BINF2111 – Introduction to Bioinformatics Computing

UNIX 101 part deux (Grep and regular exp)

Richard Allen White III, PhD
RAW Lab
Lecture 3 - Tuesday Aug 31st, 2021

Learning Objectives

- Review quiz and lab

- Grep

- Regular expressions in grep

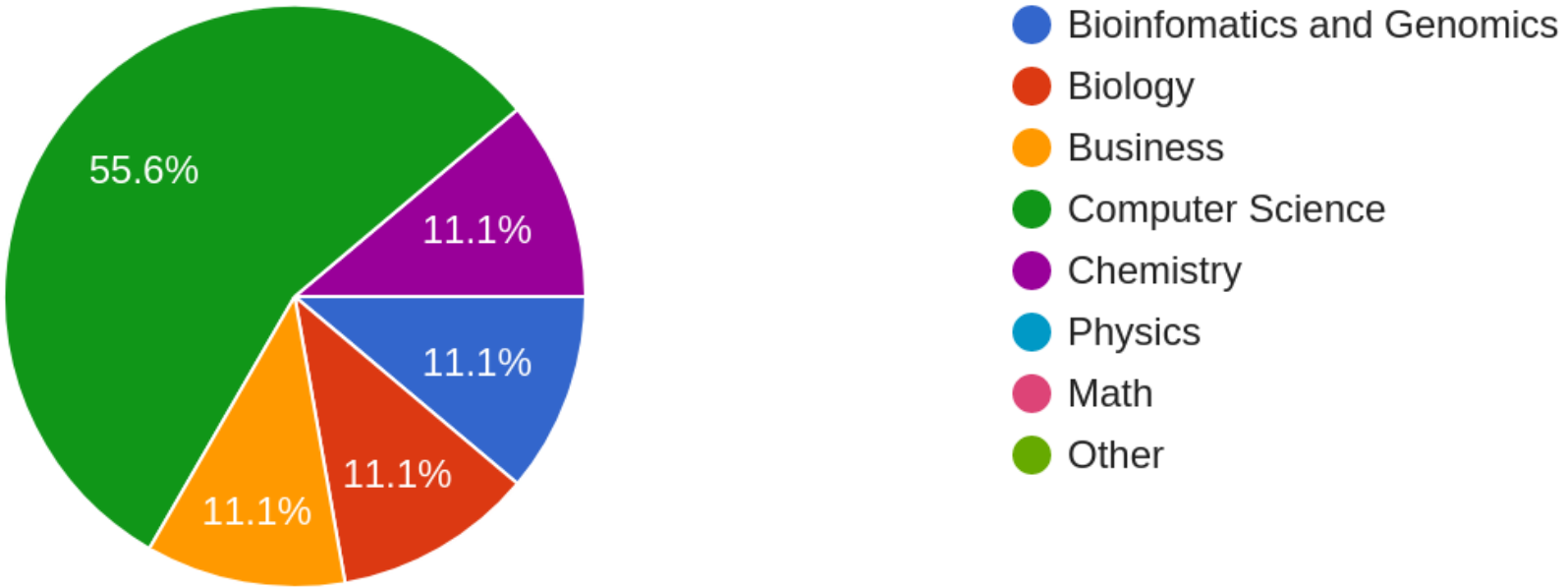
- Count nucleotide strings in grep

- Quiz 3

What is your major department ?

Which department?

9 responses



Quiz 2 answers

- Windows has the lowest number of cpu viruses?

T or F

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- Linux is closed sourced and costs lots of money
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- The cd command reads the first 5 lines of a file?
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- The cd command reads the first 5 lines of a file?
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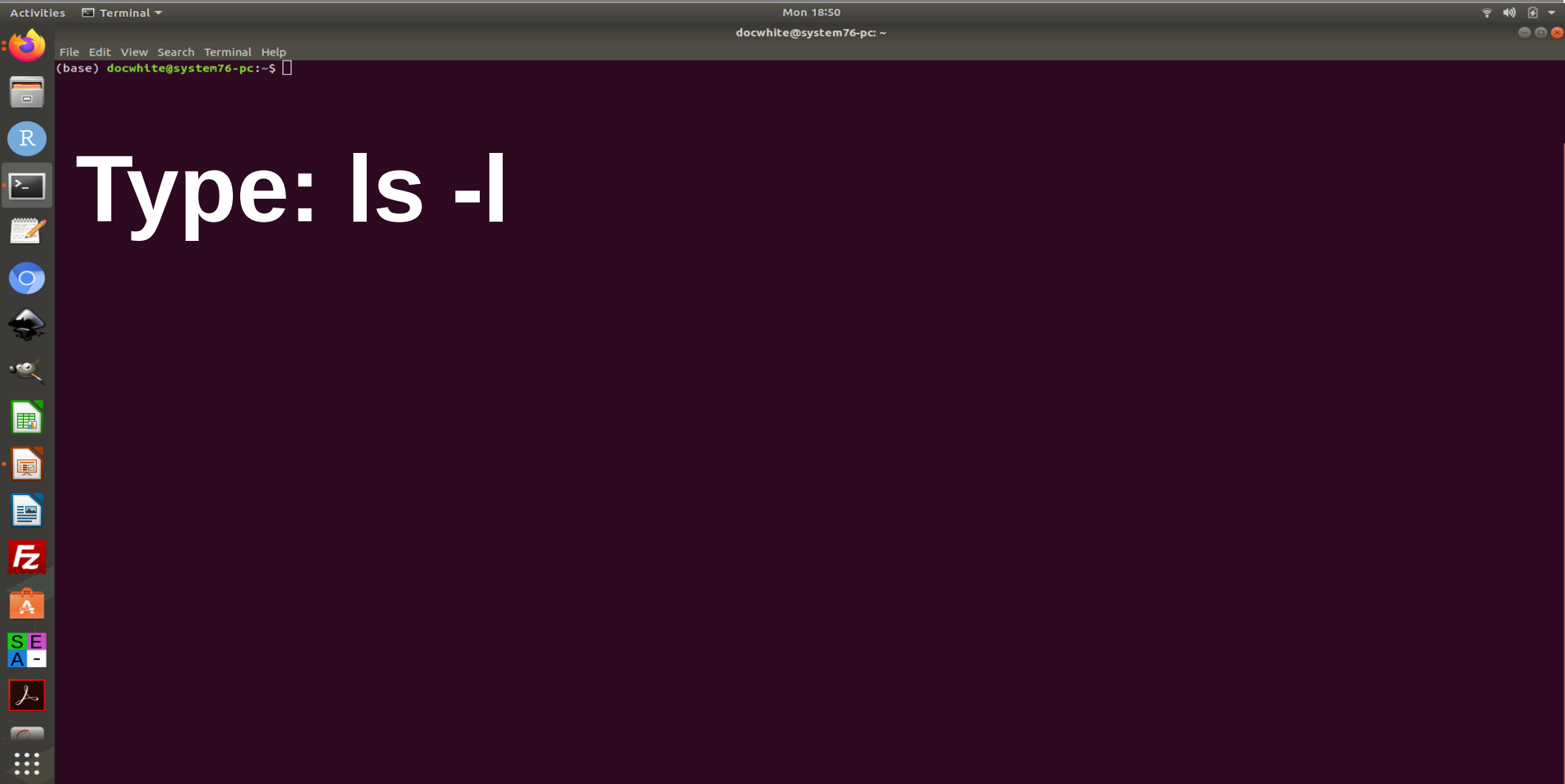
What command does that?

