CPSC 4240/6240 Discovery 1 50 points

Instructions:

This homework is done *individually*. You are allowed to use search engines, textbook/s, lecture notes, and any other non-human sources you wish. BUT you are *not* allowed to consult others, or help other students with their work, give hints or solutions to anyone in the class. The reason it is called a *Discovery* is because you will do some hands-on exercises and show what you have accomplished. Each exercise may have several sub-questions, so please read carefully. Do not copy questions, but do number your answers. Thoroughly explain what you have discovered. Save as pdf and submit. This is not the case when "less is more". Avoid generic answers, as they will not earn you any points.

Screenshots

You may need to take a screenshots (with your keyboard, not the phone) to illustrate your work. Before you do this, please increase the font size of your terminal to 20. While taking a screenshot, make sure your command line prompt displaying your username and current date are clearly visible, or if screenshot content does not display the prompt, open another terminal in the background and make sure it displays the prompt. All screenshots should be clearly legible and illustrate without a doubt what you are doing. Each screenshot must have your new prompt visible in one of the terminal windows on your desktop. You can also open your screenshot in an image editor and trim off the parts you do not need, so that they take less space. Insert them into the file when answering the question, do NOT submit them separately as image files. You will not get credit for screenshots submitted separately. You can type in black or blue, please do not use red. Save your file as a .pdf file and submit to Canvas before the deadline.

Computer Science is attention to detail, so let's make your work look nice and professional, even though *it does not have to conform to MLA, APA, or ACM format.*

What and how to submit

Submit your .pdf file to canvas before the due date. All screenshots illustrating your work should be part of the document, not submitted separately.

