CSC3320 System Level Programming
Lab Assignment 4 - Part 1 (In- Lab)

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4) $ grep 'CSC 3' CSC_Course.txt
Attach a screenshot of the output and describe what this command does.

This command basically searches and matches the exact pattern **CSC 3** as there are no metacharacters in the given expression to match more patterns.

```
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$ grep 'CSC 3' CSC_Course.txt
CSC 3210        Computer Organization and Programming
CSC 3320        System-Level Programming
Prerequisites   CSC 3320 with grade of C or higher
Prerequisites   CSC 3210 with a C or higher
Prerequisites   CSC 3210 with grade of C or higher
Prerequisites   CSC 3320 and either MATH 3020 or MATH 3030 with a C or higher
Prerequisites   CSC 2720 and CSC 3320 with grades of "C" or higher.Students must meet the Computer Sci
ence Major Eligibility Requirement in order to enroll in this course
Prerequisites   CSC 2720 and CSC 3320 with grades of "C" or higher
Prerequisites   CSC 2720 (Data Structures) and CSC 3320 (System Level Programming)
Prerequisites   CSC 2720 Data Structure and CSC 3320 System-Level Programming with grades of C or bett
er
Prerequisites   CSC 3210 Computer Organization and Programming, CSC 2720 Data Structure
Prerequisites   CSC 2720 (Data Structures) and CSC 3320 (System Level Programming)
Prerequisites   CSC 3210 and CSC 3320 with grades of C or higher
Prerequisites   CSC 3320 with grade of C or higher
Prerequisites   CSC 2720, CSC 3210, and CSC 3320 with a C or higher
Prerequisites   CSC 2720 and CSC 3210 with grades of "C" or higher
Prerequisites   CSC 3320 with grade of C or higher
Prerequisites   CSC 3320 with grade of C or higher
Prerequisites   CSC 3320 with grade of C or higher
Prerequisites   CSC 3320 with a C or higher
Prerequisites   CSC 3320 with grade of "C" or higher
Prerequisites   CSC 3320 with grade of C or higher
Prerequisites   CSC 3320 with a grade of C or higher
Prerequisites   CSC 3320 with a grade of C or higher
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$
```

5) $ grep 'CSC 3|CSC 1' CSC_Course.txt
Attach a screenshot of the output and describe what this command does.

This command searches for pattern CSC 3 or CSC 1 but doesn't match any output because the pipe (|) is a special character which falls under extended regular expression, and doesn't work for grep command.

```
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$ grep 'CSC 3|CSC 1' CSC_Course.txt
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$
```

6) $ grep -E 'CSC 3|CSC 1' CSC_Course.txt
Attach a screenshot of the output and describe what this command does.
Use extended regular expression

Grep along with option -E is the same as egrep and so as the pipe falls under extended grep, the output matches either one out of **CSC 3** or **CSC 1**.

```
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$ grep -E 'CSC 3|CSC 1' CSC_Course.txt
CSC 1010        Computers and Applications
CSC 1301        Principles of Computer Science I
CSC 1302        Principles of Computer Science II
Prerequisites   CSC 1301 with a "C" or higher
Prerequisites   CSC 1301 or CSC 2301 with a C or higher, or permission of instructor
Prerequisites   (CSC 1301 or DSCI 1301) and (MATH 1113 or MATH 2211) with a C or higher.
Prerequisites   CSC 1302, MATH 2211, and CSC 2510 or MATH 2420 with grades of "C" or higher
Prerequisites   CSC 1301 and CSC 1302 with a C or higher or permission of the department
CSC 3210        Computer Organization and Programming
Prerequisites   CSC 1302, and CSC 2510 or MATH 2420 with A C or higher
CSC 3320        System-Level Programming
Prerequisites   CSC 3320 with grade of C or higher
Prerequisites   CSC 3210 with a C or higher
Prerequisites   CSC 3210 with grade of C or higher
Prerequisites   CSC 3320 and either MATH 3020 or MATH 3030 with a C or higher
Prerequisites   CSC 2720 and CSC 3320 with grades of "C" or higher.Students must meet the Computer Science Major Eligib
ility Requirement in order to enroll in this course
Prerequisites   CSC 2720 and CSC 3320 with grades of "C" or higher
Prerequisites   CSC 2720 (Data Structures) and CSC 3320 (System Level Programming)
Prerequisites   CSC 2720 Data Structure and CSC 3320 System-Level Programming with grades of C or better
Prerequisites   CSC 3210 Computer Organization and Programming, CSC 2720 Data Structure
Prerequisites   CSC 2720 (Data Structures) and CSC 3320 (System Level Programming)
Prerequisites   CSC 3210 and CSC 3320 with grades of C or higher
Prerequisites   CSC 3320 with grade of C or higher
Prerequisites   CSC 2720, CSC 3210, and CSC 3320 with a C or higher
Prerequisites   CSC 2720 and CSC 3210 with grades of "C" or higher
Prerequisites   CSC 3320 with grade of C or higher
Prerequisites   CSC 3320 with grade of C or higher
Prerequisites   CSC 3320 with grade of C or higher
Prerequisites   CSC 3320 with a C or higher
Prerequisites   CSC 3320 with grade of "C" or higher
Prerequisites   CSC 3320 with grade of C or higher
Prerequisites   CSC 3320 with a grade of C or higher
Prerequisites   CSC 3320 with a grade of C or higher
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$
```