Lab assignment 1



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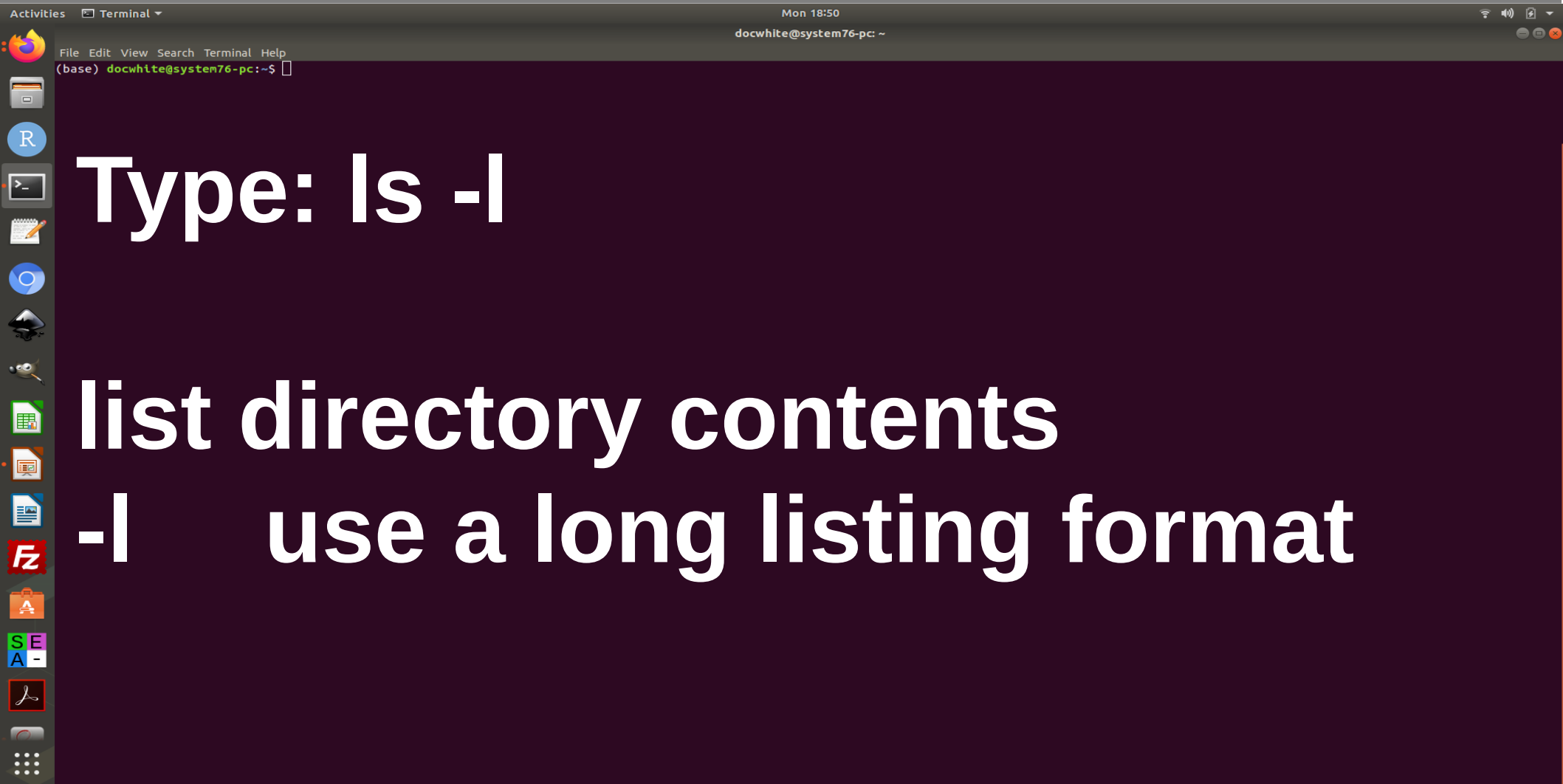

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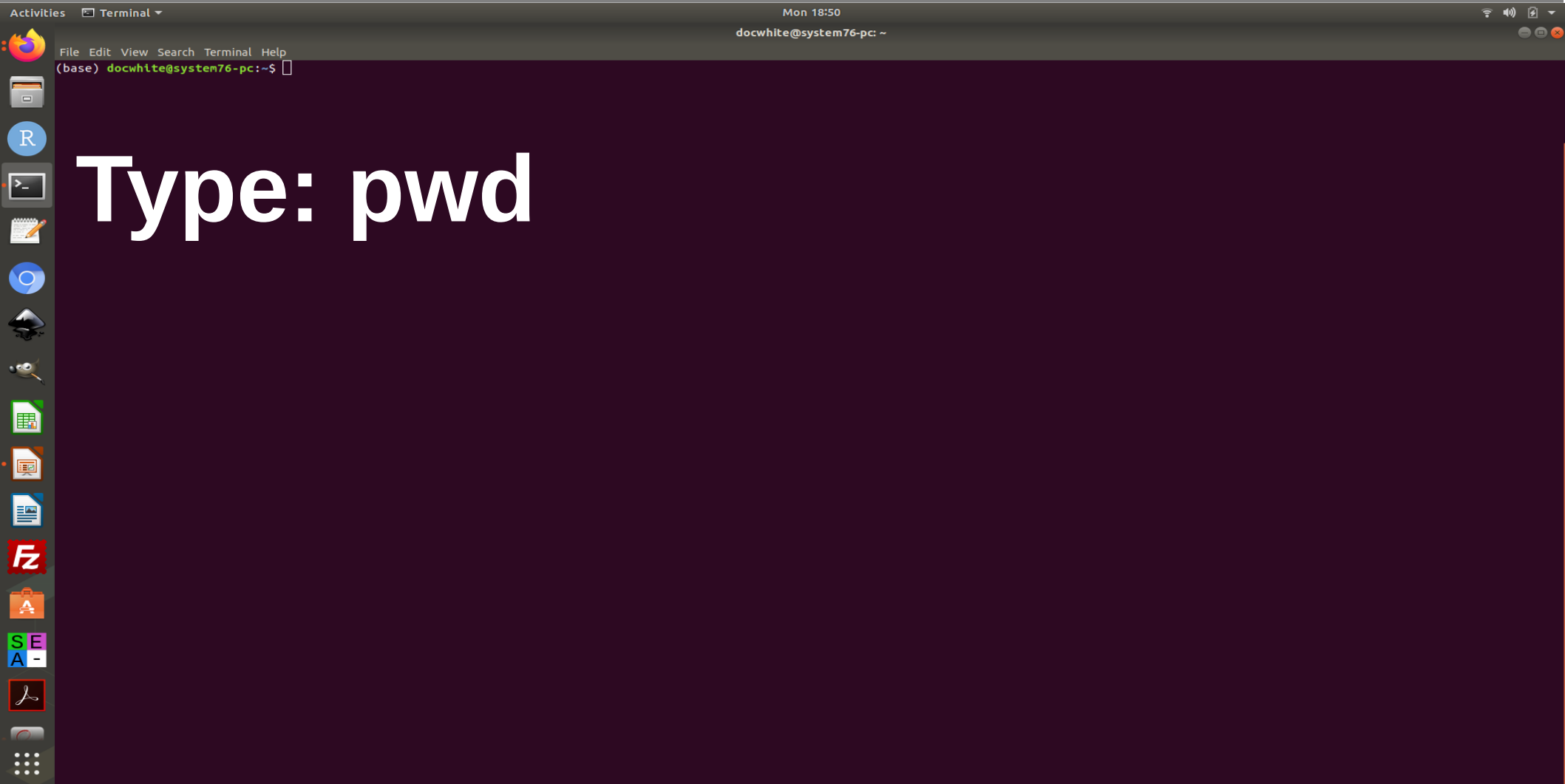