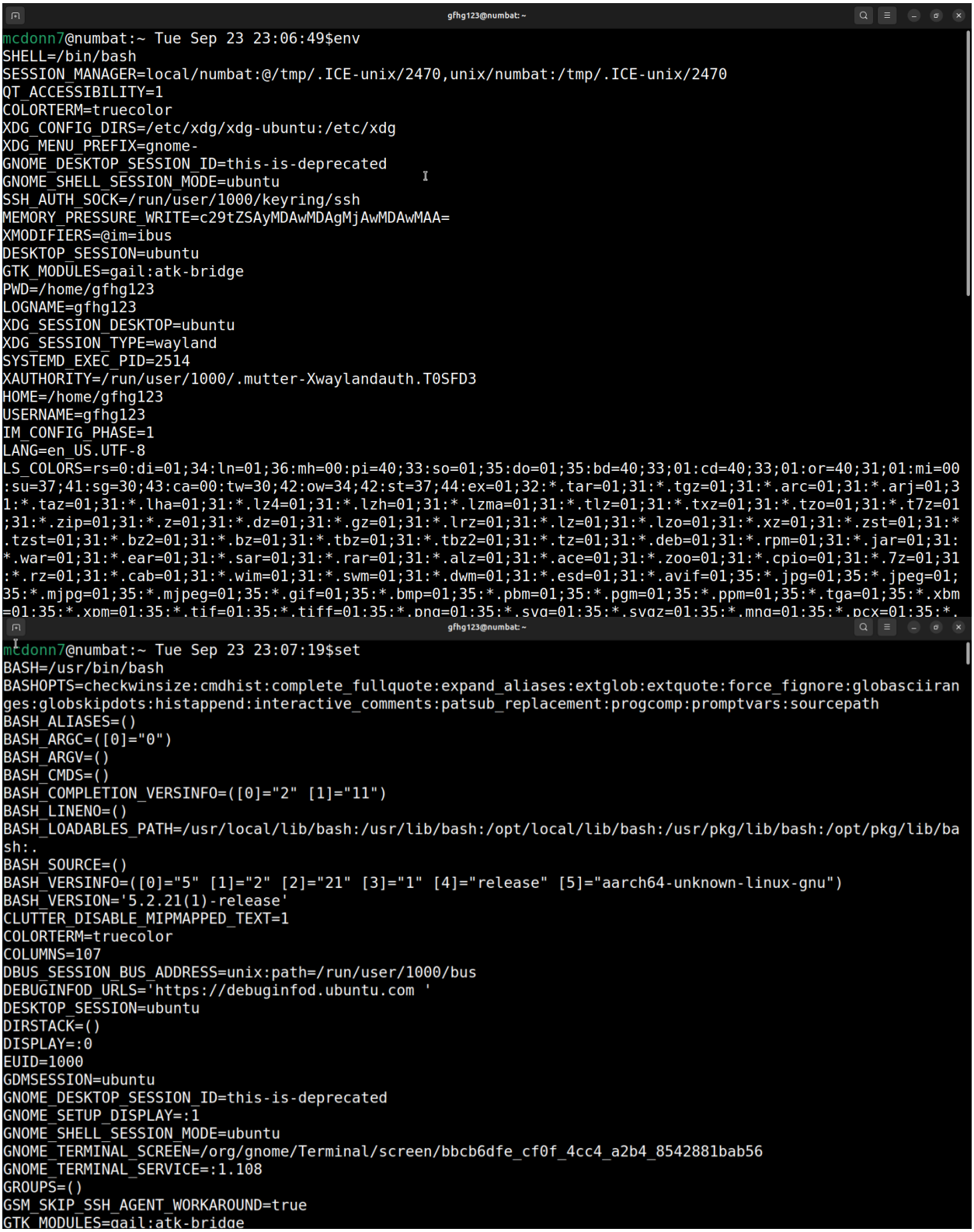
Grading and Points

Every question indicates how many points it is worth.

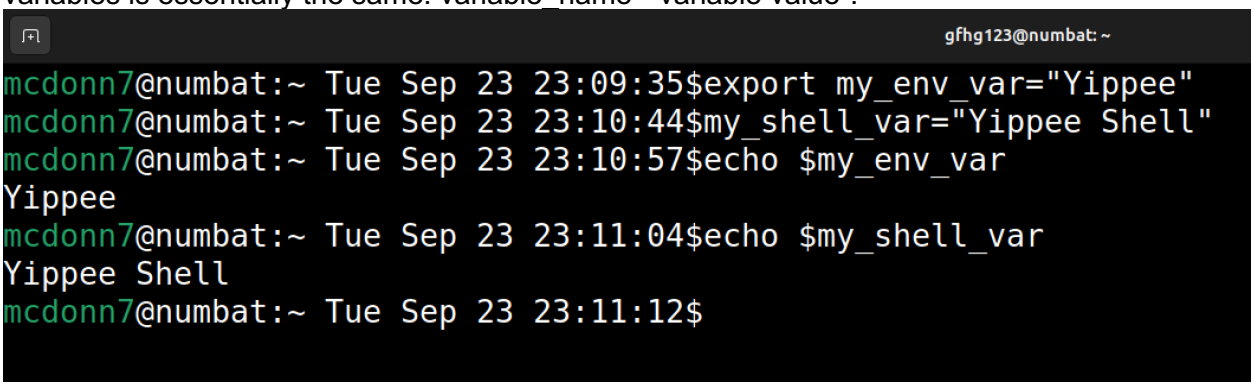
Exercises

1. Explore Linux environment variables and shell variables. Explain the difference between them, and show how to list and create such variables. Select 3 environment variables of your choice and show how to change the value. (6)

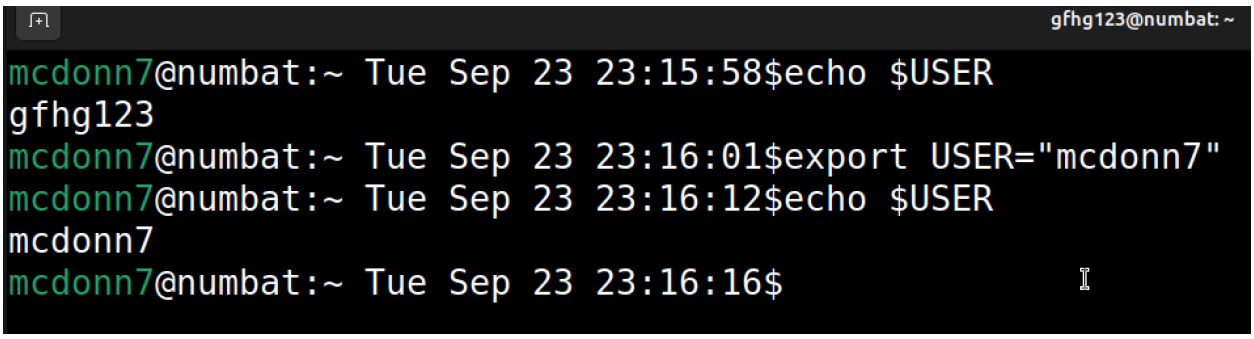
Environment variables are available to the shell and to the child processes that it starts. Shell variables, on the other hand, are for the local and current shell instance. To list environment variables, the env command is used and set is used for shell variables.