7) $ egrep 'CSC 3|CSC 1' CSC_Course.txt
Attach a screenshot of the output and describe what this command does.

The above command i.e., grep with option -E is same as using egrep command i.e. both act as extended regular expressions, so, the command matches all the strings that contain either **CSC 3** or **CSC 1** pattern in them and we get the same output as the previous command.

```
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$ egrep 'CSC 3|CSC 1' CSC_Course.txt
CSC 1010        Computers and Applications
CSC 1301        Principles of Computer Science I
CSC 1302        Principles of Computer Science II
Prerequisites   CSC 1301 with a "C" or higher
Prerequisites   CSC 1301 or CSC 2301 with a C or higher, or permission of instructor
Prerequisites   (CSC 1301 or DSCI 1301) and (MATH 1113 or MATH 2211) with a C or higher.
Prerequisites   CSC 1302, MATH 2211, and CSC 2510 or MATH 2420 with grades of "C" or higher
Prerequisites   CSC 1301 and CSC 1302 with a C or higher or permission of the department
CSC 3210        Computer Organization and Programming
Prerequisites   CSC 1302, and CSC 2510 or MATH 2420 with A C or higher
CSC 3320        System-Level Programming
Prerequisites   CSC 3320 with grade of C or higher
Prerequisites   CSC 3210 with a C or higher
Prerequisites   CSC 3210 with grade of C or higher
Prerequisites   CSC 3320 and either MATH 3020 or MATH 3030 with a C or higher
Prerequisites   CSC 2720 and CSC 3320 with grades of "C" or higher.Students must meet the Computer Science Major Eligib
ility Requirement in order to enroll in this course
Prerequisites   CSC 2720 and CSC 3320 with grades of "C" or higher
Prerequisites   CSC 2720 (Data Structures) and CSC 3320 (System Level Programming)
Prerequisites   CSC 2720 Data Structure and CSC 3320 System-Level Programming with grades of C or better
Prerequisites   CSC 3210 Computer Organization and Programming, CSC 2720 Data Structure
Prerequisites   CSC 2720 (Data Structures) and CSC 3320 (System Level Programming)
Prerequisites   CSC 3210 and CSC 3320 with grades of C or higher
Prerequisites   CSC 3320 with grade of C or higher
Prerequisites   CSC 2720, CSC 3210, and CSC 3320 with a C or higher
Prerequisites   CSC 2720 and CSC 3210 with grades of "C" or higher
Prerequisites   CSC 3320 with grade of C or higher
Prerequisites   CSC 3320 with grade of C or higher
Prerequisites   CSC 3320 with grade of C or higher
Prerequisites   CSC 3320 with a C or higher
Prerequisites   CSC 3320 with grade of "C" or higher
Prerequisites   CSC 3320 with grade of C or higher
Prerequisites   CSC 3320 with a grade of C or higher
Prerequisites   CSC 3320 with a grade of C or higher
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$
```

8) $ fgrep '3.000 Credit hours' CSC_Course.txt
Attach a screenshot of the output and describe what this command does.