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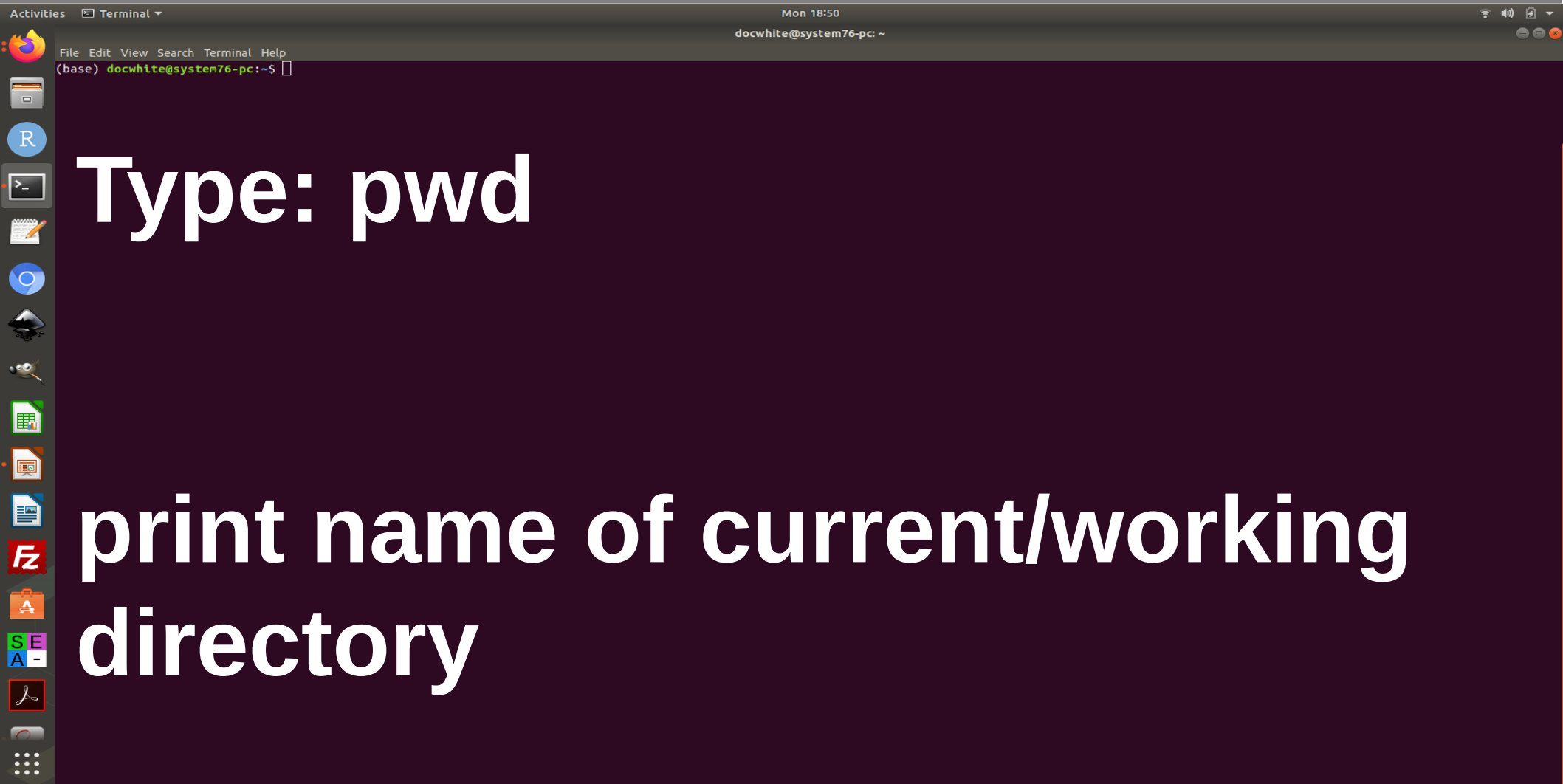

