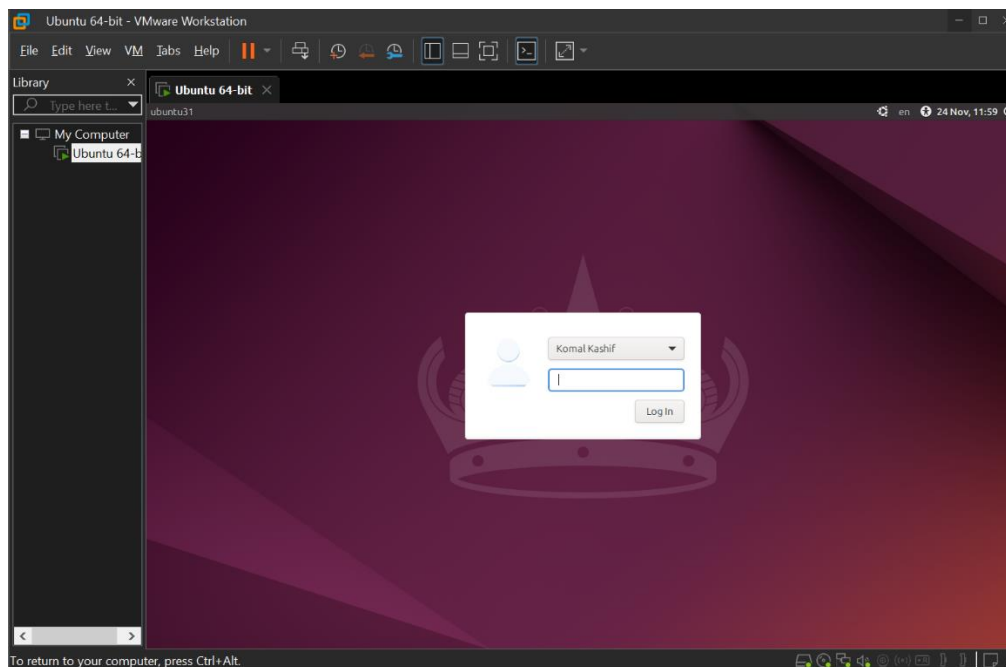
  sudo systemctl enable lightdm

  sudo systemctl set-default graphical.target

```
komal_31@ubuntu31:~$ sudo systemctl enable lightdm
Synchronizing state of lightdm.service with SysV service script with /usr/lib/systemd/systemd-sysv-install.
Executing: /usr/lib/systemd/systemd-sysv-install enable lightdm
The unit files have no installation config (WantedBy=, RequiredBy=, UpheldBy=,
Also=, or Alias= settings in the [Install] section, and DefaultInstance= for
template units). This means they are not meant to be enabled or disabled using systemctl.

Possible reasons for having these kinds of units are:
• A unit may be statically enabled by being symlinked from another unit's
  .wants/, .requires/, or .upholds/ directory.
• A unit's purpose may be to act as a helper for some other unit which has
  a requirement dependency on it.
• A unit may be started when needed via activation (socket, path, timer,
  D-Bus, udev, scripted systemctl call, ...).
• In case of template units, the unit is meant to be enabled with some
  instance name specified.
komal_31@ubuntu31:~$ sudo systemctl set-default graphical.target
Created symlink /etc/systemd/system/default.target → /usr/lib/systemd/system/graphical.target.
```

- Reboot the VM to observe that it boots to the GUI login screen:

sudo reboot

- Disable GUI Login Screen (Boot to CLI)

  - o Set the default boot target to multi-user (text mode) and disable LightDM so the system boots to the terminal:

sudo systemctl set-default multi-user.target

sudo systemctl disable lightdm

```
komal_31@ubuntu31:~$ sudo systemctl set-default multi-user.target
[sudo] password for komal_31:
Removed "/etc/systemd/system/default.target".
Created symlink /etc/systemd/system/default.target → /usr/lib/systemd/system/multi-user.target.
komal_31@ubuntu31:~$ sudo systemctl disable lightdm
Synchronizing state of lightdm.service with SysV service script with /usr/lib/systemd/systemd-sysv-install.
Executing: /usr/lib/systemd/systemd-sysv-install disable lightdm
Removed "/etc/systemd/system/display-manager.service".
```
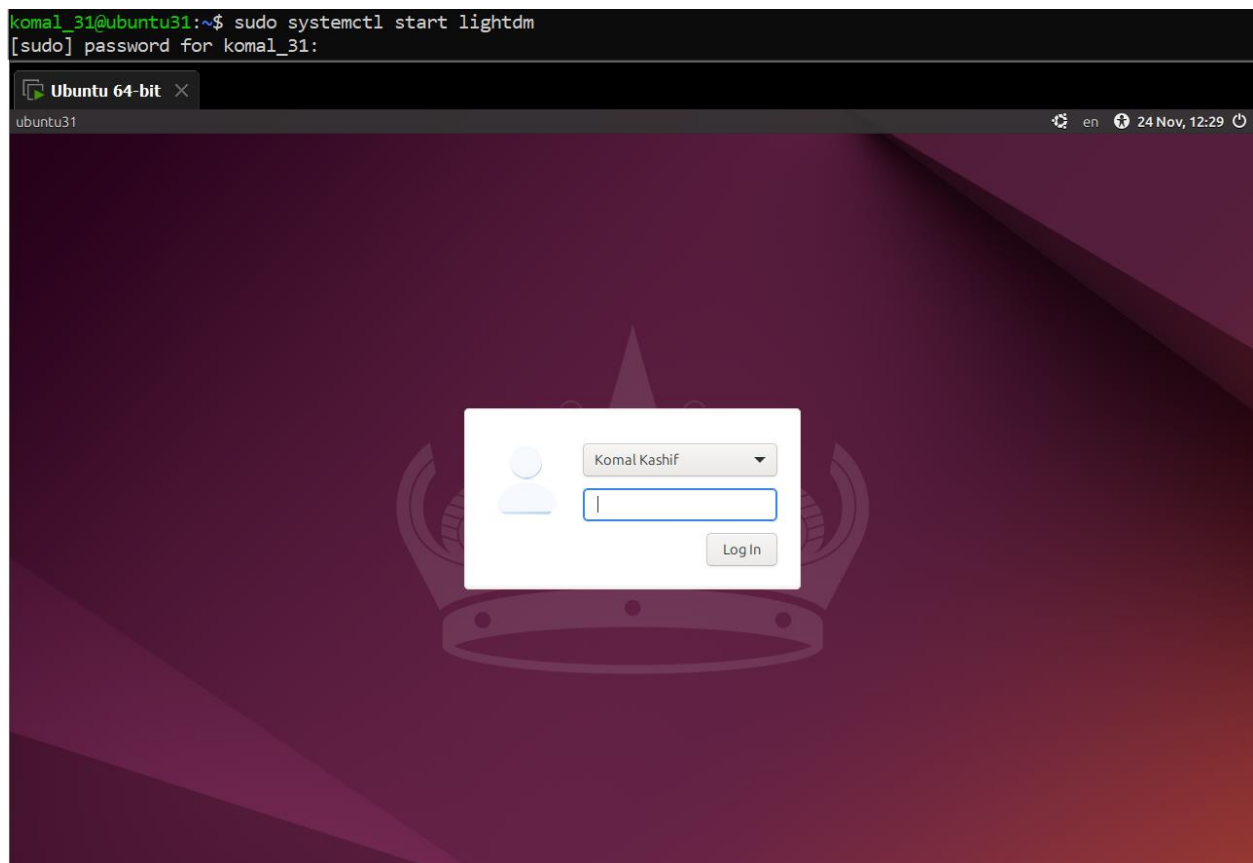
- Reboot the VM to observe that it boots to the terminal (CLI):

sudo reboot

```
Ubuntu 24.04.3 LTS ubuntu31 tty1

ubuntu31 login: _
```

- Start/Stop GUI manually (no reboot)

