Guidelines:

1. Use of the Internet is not allowed. Please close all browsers on your system. If found using any browser, negative marks will be given. Additionally, disciplinary action will be initiated. Only Linux 'man' pages are allowed.
2. Prepare a text file "Your_roll_no.txt" and write the commands used for each question in that file.
3. The exam duration is 2hrs (max). If you have completed early, notify a TA.
4. You have to upload the solution file to canvas before 4:15 PM. Solution uploaded after this time will get a negative 5 marks. If there is some issue, notify a TA beforehand to avoid negative marks.
5. It is assumed that all commands will be executed from the user's HOME directory: /home/username/
6. All commands should be compatible with the bash shell. In case, you are using a different shell, change shell to bash for this evaluation.

Section 1: Program maintenance

Note: The lines starting with a '$' symbol represents a bash command line. When asked to write a single bash command, piping multiple commands is not allowed. Each question carries one mark. The marking scheme is binary for this section.

1. In a makefile named 'Makefile', the following rule is written:

```
main.o: main.c defs.h
    gcc -c main.c -I. -o main.o
```

Inside the corresponding directory, you executed:
$ ls -lart
The output is:
-rw-rw-rw-1csecse320Aug 2416:36main.c
-rw-rw-r--1csecse1496Aug 2819:34main.o
...

Now, you executed: (say, the current date is Sep 1)
$ touch main.c
$ make main.o

What will happen to main.o? Please write down the correct option, e. g. , (a).
(a) main.o will be re-generated,
(b) main.o will remain untouched.

2. In a makefile named ‘Makefile’, the following rule is written:

```
main.o: main.c defs.h
    rm $<
```

What happens if you execute:
$ make main.o
Please write down the correct option, e. g. , (a).
(a) main.o gets deleted,
(b) main.c gets deleted,
(c) defs.h gets deleted,
(d) main.c and defs.h get deleted.

3. Your working directory has 24 C source files (.c) and a makefile named ‘Makefile’. The source files must be compiled with a particular compiler; the name of this compiler is specified in a variable named ‘COMP’. The required header files are inside a sub-directory named ‘Hfiles’. Write down a single (make) rule that will compile all ‘.c’ files and produce the corresponding ‘.o’ files. Please note that every ‘.o’ file must have the same name as its ‘.c’ file, and that should be explicitly mentioned in the recipe.

4. In the previous question, assume that the variable ‘COMP’ is not defined in your makefile. Instead, it is defined in a makefile named ‘vars.mk’ inside ‘/root/admin/’ directory. Write down the include directive needed to read the value of ‘COMP’.

5. ‘Beanie’ is a novice developer. So, Beanie is given only some ‘.o’ files and asked to make the corresponding binary files. Accordingly, Beanie has written the following makefile:

```
all : prog1 prog2

.PHONY : clean

prog1 : prog1.o utils.o
        cc -o prog1 prog1.o utils.o

prog2 : prog2.o
        cc -o prog2 prog2.o

clean:
        rm *.o
```

Could you please point out Beanie's mistake by rewriting one of the rules? (Just write down the re-written rule in the answer.)

6. There is a file named 'prog.c' which contains 27 lines of code. Its corresponding executable file is 'prog.o'. Suppose, you have launched GDB with prog.o. Write down a single GDB command that will print lines from 14 to 23 of prog.c .

7. There is a program file named 'main.c'. It is compiled with GDB to produce an executable named 'main'. When 'main' is executed, it crashes and produces a core dump file named 'core'. Write down a single bash command that will open 'main' in the GDB debugging mode right where it has crashed.

8. You have a loop variable named 'loopy' in a for loop. The for loop spans from lines 20 to 30. Line 20 contains the for loop condition 'for (loopy = 0; loopy <1000; loopy++)'; and line 30 contains the closing brace of the loop. However, it is throwing an error for some value of loopy between 934 and 999. Write down a single GDB command that will set a watchpoint or breakpoint for the most efficient debugging.