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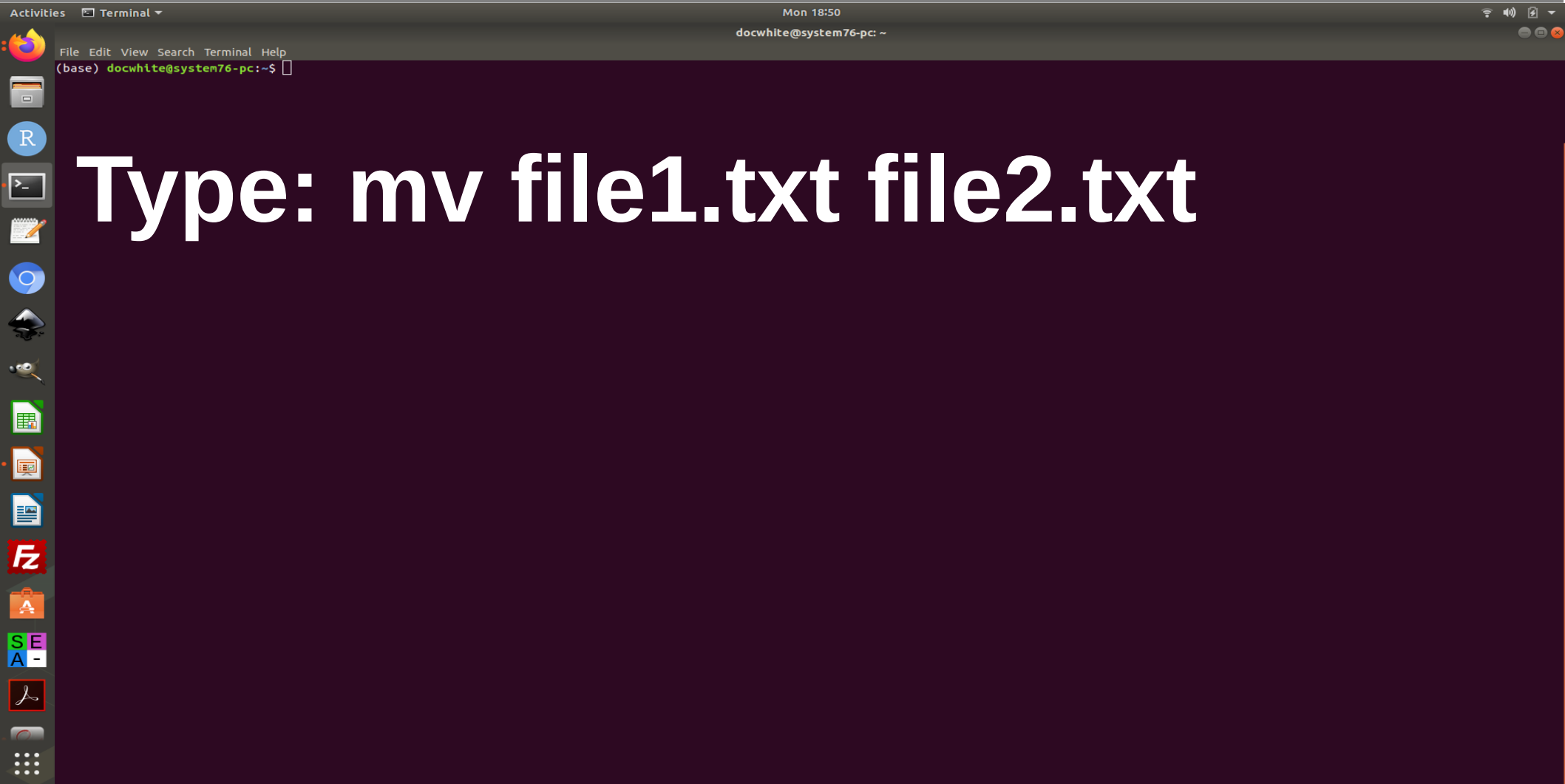

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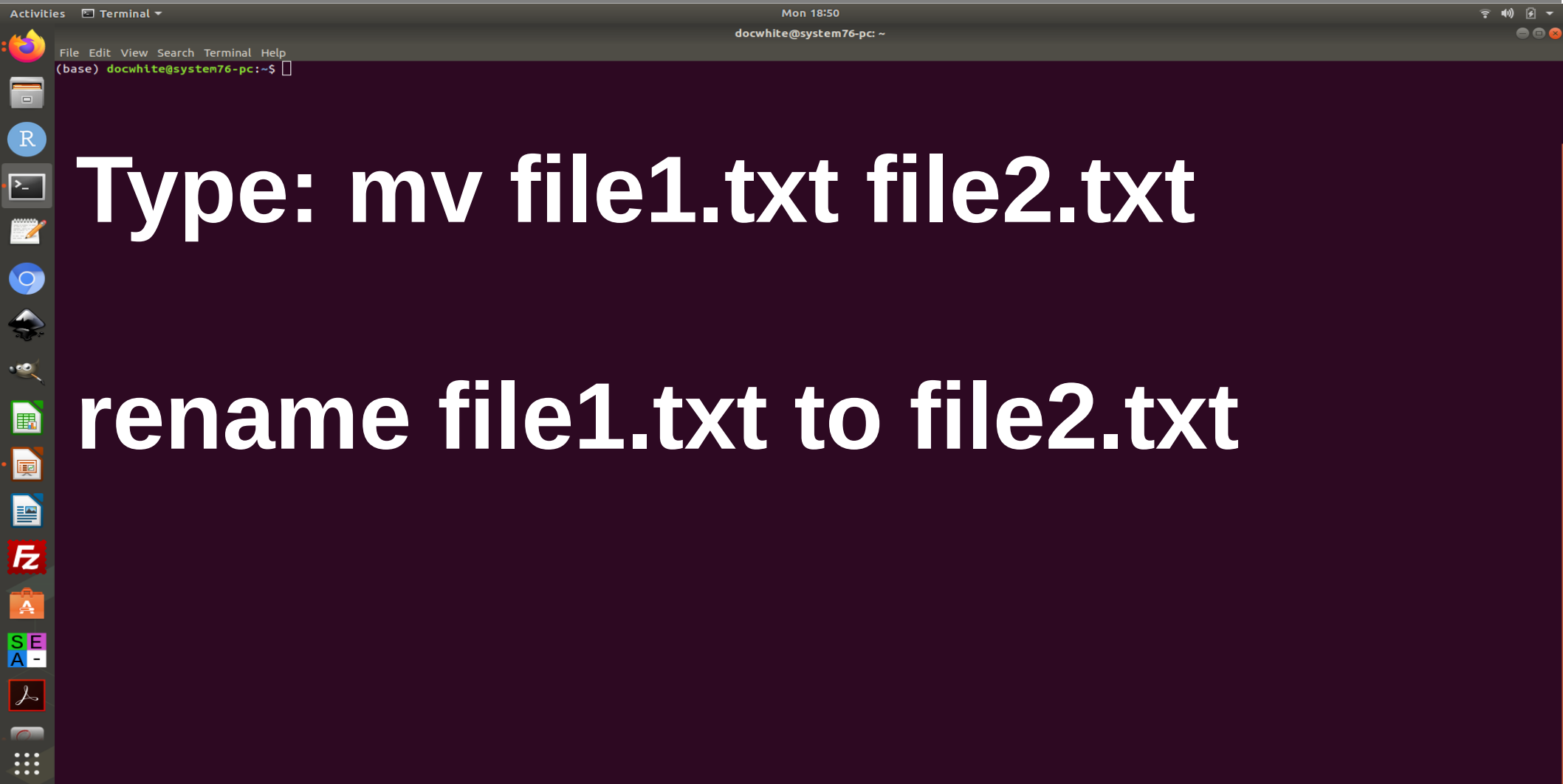