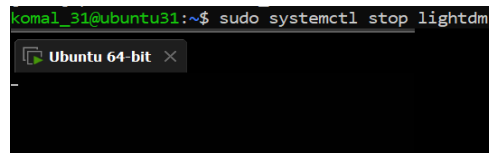 sudo systemctl start lightdm

sudo systemctl start lightdm

- Press Ctrl + Alt + F3 to switch back to TTY. You can stop the GUI session without changing the boot target.
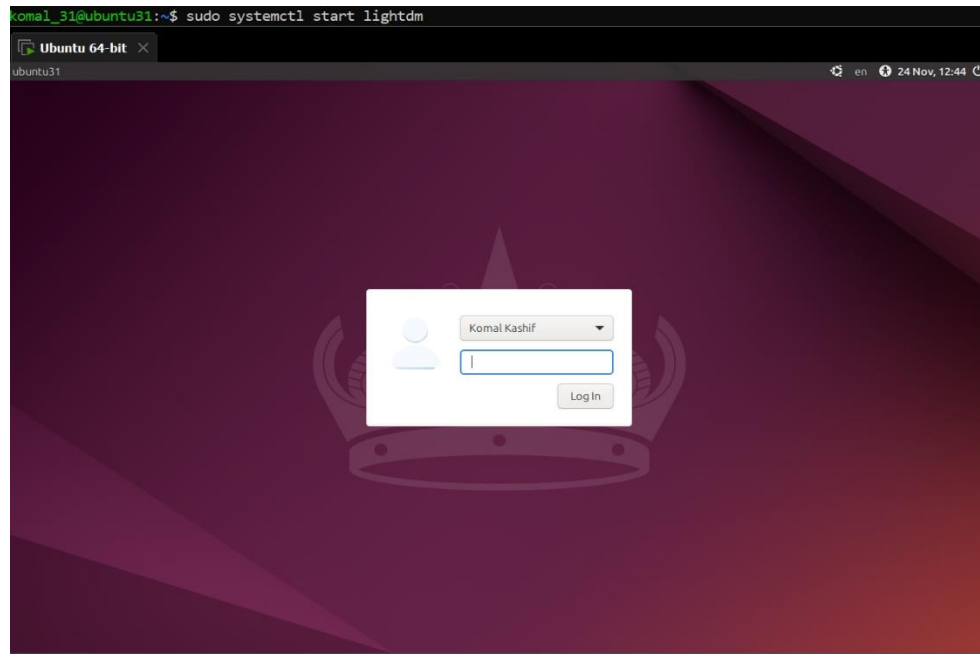
sudo systemctl stop lightdm
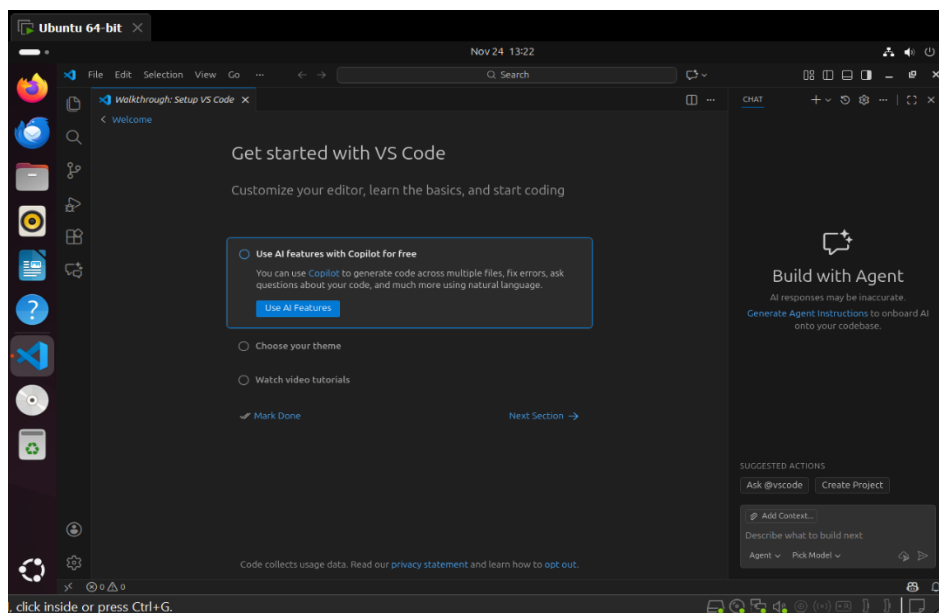
3. Start the GUI (if the system is currently set to CLI or the GUI is not running):

sudo systemctl start lightdm

4. In the GUI session launch Visual Studio Code (installed earlier in Task 4). From a GUI terminal inside the desktop, run:

Code

Task 7 - Install Google Chrome by adding its apt source & key (Chrome)

Steps (inside the VM terminal or GUI terminal or host terminal / via SSH)

1. (Learning step — first command must be the install attempt) Attempt to install Google Chrome directly to see the failure when the repo/key are missing:

sudo apt install google-chrome-stable -y

```
komal_31@ubuntu31:~$ sudo apt install google-chrome-stable -y
[sudo] password for komal_31:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
E: Unable to locate package google-chrome-stable
```

2. Inspect apt configuration so you understand why install failed. List the /etc/apt directory:

ls -la /etc/apt

```
komal_31@ubuntu31:~$ ls -la /etc/apt
total 48
drwxr-xr-x    9 root root  4096 Nov 15 11:06 .
drwxr-xr-x  156 root root 12288 Nov 24 10:57 ..
drwxr-xr-x    2 root root  4096 Nov 24 10:56 apt.conf.d
drwxr-xr-x    2 root root  4096 Mar 31  2024 auth.conf.d
drwxr-xr-x    2 root root  4096 Nov 24 13:12 keyrings
drwxr-xr-x    2 root root  4096 Aug  5 17:14 preferences.d
drwxr-xr-x    2 root root  4096 Aug  5 17:14 preferences.d.save
-rw-r--r--    1 root root    70 Nov 15 10:14 sources.list
drwxr-xr-x    2 root root  4096 Nov 24 13:13 sources.list.d
drwxr-xr-x    2 root root  4096 Aug  5 17:01 trusted.gpg.d
```

3. View the main /etc/apt/sources.list:

cat /etc/apt/sources.list

```
komal_31@ubuntu31:~$ cat /etc/apt/sources.list
# Ubuntu sources have moved to /etc/apt/sources.list.d/ubuntu.sources
```

4. List files under /etc/apt/sources.list.d:

ls -la /etc/apt/sources.list.d/

```
komal_31@ubuntu31:~$ ls -la /etc/apt/sources.list.d/
total 20
drwxr-xr-x 2 root root 4096 Nov 24 13:13 .
drwxr-xr-x 9 root root 4096 Nov 15 11:06 ..
-rw-r--r-- 1 root root  383 Nov 15 11:08 ubuntu.sources
-rw-r--r-- 1 root root 2552 Aug  5 17:02 ubuntu.sources.curtin.orig
-rw-r--r-- 1 root root  278 Nov 24 13:13 vscode.sources
```