gfhg123@numbat: ~
mcdonn7@numbat:~ Tue Sep 23 23:06:49$env
SHELL=/bin/bash
SESSION_MANAGER=local/numbat:@/tmp/.ICE-unix/2470,unix/numbat:/tmp/.ICE-unix/2470
QT_ACCESSIBILITY=1
COLORTERM=truecolor
XDG_CONFIG_DIRS=/etc/xdg/xdg-ubuntu:/etc/xdg
XDG_MENU_PREFIX=gnome-
GNOME_DESKTOP_SESSION_ID=this-is-deprecated
GNOME_SHELL_SESSION_MODE=ubuntu
SSH_AUTH_SOCK=/run/user/1000/keyring/ssh
MEMORY_PRESSURE_WRITE=c29tZSAyMDAwMDAgMjAwMDAwMAA=
XMODIFIERS=@im=ibus
DESKTOP_SESSION=ubuntu
GTK_MODULES=gail:atk-bridge
PWD=/home/gfhg123
LOGNAME=gfhg123
XDG_SESSION_DESKTOP=ubuntu
XDG_SESSION_TYPE=wayland
SYSTEMD_EXEC_PID=2514
XAUTHORITY=/run/user/1000/.mutter-Xwaylandauth.T0SFD3
HOME=/home/gfhg123
USERNAME=gfhg123
IM_CONFIG_PHASE=1
LANG=en_US.UTF-8
LS_COLORS=rs=0:di=01;34:ln=01;36:mh=00:pi=40;33:so=01;35:do=01;35:bd=40;33;01:cd=40;33;01:or=40;31;01:mi=00:su=37;41:sg=30;43:ca=00:tw=30;42:ow=34;42:st=37;44:ex=01;32:*.tar=01;31:*.tgz=01;31:*.arc=01;31:*.arj=01;31:*.taz=01;31:*.lha=01;31:*.lz4=01;31:*.lzh=01;31:*.lzma=01;31:*.tlz=01;31:*.txz=01;31:*.tzo=01;31:*.t7z=01;31:*.zip=01;31:*.z=01;31:*.dz=01;31:*.gz=01;31:*.lrz=01;31:*.lz=01;31:*.lzo=01;31:*.xz=01;31:*.zst=01;31:*.tzst=01;31:*.bz2=01;31:*.bz=01;31:*.tbz=01;31:*.tbz2=01;31:*.tz=01;31:*.deb=01;31:*.rpm=01;31:*.jar=01;31:*.war=01;31:*.ear=01;31:*.sar=01;31:*.rar=01;31:*.alz=01;31:*.ace=01;31:*.zoo=01;31:*.cpio=01;31:*.7z=01;31:*.rz=01;31:*.cab=01;31:*.wim=01;31:*.swm=01;31:*.dwm=01;31:*.esd=01;31:*.avif=01;35:*.jpg=01;35:*.jpeg=01;35:*.mjpg=01;35:*.mjpeg=01;35:*.gif=01;35:*.bmp=01;35:*.pbm=01;35:*.pgm=01;35:*.ppm=01;35:*.tga=01;35:*.xbm=01;35:*.xpm=01;35:*.tif=01;35:*.tiff=01;35:*.png=01;35:*.svg=01;35:*.svgz=01;35:*.mng=01;35:*.pcx=01;35:*.
gfhg123@numbat: ~
mcdonn7@numbat:~ Tue Sep 23 23:07:19$set
BASH=/usr/bin/bash
BASHOPTS=checkwinsize:cmdhist:complete_fullquote:expand_aliases:extglob:extquote:force_fignore:globasciiranges:globskipdots:histappend:interactive_comments:patsub_replacement:progcomp:promptvars:sourcepath
BASH_ALIASES=()
BASH_ARGC=([0]="0")
BASH_ARGV=()
BASH_CMDS=()
BASH_COMPLETION_VERSINFO=([0]="2" [1]="11")
BASH_LINENO=()
BASH_LOADABLES_PATH=/usr/local/lib/bash:/usr/lib/bash:/opt/local/lib/bash:/usr/pkg/lib/bash:/opt/pkg/lib/bash:.
BASH_SOURCE=()
BASH_VERSINFO=([0]="5" [1]="2" [2]="21" [3]="1" [4]="release" [5]="aarch64-unknown-linux-gnu")
BASH_VERSION='5.2.21(1)-release'
CLUTTER_DISABLE_MIPMAPPED_TEXT=1
COLORTERM=truecolor
COLUMNS=107
DBUS_SESSION_BUS_ADDRESS=unix:path=/run/user/1000/bus
DEBUGINFOD_URLS='https://debuginfod.ubuntu.com '
DESKTOP_SESSION=ubuntu
DIRSTACK=()
DISPLAY=:0
EUID=1000
GDMSESSION=ubuntu
GNOME_DESKTOP_SESSION_ID=this-is-deprecated
GNOME_SETUP_DISPLAY=:1
GNOME_SHELL_SESSION_MODE=ubuntu
GNOME_TERMINAL_SCREEN=/org/gnome/Terminal/screen/bbcb6dfe_cf0f_4cc4_a2b4_8542881bab56
GNOME_TERMINAL_SERVICE=:1.108
GROUPS=()
GSM_SKIP_SSH_AGENT_WORKAROUND=true
GTK_MODULES=gail:atk-bridge