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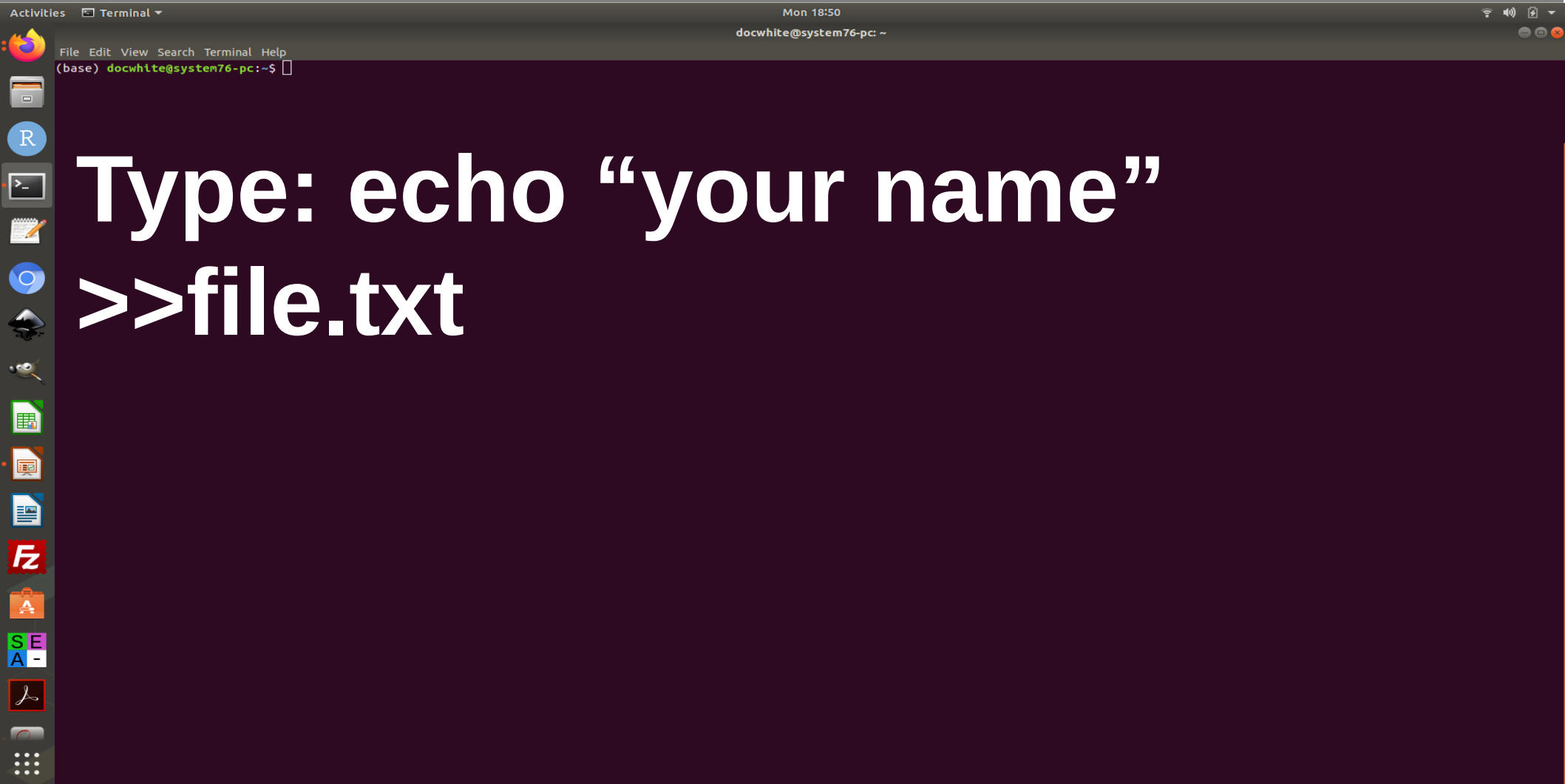

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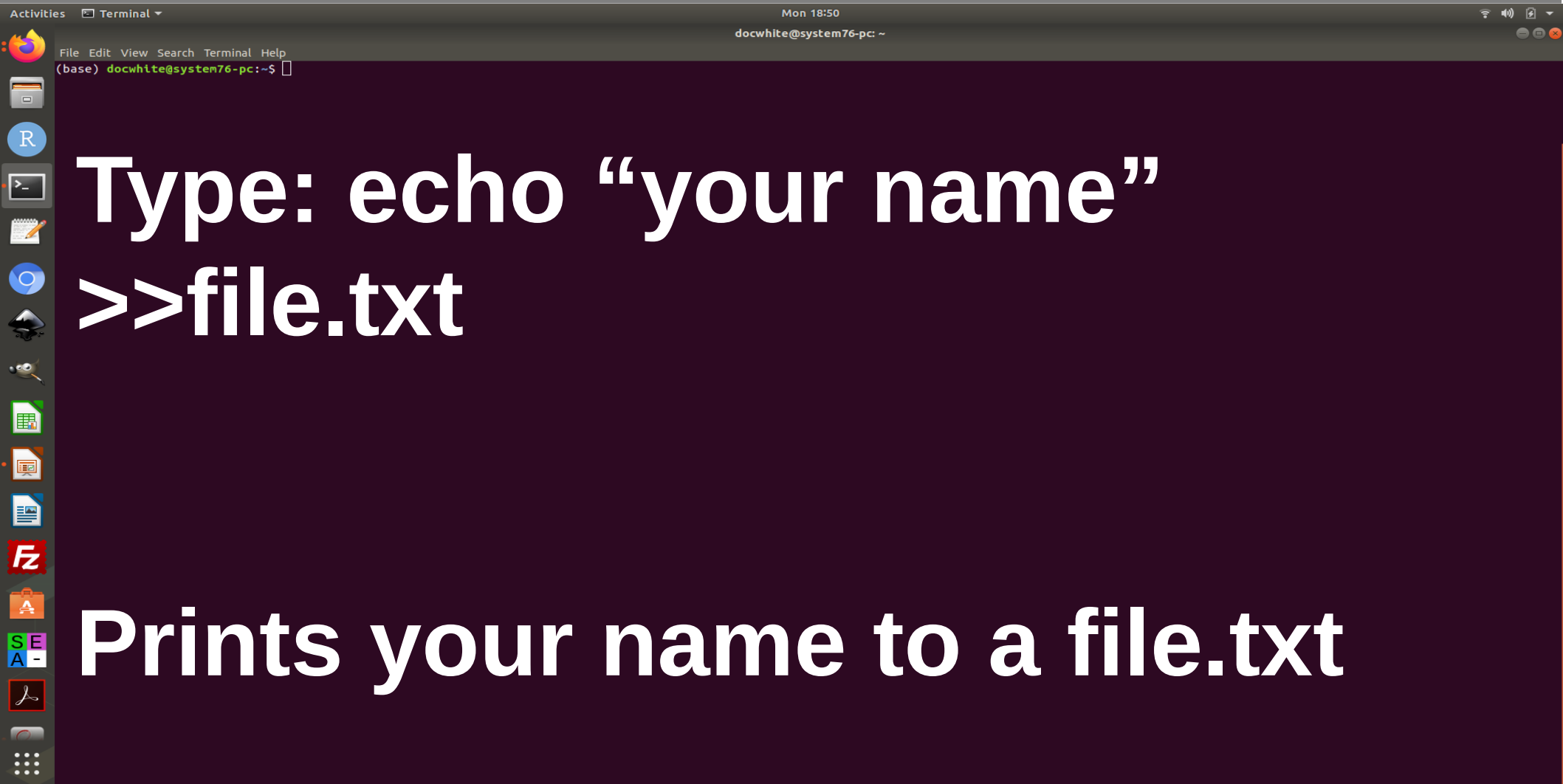