5. If there is a file named ubuntu.sources (or similarly named source file), display it to see whether Chrome's repo is present:

cat /etc/apt/sources.list.d/ubuntu.sources

```
komal_31@ubuntu31:~$ cat /etc/apt/sources.list.d/ubuntu.sources
Types: deb
URIs: http://archive.ubuntu.com/ubuntu/
Suites: noble noble-updates noble-backports
Components: main restricted universe multiverse
Signed-By: /usr/share/keyrings/ubuntu-archive-keyring.gpg

Types: deb
URIs: http://security.ubuntu.com/ubuntu/
Suites: noble-security
Components: main restricted universe multiverse
Signed-By: /usr/share/keyrings/ubuntu-archive-keyring.gpg
```

6. Add Chrome repository metadata to a sources file (method A — using ubuntu.sources). Open or create the file and append the stanza (you can alternatively use the preferred one-line method in step 11):

   sudo nano /etc/apt/sources.list.d/ubuntu.sources

   - **Append these exact lines at the end of the file:**

     Types: deb

     URIs: http://dl.google.com/linux/chrome/deb/

     Suites: stable

     Components: main

     Architectures: amd64

     Signed-By: /etc/apt/keyrings/google.gpg

   - **Save the file (Ctrl+O → Enter) and exit (Ctrl+X).**

```
komal_31@ubuntu31:~$ sudo nano /etc/apt/sources.list.d/ubuntu.sources
komal_31@ubuntu31:~$ cat /etc/apt/sources.list.d/ubuntu.sources
Types: deb
URIs: http://archive.ubuntu.com/ubuntu/
Suites: noble noble-updates noble-backports
Components: main restricted universe multiverse
Signed-By: /usr/share/keyrings/ubuntu-archive-keyring.gpg

Types: deb
URIs: http://security.ubuntu.com/ubuntu/
Suites: noble-security
Components: main restricted universe multiverse
Signed-By: /usr/share/keyrings/ubuntu-archive-keyring.gpg

Types: deb
URIs:  http://dl.google.com/linux/chrome/deb/
Suites: stable
Components: main
Architectures: amd64
Signed-By: /etc/apt/keyrings/google.gpg
```

7. Ensure the keyrings directory exists and import Google's signing key:

curl -fsSL https://dl.google.com/linux/linux_signing_key.pub | sudo gpg --dearmor -o /etc/apt/keyrings/google.gpg

```
komal_31@ubuntu31:~$ curl -fsSL https://dl.google.com/linux/linux_signing_key.pub | sudo gpg --dearmor -o /etc/apt/keyri
ngs/google.gpg
```

8. Update apt and attempt to install Chrome again (now that repo + key are added):

sudo apt update

sudo apt install google-chrome-stable -y

```
komal_31@ubuntu31:~$ sudo apt update
Hit:1 http://security.ubuntu.com/ubuntu noble-security InRelease
Hit:2 https://packages.microsoft.com/repos/code stable InRelease
Get:3 http://dl.google.com/linux/chrome/deb stable InRelease [1,825 B]
Hit:4 http://archive.ubuntu.com/ubuntu noble InRelease
Get:5 http://dl.google.com/linux/chrome/deb stable/main amd64 Packages [1,210 B]
Hit:6 http://archive.ubuntu.com/ubuntu noble-updates InRelease
Hit:7 http://archive.ubuntu.com/ubuntu noble-backports InRelease
Fetched 3,035 B in 5s (599 B/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
18 packages can be upgraded. Run 'apt list --upgradable' to see them.
```

```
komal_31@ubuntu31:~$ sudo apt install google-chrome-stable -y --fix-missing
[sudo] password for komal_31:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following NEW packages will be installed:
  google-chrome-stable
0 upgraded, 1 newly installed, 0 to remove and 18 not upgraded.
Need to get 118 MB of archives.
After this operation, 391 MB of additional disk space will be used.
Get:1 http://dl.google.com/linux/chrome/deb stable/main amd64 google-chrome-stable amd64 142.0.7444.175-1 [118 MB]
Ign:1 http://dl.google.com/linux/chrome/deb stable/main amd64 google-chrome-stable amd64 142.0.7444.175-1
Get:1 http://dl.google.com/linux/chrome/deb stable/main amd64 google-chrome-stable amd64 142.0.7444.175-1 [118 MB]
Fetched 37.9 MB in 20min 13s (31.3 kB/s)
Selecting previously unselected package google-chrome-stable.
(Reading database ... 233879 files and directories currently installed.)
Preparing to unpack .../google-chrome-stable_142.0.7444.175-1_amd64.deb ...
Unpacking google-chrome-stable (142.0.7444.175-1) ...
Setting up google-chrome-stable (142.0.7444.175-1) ...
update-alternatives: using /usr/bin/google-chrome-stable to provide /usr/bin/x-www-browser (x-www-browser) in auto mode
update-alternatives: using /usr/bin/google-chrome-stable to provide /usr/bin/gnome-www-browser (gnome-www-browser) in au
to mode
update-alternatives: using /usr/bin/google-chrome-stable to provide /usr/bin/google-chrome (google-chrome) in auto mode
Processing triggers for gnome-menus (3.36.0-1.1ubuntu3) ...
Processing triggers for man-db (2.12.0-4build2) ...
Processing triggers for bamfdaemon (0.5.6+22.04.20220217-0ubuntu5) ...
Rebuilding /usr/share/applications/bamf-2.index...
```

Alternate method — create a single google-chrome.list entry

9. Cleanup before alternate method you added the chrome earlier and want to switch to the preferred method:

sudo apt remove google-chrome-stable -y

```
komal_31@ubuntu31:~$ sudo apt remove google-chrome-stable -y
```

sudo nano /etc/apt/sources.list.d/ubuntu.sources   # remove the chrome stanza you added earlier, save and exit

```
komal_31@ubuntu31:~$ sudo nano /etc/apt/sources.list.d/ubuntu.sources
komal_31@ubuntu31:~$ cat /etc/apt/sources.list.d/ubuntu.sources
Types: deb
URIs: http://archive.ubuntu.com/ubuntu/
Suites: noble noble-updates noble-backports
Components: main restricted universe multiverse
Signed-By: /usr/share/keyrings/ubuntu-archive-keyring.gpg

Types: deb
URIs: http://security.ubuntu.com/ubuntu/
Suites: noble-security
Components: main restricted universe multiverse
Signed-By: /usr/share/keyrings/ubuntu-archive-keyring.gpg
```

sudo rm -f /etc/apt/keyrings/google.gpg

```
komal_31@ubuntu31:~$ sudo rm -f /etc/apt/keyrings/google.gpg
```

10. Create a dedicated one-line list file for Google Chrome (preferred):

echo "deb [arch=amd64 signed-by=/etc/apt/keyrings/google.gpg]
http://dl.google.com/linux/chrome/deb/ stable main" | sudo tee /etc/apt/sources.list.d/google-chrome.list > /dev/null

```
komal_31@ubuntu31:~$ echo "deb [arch=amd64 signed-by=/etc/apt/keyrings/google.gpg] http://dl.google.com/linux/chrome/deb
/ stable main" | sudo tee /etc/apt/sources.list.d/google-chrome.list > /dev/null
```