9. While debugging an executable file with GDB, you executed the following GDB command:
   (gdb) info b
   The output is:
   NumTypeDispEnbAddressWhat
   1breakpointkeepy0x00000000004005b7in adjustLevel at AI.c:14
   2breakpointkeepy0x00000000004005d2in main at AI.c:23
   Then you executed a mysterious GDB command.
   After which, you again executed 'info b' and this time the output is:
   NumTypeDispEnbAddressWhat
   1breakpointkeepy0x00000000004005b7in adjustLevel at AI.c:14
   2breakpointkeepn0x00000000004005d2in main at AI.c:23
   Please write down the mysterious GDB command you earlier executed.

10. The 'prog.c' file contains the following lines of code:

```
void printCount(int count) {
    print("%d\n", count);
}

void main(void) {
    int temp = 10;
    printCount(temp);
    print("%d\n", count);
}
```

Now, you are debugging the corresponding executable with GDB. Currently, the debugger is at line 'printCount(temp);' of 'main()'. If you issue the GDB command 'next', will the debugger be at
(a) line 'print("%d\n", count);' of 'main()'
or
(b) line 'print("%d\n", count);' of 'printCount()'.
Write down the correct option, e. g. , (a).

11. In your working directory, there is a file named 'prog.c', which is tracked by SCCS. The file contains a single line saying 'First line'. You executed the following bash commands on that file:
    $ sccs edit prog.c
    $ echo 'Second line' >> prog.c
    $ sccs delta prog.c
    $ cat prog.c
    What would be the output of the last command?
    Please write down the correct option, e. g. , (a).
    (a) First line
    (b) First line
        Second line
    (c) Second line
    (d) cat: prog.c: No such file or directory

12. Write down a single bash command to edit the SCCS delta comment of version 10.5 of a file named 'utils.c'.

13. You have the following makefile in you working directory, which is tracked by SCCS.

```
Quest: main.o
    gcc -o Quest main.o

main.o: main.c
    gcc -c main.c -o main.o

%.c:
    ## Secret recipe
```

    Please write down the secret recipe. It must contain an automatic variable.

14. You have a program file named 'factorial.c', which is tracked by SCCS. Its latest release i.e. the fifth release has ten levels. You just realized that you had made some mistakes in the seventh and eighth levels. Hence, you wish to un-do those mistakes. Please write down a single bash command that will accomplish the desired task.

15. You have made some changes to 'mild.c' since its last SCCS delta. But you have not checked in those changes. Write down a single bash command with which you can

discard these changes if you need to.

16. Suppose you are working on the 'master' branch of a Git repo. Now, you wish to create another branch named 'dev' with the latest contents of branch 'master'. Write down a single bash command that will accomplish the task.

17. Let us assume that there is a file named 'prog.c' which is tracked by Git. You wish to make some changes to prog.c and upload these changes in a remote repo. For that purpose, in which sequence you will perform the following tasks: (a) Commit, (b) Modify, (c) Stage, and (d) Push. Just write down the sequence, e. g. , acbd.

18. Suppose, you have executed the following commands in a Git repo:
    $ touch newfile.txt
    $ echo "First line" >> newfile.txt
    $ git add newfile.txt
    $ echo "Second line" >> newfile.txt
    $ git add newfile.txt
    $ git reset HEAD newfile.txt
    At this point, is 'newfile.txt' untracked or tracked by Git?

19. Suppose, you have cloned a Git repo. It has 799 commits made by 23 distinct developers. You are interested in the commits made by a developer named 'lazy-lotus'. Write down a single bash command that will print all the commits by 'lazy-lotus' and every commit will be printed on a single line.

20. In a Git repo, you executed the following command from the master branch:
    $ git log master --oneline
    The output is:
    c2169c3 Add newfile.txt
    d04d88d Added the first line.

    This repo is mirrored in a remote repo which have an alias 'origin2'. To find out the log of origin2, you executed the following commands:
    $ git remote update origin2
    $ git log origin2/master --oneline
    And the output is:
    8070cc8 Update newfile.txt online
    c2169c3 Add newfile.txt
    d04d88d Added the first line.