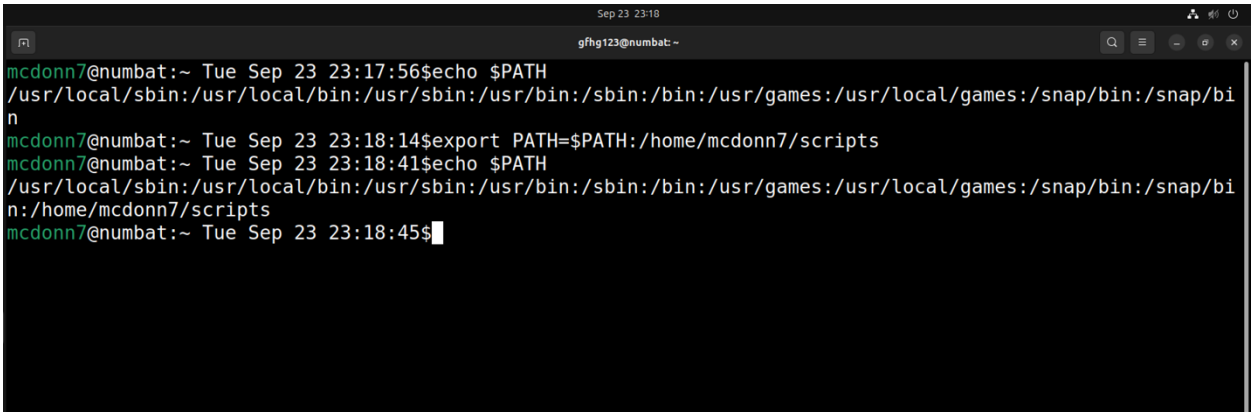
The export command is used to make environment variables. Past that, the creation of the two variables is essentially the same: variable_name=”variable value”.



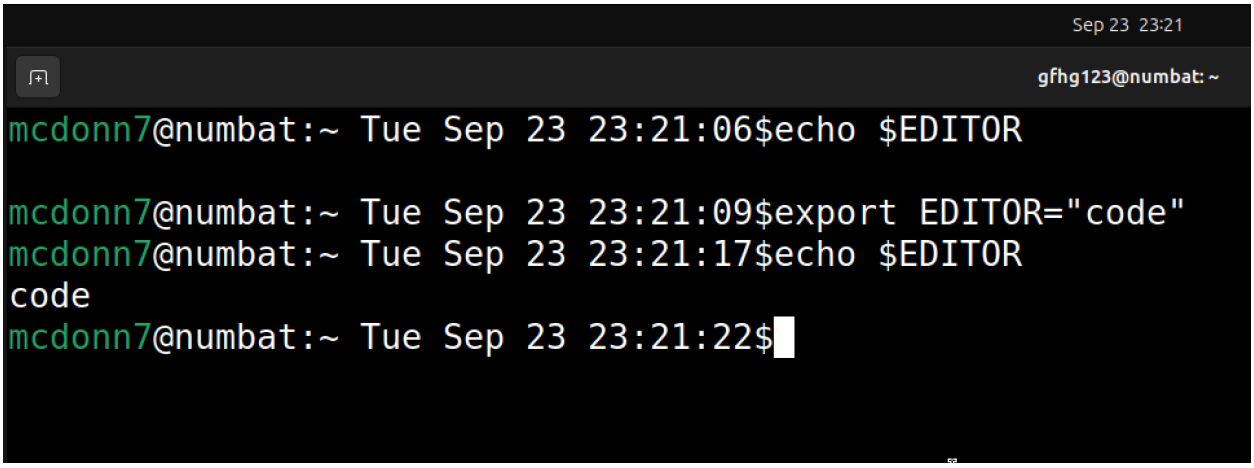
Changing value for $USER:



Changing value for $PATH



Changing value for $EDITOR:



2. Investigate Linux process with pid = 0. What is the function of the process and why is it not listed when you list running processed with top or ps. (4)

   The process with pid = 0 is known as the Kernel Idle Process. It is also known as the "swapper" process. It is utilized when there are no other processes running. The reason that it is not listed is because it is a kernel-mode process and not a user-mode process.

3. Investigate the difference between two command line programs – *more* and *less*. Explain what the differences in functionalities are. (4)

   More and Less are both used to read the content of files. However, more is a more primitive file reader as it only allows you to read, transverse forward, and it must load the entire file before you can read it. Less, on the other hand, adds special features like being able to search, bidirectional reading, and it loads the file as you go, making much faster.