11. Verify the new file exists:

ls -la /etc/apt/sources.list.d/

```
komal_31@ubuntu31:~$ ls -la /etc/apt/sources.list.d/
total 24
drwxr-xr-x 2 root root 4096 Nov 24 18:14 .
drwxr-xr-x 9 root root 4096 Nov 15 11:06 ..
-rw-r--r-- 1 root root  107 Nov 24 18:21 google-chrome.list
-rw-r--r-- 1 root root  385 Nov 24 18:14 ubuntu.sources
-rw-r--r-- 1 root root 2552 Aug  5 17:02 ubuntu.sources.curtin.orig
-rw-r--r-- 1 root root  278 Nov 24 13:13 vscode.sources
```

12. Re-add the Google signing key (if removed previously or not present):

sudo mkdir -p /etc/apt/keyrings

curl -fsSL https://dl.google.com/linux/linux_signing_key.pub | sudo gpg --dearmor -o /etc/apt/keyrings/google.gpg

```
komal_31@ubuntu31:~$ sudo mkdir -p /etc/apt/keyrings
komal_31@ubuntu31:~$ curl -fsSL https://dl.google.com/linux/linux_signing_key.pub | sudo gpg --dearmor -o /etc/apt/keyri
ngs/google.gpg
```

13. Update apt and install Chrome (preferred flow):

sudo apt update

```
komal_31@ubuntu31:~$ sudo apt update
Hit:1 http://archive.ubuntu.com/ubuntu noble InRelease
Hit:2 https://packages.microsoft.com/repos/code stable InRelease
Hit:3 http://dl.google.com/linux/chrome/deb stable InRelease
Get:4 http://archive.ubuntu.com/ubuntu noble-updates InRelease [126 kB]
Get:5 http://security.ubuntu.com/ubuntu noble-security InRelease [126 kB]
Get:6 http://archive.ubuntu.com/ubuntu noble-backports InRelease [126 kB]
Get:7 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 Packages [1,619 kB]
Get:8 http://security.ubuntu.com/ubuntu noble-security/main amd64 Components [21.6 kB]
Get:9 http://security.ubuntu.com/ubuntu noble-security/restricted amd64 Components [212 B]
Get:10 http://security.ubuntu.com/ubuntu noble-security/universe amd64 Components [52.2 kB]
Get:11 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 Components [175 kB]
Get:12 http://archive.ubuntu.com/ubuntu noble-updates/restricted amd64 Components [212 B]
Get:13 http://archive.ubuntu.com/ubuntu noble-updates/universe amd64 Packages [1,500 kB]
Get:14 http://archive.ubuntu.com/ubuntu noble-updates/universe amd64 Components [377 kB]
Get:15 http://archive.ubuntu.com/ubuntu noble-updates/multiverse amd64 Components [940 B]
Get:16 http://archive.ubuntu.com/ubuntu noble-backports/main amd64 Components [7,156 B]
Get:17 http://archive.ubuntu.com/ubuntu noble-backports/restricted amd64 Components [216 B]
Get:18 http://archive.ubuntu.com/ubuntu noble-backports/universe amd64 Components [10.9 kB]
Get:19 http://archive.ubuntu.com/ubuntu noble-backports/multiverse amd64 Components [212 B]
Get:20 http://security.ubuntu.com/ubuntu noble-security/multiverse amd64 Components [212 B]
Fetched 4,144 kB in 6s (706 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
18 packages can be upgraded. Run 'apt list --upgradable' to see them.
```

sudo apt install google-chrome-stable -y

```
komal_31@ubuntu31:~$ sudo apt install google-chrome-stable -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following NEW packages will be installed:
  google-chrome-stable
0 upgraded, 1 newly installed, 0 to remove and 18 not upgraded.
Need to get 118 MB of archives.
After this operation, 391 MB of additional disk space will be used.
Get:1 http://dl.google.com/linux/chrome/deb stable/main amd64 google-chrome-stable amd64 142.0.7444.175-1 [118 MB]
Fetched 118 MB in 2min 36s (754 kB/s)
Selecting previously unselected package google-chrome-stable.
(Reading database ... 233879 files and directories currently installed.)
Preparing to unpack .../google-chrome-stable_142.0.7444.175-1_amd64.deb ...
Unpacking google-chrome-stable (142.0.7444.175-1) ...
Setting up google-chrome-stable (142.0.7444.175-1) ...
update-alternatives: using /usr/bin/google-chrome-stable to provide /usr/bin/x-www-browser (x-www-browser) in auto mode
update-alternatives: using /usr/bin/google-chrome-stable to provide /usr/bin/gnome-www-browser (gnome-www-browser) in au
to mode
update-alternatives: using /usr/bin/google-chrome-stable to provide /usr/bin/google-chrome (google-chrome) in auto mode
Processing triggers for gnome-menus (3.36.0-1.1ubuntu3) ...
Processing triggers for man-db (2.12.0-4build2) ...
Processing triggers for bamfdaemon (0.5.6+22.04.20220217-0ubuntu5) ...
Rebuilding /usr/share/applications/bamf-2.index...
Processing triggers for desktop-file-utils (0.27-2build1) ...
Scanning processes...
Scanning linux images...

Running kernel seems to be up-to-date.

No services need to be restarted.

No containers need to be restarted.

No user sessions are running outdated binaries.

No VM guests are running outdated hypervisor (qemu) binaries on this host.
```

Task 8 - Install applications via PPA (Audacity & OBS) and launch

Steps (inside the VM terminal or GUI terminal)

1. Add the Audacity PPA, update apt and install audacity:

sudo add-apt-repository ppa:ubuntuhandbook1/audacity -y

```
komal_31@ubuntu31:~$ sudo add-apt-repository ppa:ubuntuhandbook1/audacity -y

Repository: 'Types: deb
URIs: https://ppa.launchpadcontent.net/ubuntuhandbook1/audacity/ubuntu/
Suites: noble
Components: main
'
Description:
Unofficial build of Audacity audio editor

For help, please use Audacity forum: http://forum.audacityteam.org/

If the packages here are helpful, you may buy me a coffee:

        https://ko-fi.com/ubuntuhandbook1
More info: https://launchpad.net/~ubuntuhandbook1/+archive/ubuntu/audacity
Adding repository.
Hit:1 https://packages.microsoft.com/repos/code stable InRelease
Hit:2 http://dl.google.com/linux/chrome/deb stable InRelease
Hit:3 http://security.ubuntu.com/ubuntu noble-security InRelease
Hit:4 http://archive.ubuntu.com/ubuntu noble InRelease
Hit:5 http://archive.ubuntu.com/ubuntu noble-updates InRelease
Hit:6 http://archive.ubuntu.com/ubuntu noble-backports InRelease
Get:7 https://ppa.launchpadcontent.net/ubuntuhandbook1/audacity/ubuntu noble InRelease [18.1 kB]
Get:8 https://ppa.launchpadcontent.net/ubuntuhandbook1/audacity/ubuntu noble/main amd64 Packages [1,064 B]
Get:9 https://ppa.launchpadcontent.net/ubuntuhandbook1/audacity/ubuntu noble/main Translation-en [492 B]
Fetched 19.6 kB in 6s (3,078 B/s)
Reading package lists... Done
```

sudo apt update

sudo apt install audacity -y

2. Launch Audacity (from GUI or CLI). On a headless server you may not get a GUI window — if you are using the XFCE GUI session, launch from a GUI terminal or run check for binary:

3. Add the OBS Studio PPA, update apt and install obs-studio:

sudo add-apt-repository ppa:obsproject/obs-studio -y

```
komal_31@ubuntu31:~$ sudo add-apt-repository ppa:obsproject/obs-studio -y
[sudo] password for komal_31:
Repository: 'Types: deb
URIs: https://ppa.launchpadcontent.net/obsproject/obs-studio/ubuntu/
Suites: noble
Components: main
'
Description:
Latest stable release of OBS Studio
More info: https://launchpad.net/~obsproject/+archive/ubuntu/obs-studio
Adding repository.
Hit:1 http://dl.google.com/linux/chrome/deb stable InRelease
Hit:2 http://archive.ubuntu.com/ubuntu noble InRelease
Get:3 http://security.ubuntu.com/ubuntu noble-security InRelease [126 kB]
Hit:4 https://packages.microsoft.com/repos/code stable InRelease
Get:5 http://archive.ubuntu.com/ubuntu noble-updates InRelease [126 kB]
Get:6 https://ppa.launchpadcontent.net/obsproject/obs-studio/ubuntu noble InRelease [17.8 kB]
Hit:7 https://ppa.launchpadcontent.net/ubuntuhandbook1/audacity/ubuntu noble InRelease
Hit:8 http://archive.ubuntu.com/ubuntu noble-backports InRelease
Get:9 http://security.ubuntu.com/ubuntu noble-security/main amd64 Packages [1,317 kB]
Get:10 https://ppa.launchpadcontent.net/obsproject/obs-studio/ubuntu noble/main amd64 Packages [1,172 B]
Get:11 https://ppa.launchpadcontent.net/obsproject/obs-studio/ubuntu noble/main Translation-en [160 B]
Get:12 http://security.ubuntu.com/ubuntu noble-security/main amd64 c-n-f Metadata [9,448 B]
Get:13 http://security.ubuntu.com/ubuntu noble-security/universe amd64 Packages [909 kB]
Get:14 http://security.ubuntu.com/ubuntu noble-security/universe amd64 c-n-f Metadata [19.4 kB]
Get:15 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 Packages [1,619 kB]
Get:16 http://archive.ubuntu.com/ubuntu noble-updates/universe amd64 Packages [1,500 kB]
Fetched 5,646 kB in 11s (511 kB/s)
```

sudo apt update

```
komal_31@ubuntu31:~$ sudo apt update
Hit:1 http://security.ubuntu.com/ubuntu noble-security InRelease
Hit:2 https://packages.microsoft.com/repos/code stable InRelease
Hit:3 http://archive.ubuntu.com/ubuntu noble InRelease
Hit:4 http://dl.google.com/linux/chrome/deb stable InRelease
Hit:5 https://ppa.launchpadcontent.net/obsproject/obs-studio/ubuntu noble InRelease
Hit:6 http://archive.ubuntu.com/ubuntu noble-updates InRelease
Hit:7 https://ppa.launchpadcontent.net/ubuntuhandbook1/audacity/ubuntu noble InRelease
Hit:8 http://archive.ubuntu.com/ubuntu noble-backports InRelease
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
25 packages can be upgraded. Run 'apt list --upgradable' to see them.
```

sudo apt install obs-studio -y

```
komal_31@ubuntu31:~$ sudo apt install obs-studio -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  libaacs0 libass9 libavdevice60 libavfilter9 libavformat60 libb2-1 libbdplus0 libblas3 libbluray2 libbs2b0
  libchromaprint1 libcjson1 libdc1394-25 libfdk-aac2 libfftw3-double3 libflite1 libgfortran5 libgme0 liblapack3
  libluajit-5.1-2 libluajit-5.1-common libmbedcrypto7t64 libmbedtls14t64 libmbedx509-1t64 libmysofa1 libnorm1t64
  libopenal-data libopenal1 libopenmpt0t64 libpgm-5.3-0t64 libplacebo338 libpocketsphinx3 libpostproc57
  libqrcodegencpp1 libqt6core6t64 libqt6dbus6t64 libqt6gui6t64 libqt6network6t64 libqt6opengl6t64 libqt6qml6
  libqt6qmlmodels6 libqt6quick6 libqt6svg6 libqt6waylandclient6 libqt6waylandcompositor6
  libqt6waylandeglclienthwintegration6 libqt6waylandeglcompositorhwintegration6 libqt6widgets6t64
  libqt6wlshellintegration6 libqt6xml6t64 librabbitmq4 librist4 librubberband2 libsdl2-2.0-0 libsndio7.0
  libsphinxbase3t64 libsrt1.5-gnutls libsrt1.5-openssl libssh-gcrypt-4 libswscale7 libts0t64 libudfread0 libunibreak5
  libvidstab1.1 libxcb-composite0 libzimg2 libzmq5 pocketsphinx-en-us qt6-gtk-platformtheme qt6-qpa-plugins
  qt6-translations-l10n qt6-wayland
Suggested packages:
  libbluray-bdj libfftw3-bin libfftw3-dev qt6-qmltooling-plugins sndiod
The following NEW packages will be installed:
  libaacs0 libass9 libavdevice60 libavfilter9 libavformat60 libb2-1 libbdplus0 libblas3 libbluray2 libbs2b0
  libchromaprint1 libcjson1 libdc1394-25 libfdk-aac2 libfftw3-double3 libflite1 libgfortran5 libgme0 liblapack3
  libluajit-5.1-2 libluajit-5.1-common libmbedcrypto7t64 libmbedtls14t64 libmbedx509-1t64 libmysofa1 libnorm1t64
  libopenal-data libopenal1 libopenmpt0t64 libpgm-5.3-0t64 libplacebo338 libpocketsphinx3 libpostproc57
  libqrcodegencpp1 libqt6core6t64 libqt6dbus6t64 libqt6gui6t64 libqt6network6t64 libqt6opengl6t64 libqt6qml6
  libqt6qmlmodels6 libqt6quick6 libqt6svg6 libqt6waylandclient6 libqt6waylandcompositor6
  libqt6waylandeglclienthwintegration6 libqt6waylandeglcompositorhwintegration6 libqt6widgets6t64
  libqt6wlshellintegration6 libqt6xml6t64 librabbitmq4 librist4 librubberband2 libsdl2-2.0-0 libsndio7.0
  libsphinxbase3t64 libsrt1.5-gnutls libsrt1.5-openssl libssh-gcrypt-4 libswscale7 libts0t64 libudfread0 libunibreak5
  libvidstab1.1 libxcb-composite0 libzimg2 libzmq5 obs-studio pocketsphinx-en-us qt6-gtk-platformtheme qt6-qpa-plugins
  qt6-translations-l10n qt6-wayland
0 upgraded, 73 newly installed, 0 to remove and 25 not upgraded.
```

4. Launch OBS Studio (from GUI or verify binary presence):

obs --version

```
komal_31@ubuntu31:~$ obs --version
OBS Studio - 32.0.2
```

Task 9 - Create a Kubernetes sample YAML using vim

Steps (inside the VM terminal or host terminal / via SSH)

1. Check whether vim is installed by running:

vim

```
                    VIM - Vi IMproved

                      version 9.1.697
                   by Bram Moolenaar et al.
             Modified by team+vim@tracker.debian.org
          Vim is open source and freely distributable

                 Help poor children in Uganda!
         type   :help iccf<Enter>        for information

         type   :q<Enter>                to exit
         type   :help<Enter>   or  <F1>  for on-line help
         type   :help version9<Enter>    for version info
```

Vim is already installed.