N/A – not applicable

```
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$ fgrep '3.000 Credit hours' CSC_Course.txt
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$
```

9) $ fgrep -x '3.000 Credit hours' CSC_Course.txt
Attach a screenshot of the output and describe what this command does.
Only match the whole line

N/A – not applicable

```
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$ fgrep -x '3.000 Credit hours' CSC_Course.txt
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$
```

10) $ grep 'CSC.*Programming' CSC_Course.txt
Attach a screenshot of the output and describe what this command does.

This command matches all the strings that contain **CSC** followed by zero or more characters and then followed by **Programming** .

```
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$ grep 'CSC.*Programming' CSC_Course.txt
CSC 2301        Introduction to Python Programming
CSC 2302        Python Programming for Data Science
CSC 3210        Computer Organization and Programming
CSC 3320        System-Level Programming
Prerequisites   CSC 2720 (Data Structures) and CSC 3320 (System Level Programming)
CSC 4225        Internetwork Programming
Prerequisites   CSC 2720 Data Structure and CSC 3320 System-Level Programming with grades of C or bett
er
Prerequisites   CSC 3210 Computer Organization and Programming, CSC 2720 Data Structure
Prerequisites   CSC 2720 (Data Structures) and CSC 3320 (System Level Programming)
CSC 4330        Programming Language Concepts
CSC 4370        Web Programming
CSC 4380        Windowing Systems Programming
CSC 4760        Big Data Programming
Students must meet the Computer Science Major Eligibility Requirement in order to enroll in this cours
e. Crosslisted with CSC 6760. This course will cover the technologies, tools, frameworks and languages
 that are most commonly used in Big Data Programming. Focus will be on algorithms for analyzing and mi
ning massive datasets, graphs and social network data. Topics include the storage, management, process
ing and analysis of massive datasets, as well as Big Data governance, security, and privacy issues.
CSC 4840        Advanced Computer Graphics Programming
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$
```

11) $ grep '^CSC.*Programming$' CSC_Course.txt
Attach a screenshot of the output and describe what this command does.

This command matches all the strings that only begin with **CSC** and end the line with **Programming** and can contain zero or more characters in between **CSC** and **Programming**.

```
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$ grep '^CSC.*Programming$' CSC_Course.txt
CSC 2301        Introduction to Python Programming
CSC 3210        Computer Organization and Programming
CSC 3320        System-Level Programming
CSC 4225        Internetwork Programming
CSC 4370        Web Programming
CSC 4380        Windowing Systems Programming
CSC 4760        Big Data Programming
CSC 4840        Advanced Computer Graphics Programming
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$
```

12) $ grep --color 'CSC[^3]*3{2}' CSC_Course.txt

Attach a screenshot of the output and describe what this command does.

This command shows matched string in different color as option --color is used. The matched pattern contains **CSC** followed by anything except 3 and then can contain zero or more characters other than 3 and then contains 3 with repetition of 2 times. However, the {} doesn't act as a special character in basic regular expressions and so doesn't output anything.

```
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$ grep --color 'CSC[^3]*3{2}' CSC_Course.txt
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$
```

13) $ egrep --color -w 'CSC[^3]*3{2}[^3]*' CSC_Course.txt

Attach a screenshot of the output and describe what this command does.

This command shows matched string in different color as option --color is used, option -w matches the lines that are whole words. The matched pattern has **CSC** followed by anything except 3 and then can contain zero or more characters other than 3 and then contains 3 with repetition of 2 times followed by zero or more characters other than 3. Here, the {} acts as a special character in egrep and gives following output.

```
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$ egrep --color -w 'CSC[^3]*3{2}[^3]*' CSC_Course.txt
CSC 3320        System-Level Programming
Prerequisites   CSC 3320 with grade of C or higher
Prerequisites   CSC 3320 and either MATH 3020 or MATH 3030 with a C or higher
Prerequisites   CSC 2720 and CSC 3320 with grades of "C" or higher.Students must meet the Computer Sci
ence Major Eligibility Requirement in order to enroll in this course
Prerequisites   CSC 2720 and CSC 3320 with grades of "C" or higher
Prerequisites   CSC 2720 (Data Structures) and CSC 3320 (System Level Programming)
Prerequisites   CSC 2720 Data Structure and CSC 3320 System-Level Programming with grades of C or bett
er
Prerequisites   CSC 2720 (Data Structures) and CSC 3320 (System Level Programming)
Prerequisites   CSC 3210 and CSC 3320 with grades of C or higher
Prerequisites   CSC 3320 with grade of C or higher
CSC 4330        Programming Language Concepts
Prerequisites   CSC 2720, CSC 3210, and CSC 3320 with a C or higher
Prerequisites   CSC 3320 with grade of C or higher
Prerequisites   CSC 3320 with grade of C or higher
Prerequisites   CSC 3320 with grade of C or higher
Prerequisites   CSC 3320 with a C or higher
Prerequisites   CSC 3320 with grade of "C" or higher
Prerequisites   CSC 3320 with grade of C or higher
Prerequisites   CSC 3320 with a grade of C or higher
Prerequisites   CSC 3320 with a grade of C or higher
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$
```