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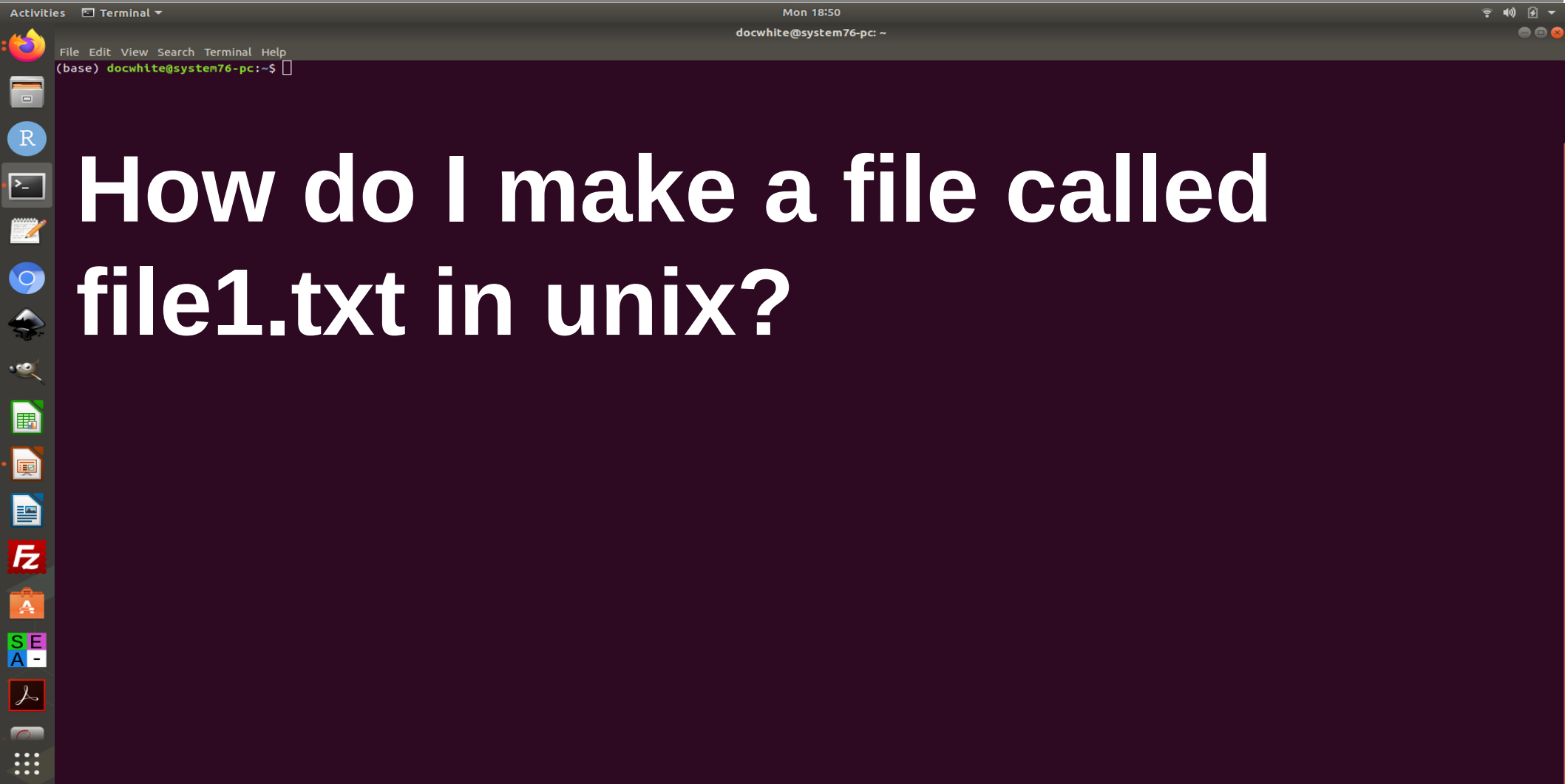
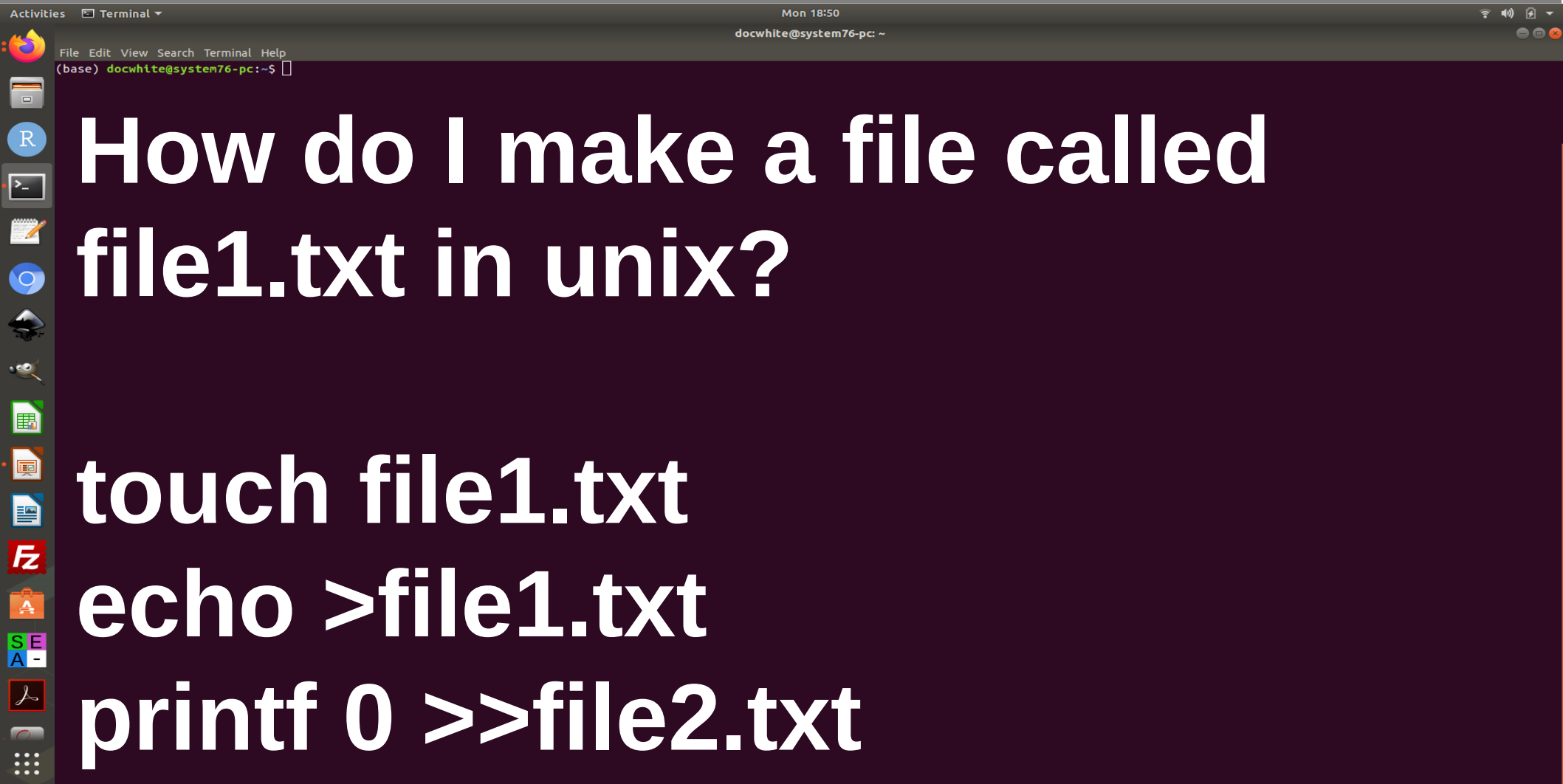