2. Create the Lab5 working directory in your home and change into it:

mkdir -p ~/Lab5

cd ~/Lab5

```
komal_31@ubuntu31:~$ mkdir -p ~/Lab5
komal_31@ubuntu31:~$ cd ~/Lab5
komal_31@ubuntu31:~/Lab5$ pwd
/home/komal_31/Lab5
```
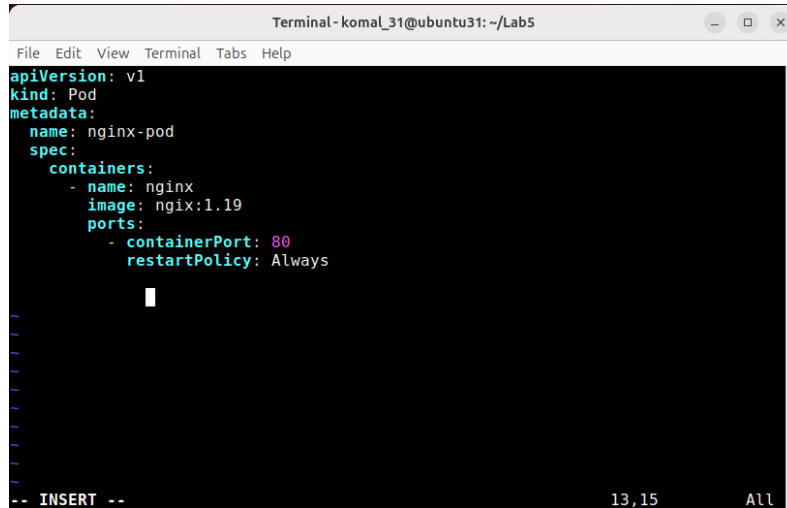
3. Create the Kubernetes sample file using vim:

vim k8s-sample.yaml

- Once vim opens, enable insert mode by pressing i, then paste the following YAML exactly:

    apiVersion: v1
    kind: Pod
    metadata:
        name: nginx-pod
         spec:
    containers:

```
    - name: nginx
      image: nginx:1.19
      ports:
         - containerPort: 80
           restartPolicy: Always
```


4. Exit insert mode by pressing Esc, then save and quit vim with:

:wq

- Save a screenshot of the ls -la output showing the file exists

Task 10 - Edit the Kubernetes YAML - add annotation, verify, then discard temporary change.

Steps (inside the VM terminal or host terminal / via SSH)

1. Open the manifest with vim:

cd ~/Lab5

vim k8s-sample.yaml

- When vim opens, ensure you are in command mode (press Esc) then press i to enter insert mode.

2. Add the annotation under the metadata section (indentation must match YAML). Example (insert these lines under metadata:):

annotations:

 lab: lesson11

- After adding the lines, press Esc to return to command mode and save & quit:

:wq

```
komal_31@ubuntu31:~/Lab5$ cat k8s-sample.yaml
apiVersion: v1
kind: Pod
metadata:
  name: nginx-pod
  annotations:
    lab: lesson11
  spec:
    containers:
      - name: nginx
        image: ngix:1.19
        ports:
          - containerPort: 80
            restartPolicy: Always
```

3. Discard changes (practice: make a temporary edit and exit without saving)

- Open the file again:

vim k8s-sample.yaml

- Enter insert mode (i) and add a temporary comment line anywhere, for example:

temp: do-not-keep

```
apiVersion: v1
kind: Pod
metadata:
  name: nginx-pod
  annotations:
    lab: lesson11
  spec:
    containers:
      - name: nginx
        image: ngix:1.19
        ports:
          - containerPort: 80
            restartPolicy: Always


          # temp: do-not-keep
```

- Do NOT save. Press Esc to go back to command mode, then force quit without savin

- Verify the file does NOT contain the temporary comment

```
Terminal - komal_31@ubuntu31: ~/Lab5

File  Edit  View  Terminal  Tabs  Help
        image: ngix:1.19
        ports:
          - containerPort: 80
            restartPolicy: Always


komal_31@ubuntu31:~/Lab5$ vim k8s-sample.yaml
komal_31@ubuntu31:~/Lab5$ cat k8s-sample.yaml
apiVersion: v1
kind: Pod
metadata:
  name: nginx-pod
  annotations:
    lab: lesson11
  spec:
    containers:
      - name: nginx
        image: ngix:1.19
        ports:
          - containerPort: 80
            restartPolicy: Always
```

Task 11 - Vim editing practice - delete, undo, numeric deletes, navigation

Steps (inside the VM terminal or host terminal / via SSH)

1. Open the file with vim:

cd ~/Lab5

vim k8s-sample.yaml

 2. Delete the line containing image: nginx:1.19 with a single command:

- Ensure you are in command mode (press Esc), move the cursor to the line with image: nginx:1.19, then delete that line

- Immediately undo the deletion with:

```
apiVersion: v1
kind: Pod
metadata:
  name: nginx-pod
  annotations:
    lab: lesson11
  spec:
    containers:
      - name: nginx
        ports:
          - containerPort: 80
            restartPolicy: Always

apiVersion: v1
kind: Pod
metadata:
  name: nginx-pod
  annotations:
    lab: lesson11
  spec:
    containers:
      - name: nginx
        image: ngix:1.19
        ports:
          - containerPort: 80
            restartPolicy: Always
~
~
~
~
~
~
~
~
1 more line; before #4  18 seconds ago          10,8        All
```

3. Delete 3 lines at once using the numeric delete command:

- In command mode, position the cursor on the first line of the three you want to delete (for example start at the image: line again), then run:

d3d

(or 3dd or d3<enter> — either numeric prefix form is acceptable; document which you used)

- Immediately undo the deletion with:

```
apiVersion: v1
kind: Pod
metadata:
  name: nginx-pod
  annotations:
    lab: lesson11
  spec:
    containers:
      - name: nginx
        restartPolicy: Always






3 fewer lines                                    10,13      All
apiVersion: v1
kind: Pod
metadata:
  name: nginx-pod
  annotations:
    lab: lesson11
  spec:
    containers:
      - name: nginx
        image: ngix:1.19
        ports:
          - containerPort: 80
            restartPolicy: Always




3 more lines; before #5  70 seconds ago          10,8       All
```

4. Navigation practice (from command mode)
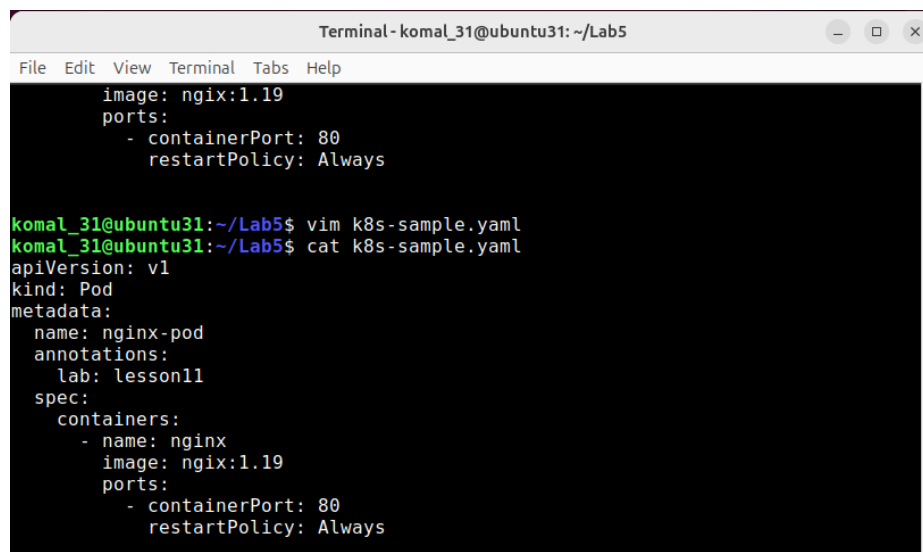
- Jump to the first line:

1G

```
apiVersion: v1
kind: Pod
metadata:
  name: nginx-pod
  annotations:
    lab: lesson11
  spec:
    containers:
      - name: nginx
        image: ngix:1.19
        ports:
          - containerPort: 80
            restartPolicy: Always


```

- Jump to the last line:

G

```
apiVersion: v1
kind: Pod
metadata:
  name: nginx-pod
  annotations:
    lab: lesson11
  spec:
    containers:
      - name: nginx
        image: ngix:1.19
        ports:
          - containerPort: 80
            restartPolicy: Always


```

Task 12 - Vim search, add matches, substitute, undo

Steps (inside the VM terminal / in the ~/Lab5 directory)

1. Open the file with vim:

cd ~/Lab5

vim k8s-sample.yaml

2. Search for the string nginx using the forward search command:

- From command mode type:

/nginx

and press Enter.