14) $ grep 'CSC.*C++' CSC_Course.txt

Attach a screenshot of the output and describe what this command does.

In basic regular expression, + symbol doesn't act as a special character and so doesn't output anything as there is no match in the given file.

```
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$ grep 'CSC.*C++' CSC_Course.txt
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$
```

15) $ egrep 'CSC.*C\+\+' CSC_Course.txt

Attach a screenshot of the output and describe what this command does.

In extended regular expression, + acts as a metacharacter however \ escapes them to convert them as a literal and searches for **CSC** followed by zero or more occurrences of any single characters followed by **C++**. However, the given file doesn't contain any pattern of that kind and so doesn't output anything.

```
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$ egrep 'CSC.*C\+\+' CSC_Course.txt
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$
```

16) $ egrep 'CSC.*C++' CSC_Course.txt
Please only describe what this command does.

The command egrep matches extended regular expression that contains **CSC** followed by zero or more occurrences of any single character followed by at least one **C**.

Optional Part:

1) $ sed -E -n 's/(CSC 3[0-9]{3})(.*)/\1/p' CSC_Course.txt
Attach a screenshot of the output and describe what this command does.

The sed command is enhanced to match extended regular expressions using -E option and option -n suppresses the default print behavior of sed command. This command prints all the first matches of the pattern **CSC 3** followed by any three digits of range 0-9 followed by zero or more occurrences of any single character.

```
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$ sed -E -n 's/(CSC 3[0-9]{3})(.*)/\1/p' CSC_Course.txt
CSC 3210
CSC 3320
Prerequisites   CSC 3320
Prerequisites   CSC 3210
Prerequisites   CSC 3210
Prerequisites   CSC 3320
Prerequisites   CSC 2720 and CSC 3320
Prerequisites   CSC 2720 and CSC 3320
Prerequisites   CSC 2720 (Data Structures) and CSC 3320
Prerequisites   CSC 2720 Data Structure and CSC 3320
Prerequisites   CSC 3210
Prerequisites   CSC 2720 (Data Structures) and CSC 3320
Prerequisites   CSC 3210
Prerequisites   CSC 3320
Prerequisites   CSC 2720, CSC 3210
Prerequisites   CSC 2720 and CSC 3210
Prerequisites   CSC 3320
Prerequisites   CSC 3320
Prerequisites   CSC 3320
Prerequisites   CSC 3320
Prerequisites   CSC 3320
Prerequisites   CSC 3320
Prerequisites   CSC 3320
Prerequisites   CSC 3320
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$
```

2) $ awk -F'-' '/(CSC 3[0-9]{3})(.*)/{print $1}' CSC_Course.txt
Attach a screenshot of the output and describe what this command does.