   "Less is more, more or less"

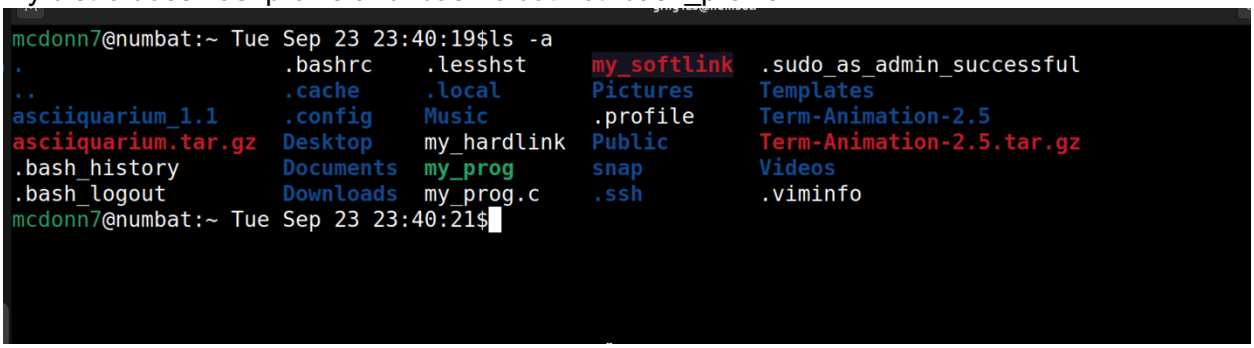
4. Investigate files *.profile*, *.bashrc*, and *.bash_profile*. Answer the following questions.(8)

   a. Explain why their filenames start with a dot. Which command allows you to list these files.

   These filenames start with a dot because they are hidden files. Adding -a or -A to ls lists all hidden files as well as normal files.

   b. Does Ubuntu distro have all of them, or which ones does it have? Please include screenshot/s showing if your system has these files.

My distro does has .profile and .bashrc but not .bash_profile.



c. Describe in general terms what the contents of these files are, and what role they play in the system.

.profile – This is used when a user logs in via console or SSH. It is not specific to a certain shell like bash is, but is used to set up the environment. It is executed upon log in. It contains environment variables.

.bashrc – This is used to set up a specific bash shell environment and creates everything needed for that. It is executed upon creation of a Bash Shell. It contains aliases, functions for the shell, shell options, and custom prompts.

.bash_profile -This is used for log ins specific to a Bash Shell and is executed upon log in. Normally a user will only have this or .profile and not both. This contains environment variables and which apps should start at login.

d. When do they get executed?

.profile – log in

.bashrc – creation of a bash shell

.bash_profile – log in

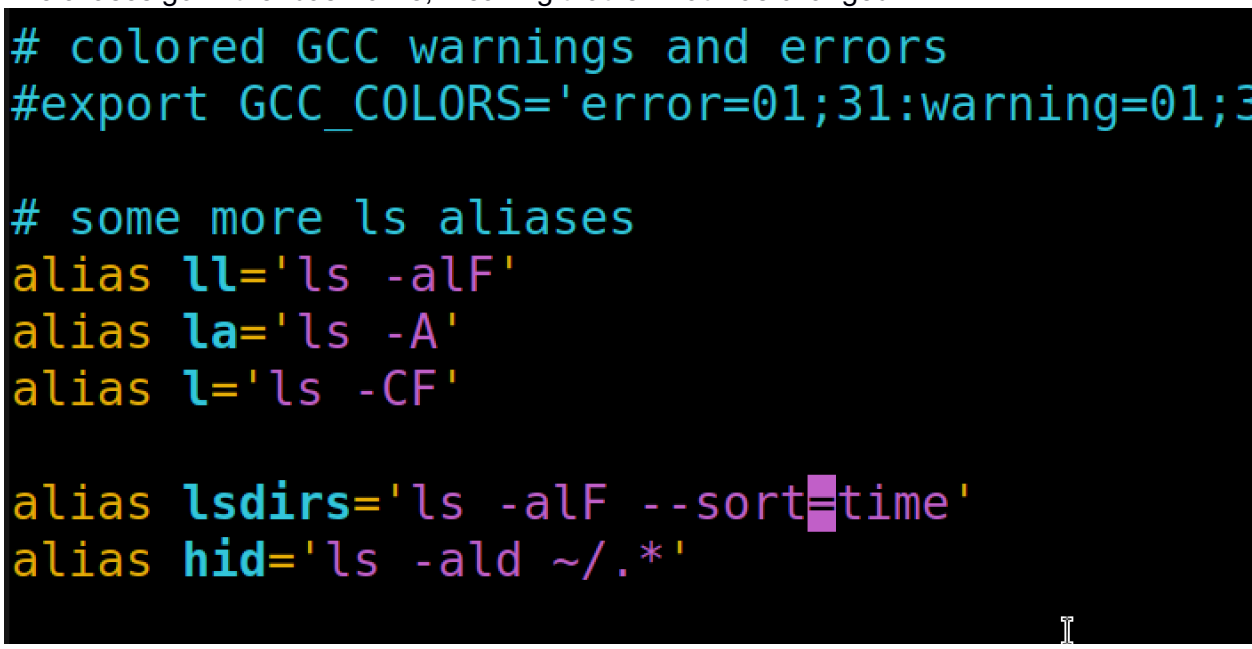
5. Research aliases. Create aliases described below that persist across boots. To do this you will place these aliases into the appropriate file, so that they work every time you boot the system. (6)