- Note the first match is highlighted and the cursor is placed on it.
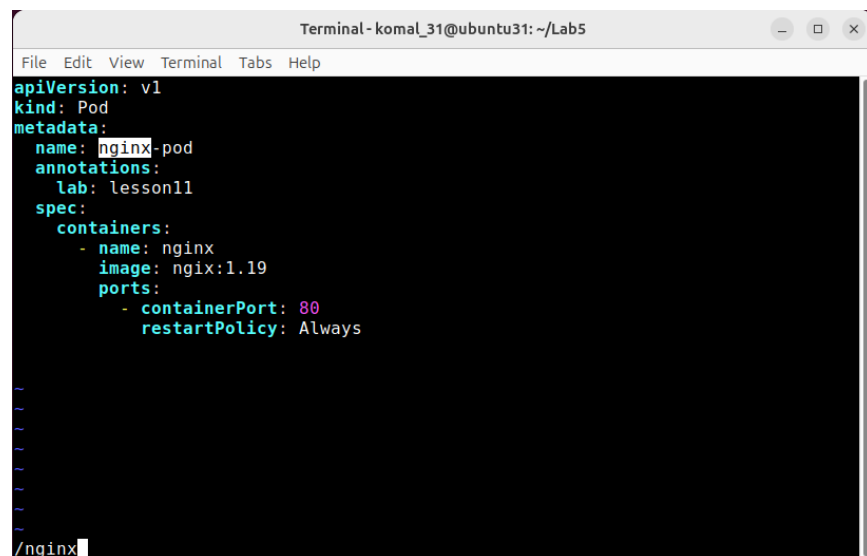
3. Move to the next match and previous match:

- Press n to jump to the next match (capture screenshot if desired) and press N to jump back to the previous match.

```
apiVersion: v1
kind: Pod
metadata:
  name: nginx-pod
  annotations:
    lab: lesson11
  spec:
    containers:
      - name: nginx
        image: ngix:1.19
        ports:
          - containerPort: 80
            restartPolicy: Always

~
~
~
~
~
~
~
/nginx                                          9,15        All
apiVersion: v1
kind: Pod
metadata:
  name: nginx-pod
  annotations:
    lab: lesson11
  spec:
    containers:
      - name: nginx
        image: ngix:1.19
        ports:
          - containerPort: 80
            restartPolicy: Always

~
~
~
~
~
~
?nginx                                          4,9         All
```

4. Add two more occurrences of the word nginx in the file:

- Enter insert mode (i) at an appropriate place (for example add two new comment lines or add them under metadata as comments), type two new occurrences of nginx, then press Esc to return to command mode and save the file with :w.

```
apiVersion: v1
kind: Pod
metadata:
  name: nginx-pod
    # nginx 1
    # nginx 2
  annotations:
    lab: lesson11
  spec:
    containers:
      - name: nginx
        image: ngix:1.19
        ports:
          - containerPort: 80
            restartPolicy: Always

~
~
~
~
~
~
"k8s-sample.yaml" 17L, 264B written             16,0-1      All
```

5. Demonstrate that n cycles forward through all matches:

- In vim command mode press /nginx Enter, then repeatedly press n to cycle forward through each match.

```
apiVersion: v1                          apiVersion: v1
kind: Pod                               kind: Pod
metadata:                               metadata:
  name: nginx-pod                         name: nginx-pod
     # nginx 1                               # nginx 1
     # nginx 2                               # nginx 2
  annotations:                            annotations:
    lab: lesson11                           lab: lesson11
  spec:                                   spec:
    containers:                             containers:
      - name: nginx                           - name: nginx
        image: ngix:1.19                        image: ngix:1.19
        ports:                                  ports:
           - containerPort: 80                     - containerPort: 80
             restartPolicy: Always                  restartPolicy: Always

apiVersion: v1                          apiVersion: v1
kind: Pod                               kind: Pod
metadata:                               metadata:
  name: nginx-pod                         name: nginx-pod
     # nginx 1                               # nginx 1
     # nginx 2                               # nginx 2
  annotations:                            annotations:
    lab: lesson11                           lab: lesson11
  spec:                                   spec:
    containers:                             containers:
      - name: nginx                           - name: nginx
        image: ngix:1.19                        image: ngix:1.19
        ports:                                  ports:
           - containerPort: 80                     - containerPort: 80
             restartPolicy: Always                  restartPolicy: Always
```

6. Substitute all occurrences of nginx with webapp:

- From command mode execute the substitute command:

:%s/nginx/webapp

- This will replace all occurrences in the file (note: this changes the buffer).

```
apiVersion: v1
kind: Pod
metadata:
  name: webapp-pod
     # webapp 1
     # webapp 2
  annotations:
    lab: lesson11
  spec:
    containers:
      - name: webapp
        image: ngix:1.19
        ports:
           - containerPort: 80
             restartPolicy: Always
```

7. Immediately undo the substitution using u:

  - Press u in command mode to undo the last change.

```
apiVersion: v1
kind: Pod
metadata:
  name: nginx-pod
    # nginx 1
    # nginx 2
  annotations:
    lab: lesson11
  spec:
    containers:
      - name: nginx
        image: ngix:1.19
        ports:
          - containerPort: 80
            restartPolicy: Always
```