    Write down a single bash command that will synchronise the local master branch with its copy in origin2.

Section 2: Linux commands

Note: The following questions need to be answered in a one line. You can use any command multiple times within a single line. For example, a one liner to list all the IP address connected to your system on port 22 is:

```
netstat -tn 2 > /dev/null | grep :22 | awk '{print $5}' | cut -d: -f1 | sort | uniq -c | sort -nr
```

Note that in the above example, sort command is used twice.

You can use any combinations of linux utilities installed on your system, including but not limited to cat, sort, uniq, grep, sed, awk, find. Also some questions requires creation of new files, which can be done using output redirection operator.

1. The file ‘words.txt‘ contains a single token per line. There are lots of duplicate tokens in this file i.e. the same token is present in multiple lines. Write a command to create a file named ‘vocab.txt’ which only contains unique tokens present in the ‘words.txt’ file, where every line contains only one token.

2. How will you find all the files whose names have the prefix ‘main’ present in the directory ‘mystery’. The files may be present in any of its subdirectories.

3. How will you find all the files present in the cricket_commentary_dataset directory which contain the words “kohli” and “chahal” in them. Here the words are present inside the file, not in the file names. You have to only list file names or file paths not the matched pattern.

4. Find out the total free disk space on your system filesystems. The ‘df -m’ command will list all filesystem on your PC and the available column will mention the free space on each filesystem in megabyte. You can pipe this output to other commands and get the total free space, which will be the sum of the ‘Available’ column of all filesystems.

5. How will you find all files larger than 1 mb present in the mid-semester-exam directory.

6. The file ‘alice.txt’ is a text version of the book “Alice’s Adventures in Wonderland”. Find out the top 40 words based on their occurrence frequency used in the book. For simplicity assume words are delimited by spaces, which implies “Author:”, “Gutenberg-tm,” are valid words, but ”which has” is not.

7. Network Time Protocol (NTP) is used to synchronize the clock of a local computer with a remote machine. If a system is connected to an unrestricted internet, usually all modern OS like Ubuntu will automatically update its date and time. However, if a

local computer is behind a restricted internet access it is not possible for an OS to use NTP protocol to update date and time. Suppose your computer is behind such a restricted network, how will you update your system time automatically?

Hint: You can make a https request to google.com, the response received will contain a time stamp set by google servers. Assuming that google servers have up to date & time and the network latency is negligible, you can use this time stamp to update your system time. For this question, a sample response from google.com is available in google_response.txt file. You can extract the date and time values from this file. The expected answer should be in the format:
cat google_response.txt | multile_one_liner_commands
with the expected output: Tue Sep 10 16:27:18 GMT 2019.
Note that the output format of date and time is different from what is present in the text file and you have to get the output in the expected format.

8. Suppose you are a system administrator of iitg.ac.in website. IITG website is hosted using Apache web server which maintains an access in a log file named apache.log. The director asked you to find out different statistics related to the website as described below:
    a. How many unique visits did the website got during 7th december to 10th December 2010 (Both days are inclusive)? Multiple visits from the same IP will not be counted as unique visit.
    b. FInd out the top 10 referrer webpages to the iitg website on 6th December?
    c. What is the most popular web page accessed by the users.

    Hint: The log description is as follows. One line contains a single request received by the server. Note that the data is not an actual data from iitg.ac.in but a real data from a website which also uses apache.

    127.0.0.1 - - [10/Oct/2000:13:55:36 -0700] "GET /apache_pb.gif HTTP/1.0" 200 2326 "http://www.example.com/start.html" "Mozilla/4.08 [en] (Win98; I ;Nav)"

    The blue color string is the referrer webpage.
    The black color string is IP address of the visitor.
    The dark green color string is date and time.
    The magenta color string is the web page accessed by the user.


HELP ME MAN PAGES
YOU'RE MY ONLY HOPE
memegenerator.net