   a. Alias *lsdirs* to list all files/subdirectories in the current directory (should work in any directory, so do not hard-code the path), even hidden files, in long format, in sorted by tiime with a slash indicating if an entry is a directory.

   b. Alias *hid* to lists only hidden files in your home directory, in long format.

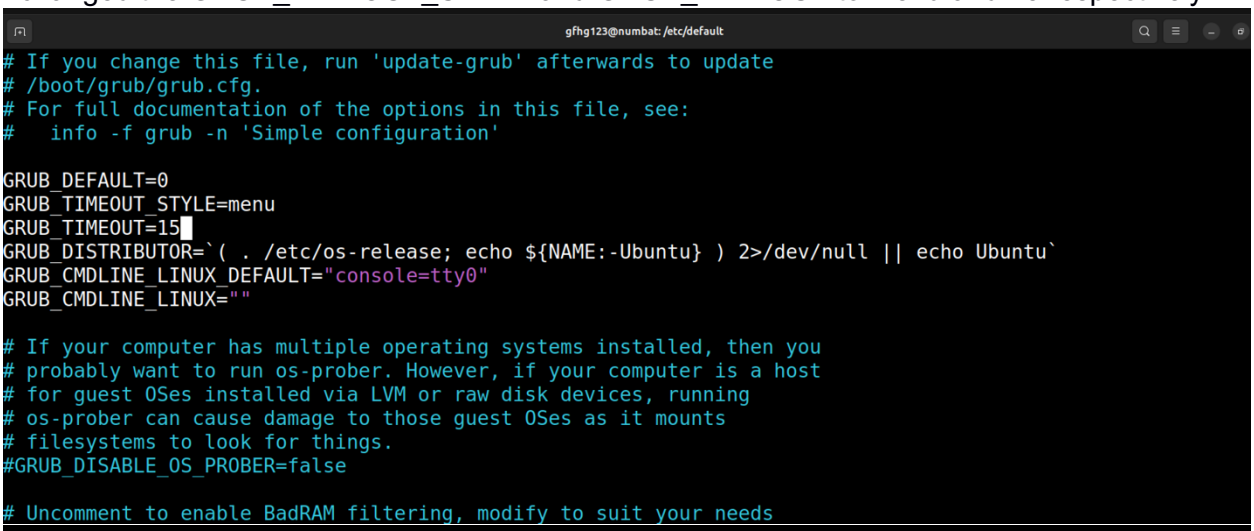
   c. Which file did you change to add aliases? Open that file in an editor, take a screenshot with your changes and insert below.