How do I make a file called file1.txt in unix?

Lab assignment 1



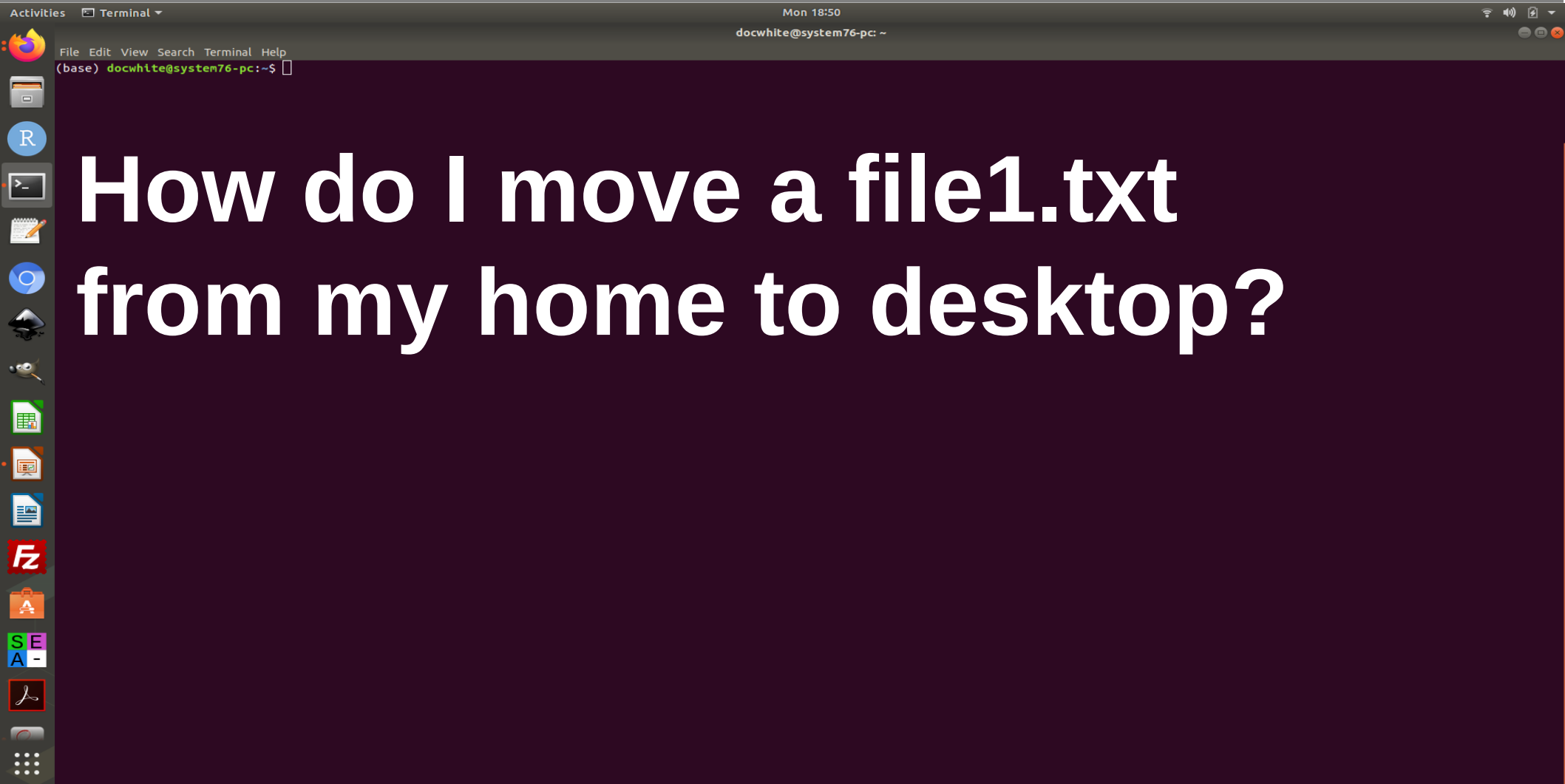
How do I make a file called file1.txt in unix?