The command specifies – (hyphen) as the field separator and the command prints all the first fields that contain **CSC 3** followed by any 3 digits of range 0-9 followed by zero or more occurrences of any single character.

```
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$ awk -F'-' '/(CSC 3[0-9]{3})(.*)/{print $1}' CSC_Course.txt
CSC 3210        Computer Organization and Programming
CSC 3320        System
Prerequisites   CSC 3320 with grade of C or higher
Prerequisites   CSC 3210 with a C or higher
Prerequisites   CSC 3210 with grade of C or higher
Prerequisites   CSC 3320 and either MATH 3020 or MATH 3030 with a C or higher
Prerequisites   CSC 2720 and CSC 3320 with grades of "C" or higher.Students must meet the Computer Science Major Eligib
ility Requirement in order to enroll in this course
Prerequisites   CSC 2720 and CSC 3320 with grades of "C" or higher
Prerequisites   CSC 2720 (Data Structures) and CSC 3320 (System Level Programming)
Prerequisites   CSC 2720 Data Structure and CSC 3320 System
Prerequisites   CSC 3210 Computer Organization and Programming, CSC 2720 Data Structure
Prerequisites   CSC 2720 (Data Structures) and CSC 3320 (System Level Programming)
Prerequisites   CSC 3210 and CSC 3320 with grades of C or higher
Prerequisites   CSC 3320 with grade of C or higher
Prerequisites   CSC 2720, CSC 3210, and CSC 3320 with a C or higher
Prerequisites   CSC 2720 and CSC 3210 with grades of "C" or higher
Prerequisites   CSC 3320 with grade of C or higher
Prerequisites   CSC 3320 with grade of C or higher
Prerequisites   CSC 3320 with grade of C or higher
Prerequisites   CSC 3320 with a C or higher
Prerequisites   CSC 3320 with grade of "C" or higher
Prerequisites   CSC 3320 with grade of C or higher
Prerequisites   CSC 3320 with a grade of C or higher
Prerequisites   CSC 3320 with a grade of C or higher
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$
```

3) $ sed -E -n 's/(CSC [0-9]{4})(-)(.*)/\3/p' CSC_Course.txt
Attach a screenshot of the output and describe what this command does.

```
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$ sed -E -n 's/(CSC [0-9]{4})( - )(.*)/\3/p' CSC_Course.txt
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$
```

The sed command is enhanced to match extended regular expressions using -E option and option -n suppresses the default print behavior of sed command. This command prints all the third matches of the pattern **CSC** followed by any four digits of range 0-9 followed by **–** (hyphen) then followed by zero or more occurrences of any single character. However, there are no patterns that match and when – is replaced by **,** (comma) we get the following output :

```
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$ sed -E -n 's/(CSC [0-9]{4}(,)(.*))/\3/ p' CSC_Course.txt
Prerequisites    MATH 2211, and CSC 2510 or MATH 2420 with grades of "C" or higher
Prerequisites    and CSC 2510 or MATH 2420 with A C or higher
Prerequisites    CSC 3210, and CSC 3320 with a C or higher
Prerequisites    BIOL 1103K, [or BIOL 1103 and BIOL 1103L] and CHEM 1211K [or CHEM 1211 and CHEM 1211L] with grades of
"C" or higher.Students must meet the Computer Science Major Eligibility Requirement in order to enroll in this course
```

4) $ sed -E -n 's/(CSC [0-9]{4})(-)(.*)/\3/p' CSC_Course.txt|
sort
Attach a screenshot of the output and describe what this command does.

```
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$ sed -E -n 's/(CSC [0-9]{4})( - )(.*)/\3/p' CSC_Course.txt|sort
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$
```

The sed command is enhanced to match extended regular expressions using -E option and option -n suppresses the default print behavior of sed command. This command prints all the third matches of the pattern **CSC** followed by any four digits of range 0-9 followed by **–** (hyphen) then followed by zero or more occurrences of any single character and the output is then given as input to sort. However, there are no patterns that match and when – is replaced by **,** (comma) we get the following output after sorting :

```
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$ sed -E -n 's/(CSC [0-9]{4}(,)(.*))/\3/ p' CSC_Course.txt|sort
Prerequisites    and CSC 2510 or MATH 2420 with A C or higher
Prerequisites    BIOL 1103K, [or BIOL 1103 and BIOL 1103L] and CHEM 1211K [or CHEM 1211 and CHEM 1211L] with grades of
"C" or higher.Students must meet the Computer Science Major Eligibility Requirement in order to enroll in this course
Prerequisites    CSC 3210, and CSC 3320 with a C or higher
Prerequisites    MATH 2211, and CSC 2510 or MATH 2420 with grades of "C" or higher
[vsrikakulapu1@gsuad.gsu.edu@snowball Lab4]$
```