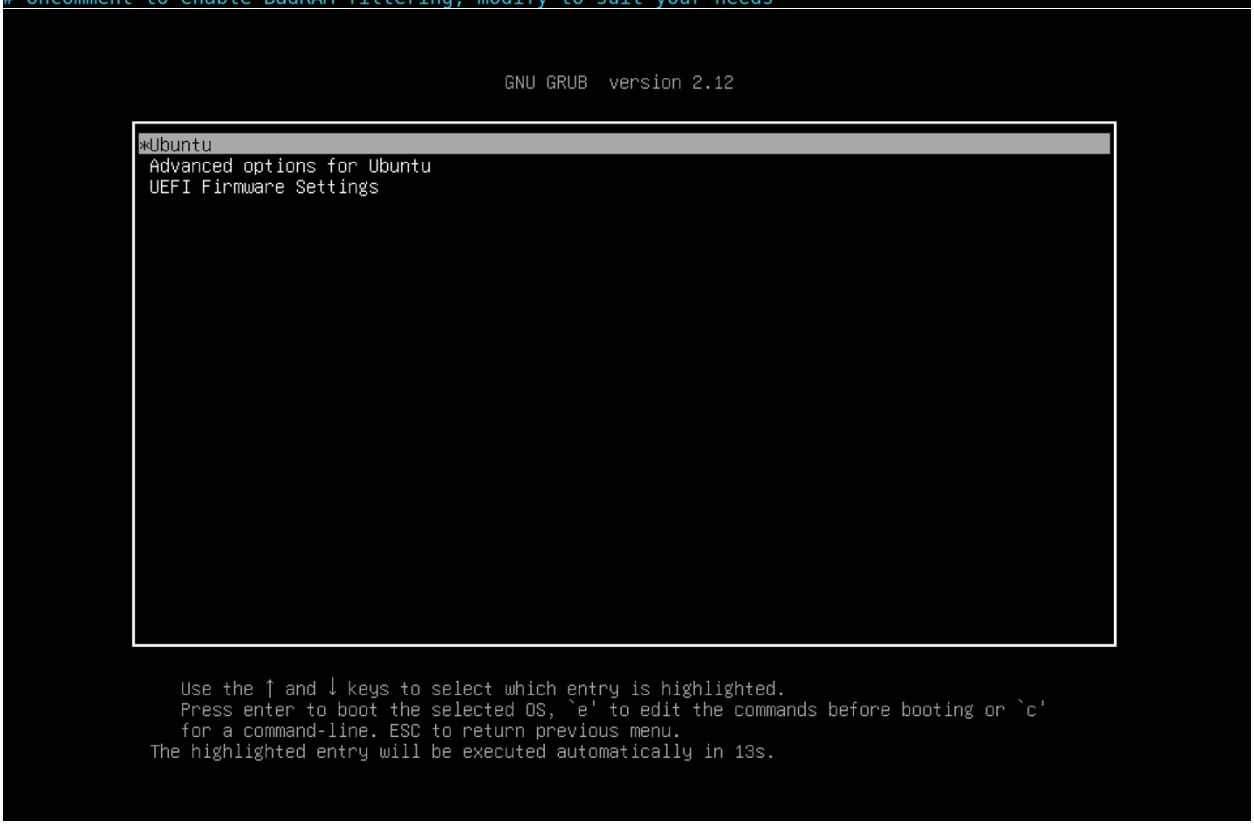
The aliases go in the .bashrc file, meaning that is what was changed.



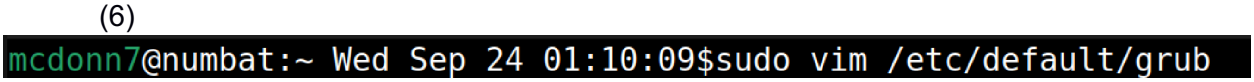
6. Figure out how to display GRUB menu on startup for a single-OS system. In multi-boot system it will be shown automatically, but there is also a way to display it in a single-boot system, like your VM. Research which grub variables you need to change to do this. Insert a screenshot that shows what changes you have made and in which file, and another screenshot that shows your grub menu displayed at boot time. (6)

I changed the GRUB_TIMEOUT_STYLE and GRUB_TIMEOUT to menu and 15 respectively.





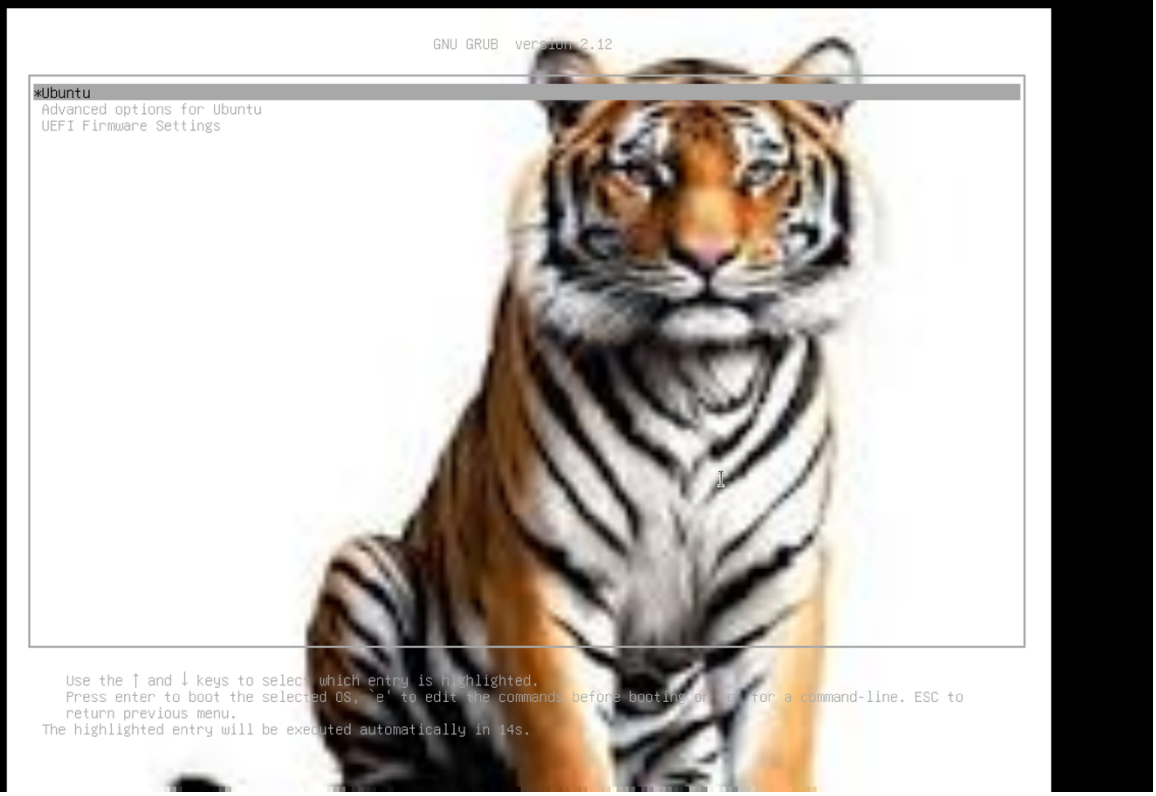
7. Change background image of GRUB menu to a tiger (find the one you like online). There is more than one way to do this. Insert a screenshot that clearly shows how/where you did this and another screenshot that shows that your background image is now a tiger. (6)