Exam Evaluation Question

  - Install Docker Desktop on your VMWare Workstation Ubuntu Server. No commands or solutions are provided in this lab — treat this as an evaluation/exam question.

```
komal_31@ubuntu31:~/Lab5$ sudo apt update && sudo apt upgrade -y
[sudo] password for komal_31:
Hit:1 https://packages.microsoft.com/repos/code stable InRelease
Hit:2 http://archive.ubuntu.com/ubuntu noble InRelease
Hit:3 http://dl.google.com/linux/chrome/deb stable InRelease
Hit:4 http://security.ubuntu.com/ubuntu noble-security InRelease
Hit:5 http://archive.ubuntu.com/ubuntu noble-updates InRelease
Hit:6 http://archive.ubuntu.com/ubuntu noble-backports InRelease
Hit:7 https://ppa.launchpadcontent.net/obsproject/obs-studio/ubuntu noble InRelease
Hit:8 https://ppa.launchpadcontent.net/ubuntuhandbook1/audacity/ubuntu noble InRelease
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
25 packages can be upgraded. Run 'apt list --upgradable' to see them.
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Calculating upgrade... Done
Get more security updates through Ubuntu Pro with 'esm-apps' enabled:
  libzvbi-common libcjson1 libavdevice60 libpostproc57 libavcodec60
  libzvbi0t64 libavutil58 libswscale7 libswresample4 7zip libavformat60
  libavfilter9
Learn more about Ubuntu Pro at https://ubuntu.com/pro
The following NEW packages will be installed:
```

```
komal_31@ubuntu31:~/Lab5$ sudo apt install ca-certificates curl gnupg lsb-release -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
ca-certificates is already the newest version (20240203).
ca-certificates set to manually installed.
curl is already the newest version (8.5.0-2ubuntu10.6).
curl set to manually installed.
gnupg is already the newest version (2.4.4-2ubuntu17.3).
gnupg set to manually installed.
lsb-release is already the newest version (12.0-2).
lsb-release set to manually installed.
The following packages were automatically installed and are no longer required:
  linux-headers-6.8.0-71 linux-headers-6.8.0-71-generic linux-image-6.8.0-71-generic linux-modules-6.8.0-71-generic
  linux-modules-extra-6.8.0-71-generic linux-tools-6.8.0-71 linux-tools-6.8.0-71-generic
Use 'sudo apt autoremove' to remove them.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
```

```
komal_31@ubuntu31:~/Lab5$ sudo mkdir -p /etc/apt/keyrings
komal_31@ubuntu31:~/Lab5$ curl -fsSl https://download.docker.com/linux/ubuntu/gpg | sudo gpg --dearmor -o /etc/apt/keyr
ings/docker.gpg
```

```
komal_31@ubuntu31:~/Lab5$ echo \
> "deb [arch=$(dpkg --print-architecture) signed-by=/etc/apt/keyrings/docker.gpg] \ https://download.docker.com/linux/u
buntu/gpg \ $(lsb_release -cs) stable" | \
> sudo tee /etc/apt/sources.list.d/docker.list > /dev/null
```

```
komal_31@ubuntu31:~$ sudo apt update
Get:1 https://download.docker.com/linux/ubuntu noble InRelease [48.5 kB]
Hit:2 https://packages.microsoft.com/repos/code stable InRelease
Get:3 https://download.docker.com/linux/ubuntu noble/stable amd64 Packages [37.5 kB]
Hit:4 http://dl.google.com/linux/chrome/deb stable InRelease
Hit:5 http://archive.ubuntu.com/ubuntu noble InRelease
Hit:6 http://security.ubuntu.com/ubuntu noble-security InRelease
Hit:7 https://ppa.launchpadcontent.net/obsproject/obs-studio/ubuntu noble InRelease
Hit:8 https://ppa.launchpadcontent.net/ubuntuhandbook1/audacity/ubuntu noble InRelease
Hit:9 http://archive.ubuntu.com/ubuntu noble-updates InRelease
Hit:10 http://archive.ubuntu.com/ubuntu noble-backports InRelease
Fetched 86.0 kB in 2s (51.8 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
All packages are up to date.
```

```
komal_31@ubuntu31:~$ wget https://desktop.docker.com/linux/main/amd64/docker-desktop-amd64.deb
--2025-11-24 22:11:13--  https://desktop.docker.com/linux/main/amd64/docker-desktop-amd64.deb
Resolving desktop.docker.com (desktop.docker.com)... 18.64.141.6, 18.64.141.30, 18.64.141.29, ...
Connecting to desktop.docker.com (desktop.docker.com)|18.64.141.6|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 429404404 (410M) [application/octet-stream]
Saving to: 'docker-desktop-amd64.deb'

docker-desktop-amd64.deb       100%[===================================================>] 409.51M  17.8MB/s    in 30s

2025-11-24 22:11:44 (13.6 MB/s) - 'docker-desktop-amd64.deb' saved [429404404/429404404]

komal_31@ubuntu31:~$ sudo apt install ./docker-desktop-amd64.deb
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Note, selecting 'docker-desktop' instead of './docker-desktop-amd64.deb'
The following packages were automatically installed and are no longer required:
  linux-headers-6.8.0-71 linux-headers-6.8.0-71-generic linux-image-6.8.0-71-generic linux-modules-6.8.0-71-generic
  linux-modules-extra-6.8.0-71-generic linux-tools-6.8.0-71 linux-tools-6.8.0-71-generic
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
```

```
komal_31@ubuntu31:~$ docker --version
Docker version 29.0.3, build 511dad6
komal_31@ubuntu31:~$ sudo systemctl status docker
● docker.service - Docker Application Container Engine
     Loaded: loaded (/usr/lib/systemd/system/docker.service; enabled; preset: enabled)
     Active: active (running) since Mon 2025-11-24 21:59:56 UTC; 1min 40s ago
TriggeredBy: ● docker.socket
       Docs: https://docs.docker.com
   Main PID: 30456 (dockerd)
      Tasks: 9
     Memory: 31.0M (peak: 31.5M)
        CPU: 859ms
     CGroup: /system.slice/docker.service
             └─30456 /usr/bin/dockerd -H fd:// --containerd=/run/containerd/containerd.sock

Nov 24 21:59:55 ubuntu31 dockerd[30456]: time="2025-11-24T21:59:55.151003215Z" level=info msg="Restoring containers: st⟩
Nov 24 21:59:55 ubuntu31 dockerd[30456]: time="2025-11-24T21:59:55.321653500Z" level=info msg="Deleting nftables IPv4 r⟩
Nov 24 21:59:55 ubuntu31 dockerd[30456]: time="2025-11-24T21:59:55.333330991Z" level=info msg="Deleting nftables IPv6 r⟩
Nov 24 21:59:56 ubuntu31 dockerd[30456]: time="2025-11-24T21:59:56.303061085Z" level=info msg="Loading containers: done⟩
Nov 24 21:59:56 ubuntu31 dockerd[30456]: time="2025-11-24T21:59:56.347980009Z" level=info msg="Docker daemon" commit=1f⟩
Nov 24 21:59:56 ubuntu31 dockerd[30456]: time="2025-11-24T21:59:56.348229924Z" level=info msg="Initializing buildkit"
Nov 24 21:59:56 ubuntu31 dockerd[30456]: time="2025-11-24T21:59:56.457741266Z" level=info msg="Completed buildkit initi⟩
Nov 24 21:59:56 ubuntu31 dockerd[30456]: time="2025-11-24T21:59:56.492941290Z" level=info msg="Daemon has completed ini⟩
Nov 24 21:59:56 ubuntu31 dockerd[30456]: time="2025-11-24T21:59:56.493036663Z" level=info msg="API listen on /run/docke⟩
Nov 24 21:59:56 ubuntu31 systemd[1]: Started docker.service - Docker Application Container Engine.
```

- Verify Docker Desktop is installed by launching the Docker Desktop application and confirming it runs.

```
komal_31@ubuntu31:~$ docker --version
Docker version 29.0.3, build 511dad6
komal_31@ubuntu31:~$ sudo systemctl status docker
[sudo] password for komal_31:
● docker.service - Docker Application Container Engine
     Loaded: loaded (/usr/lib/systemd/system/docker.service; enabled; preset: e
     Active: active (running) since Mon 2025-11-24 22:18:12 UTC; 20min ago
TriggeredBy: ● docker.socket
       Docs: https://docs.docker.com
   Main PID: 1409 (dockerd)
      Tasks: 9
     Memory: 104.1M (peak: 104.6M)
        CPU: 2.243s
     CGroup: /system.slice/docker.service
             └─1409 /usr/bin/dockerd -H fd:// --containerd=/run/containerd/cont
```