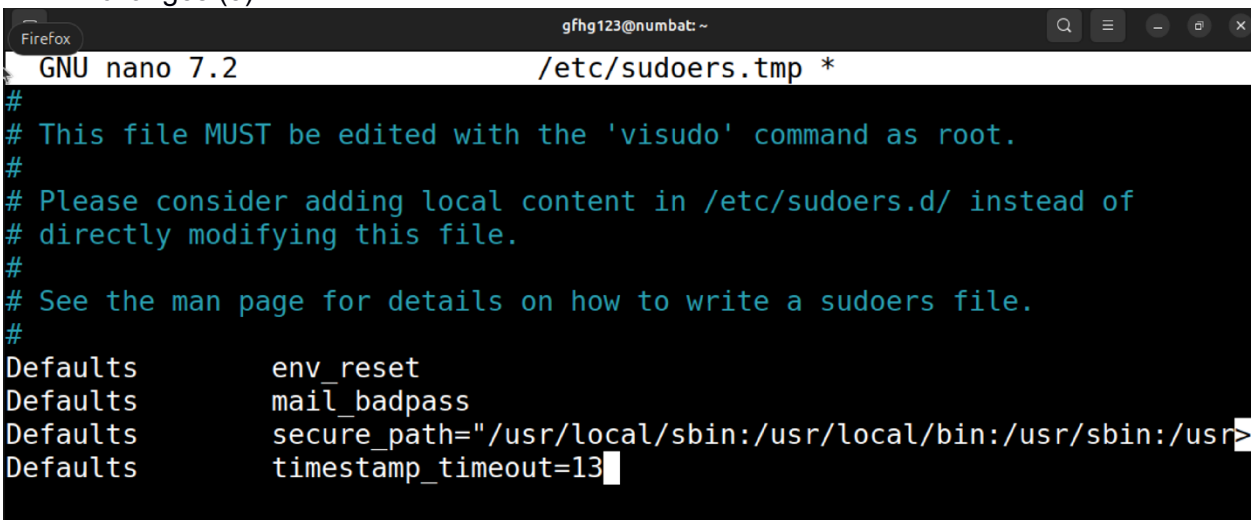
gfhg123@numbat: ~

```
# If you change this file, run 'update-grub' a
# /boot/grub/grub.cfg.
# For full documentation of the options in thi
#   info -f grub -n 'Simple configuration'

GRUB_DEFAULT=0
GRUB_TIMEOUT_STYLE=menu
GRUB_TIMEOUT=15
GRUB_DISTRIBUTOR=`( . /etc/os-release; echo $
| echo Ubuntu`
GRUB_CMDLINE_LINUX_DEFAULT="console=tty0"
GRUB_CMDLINE_LINUX=""
GRUB_BACKGROUND=/boot/grub/tiger.png
```



8. Investigate the sudo grace period. Change it to be 13 minutes. Screenshot your changes.(5)



9. In this exercise you will limit the number of processes that your user can create to a small number (20-30?) and test to verify that the change is effective by running a fork bomb. First run a fork bomb in your VM to see that the system crashed. Then you will limit the number and run again and screenshot the results and all the changes made. (5)