touch file1.txt

echo >file1.txt

printf 0 >>file2.txt

Lab assignment 1



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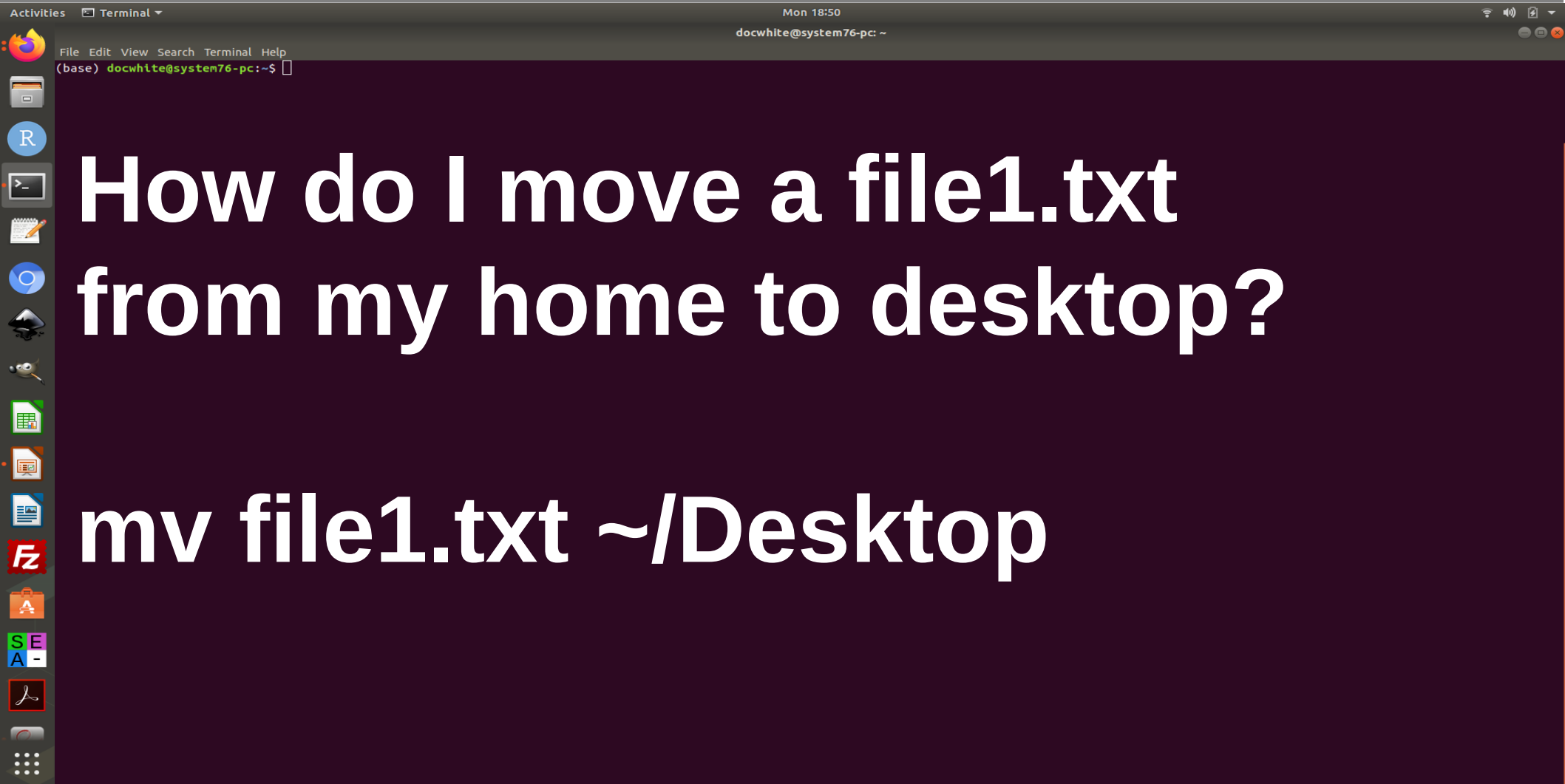

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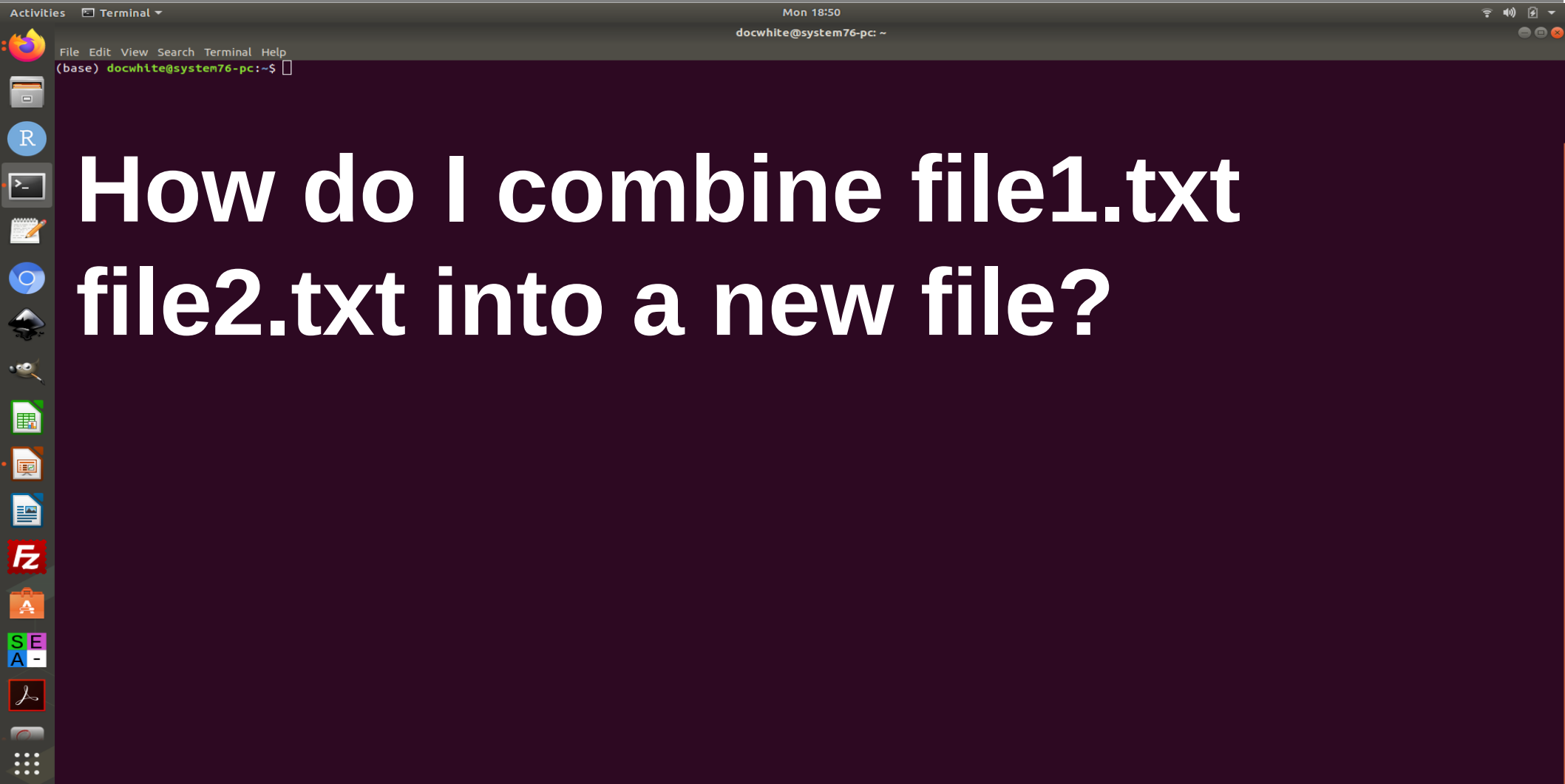

How do I combine file1.txt file2.txt into a new file?

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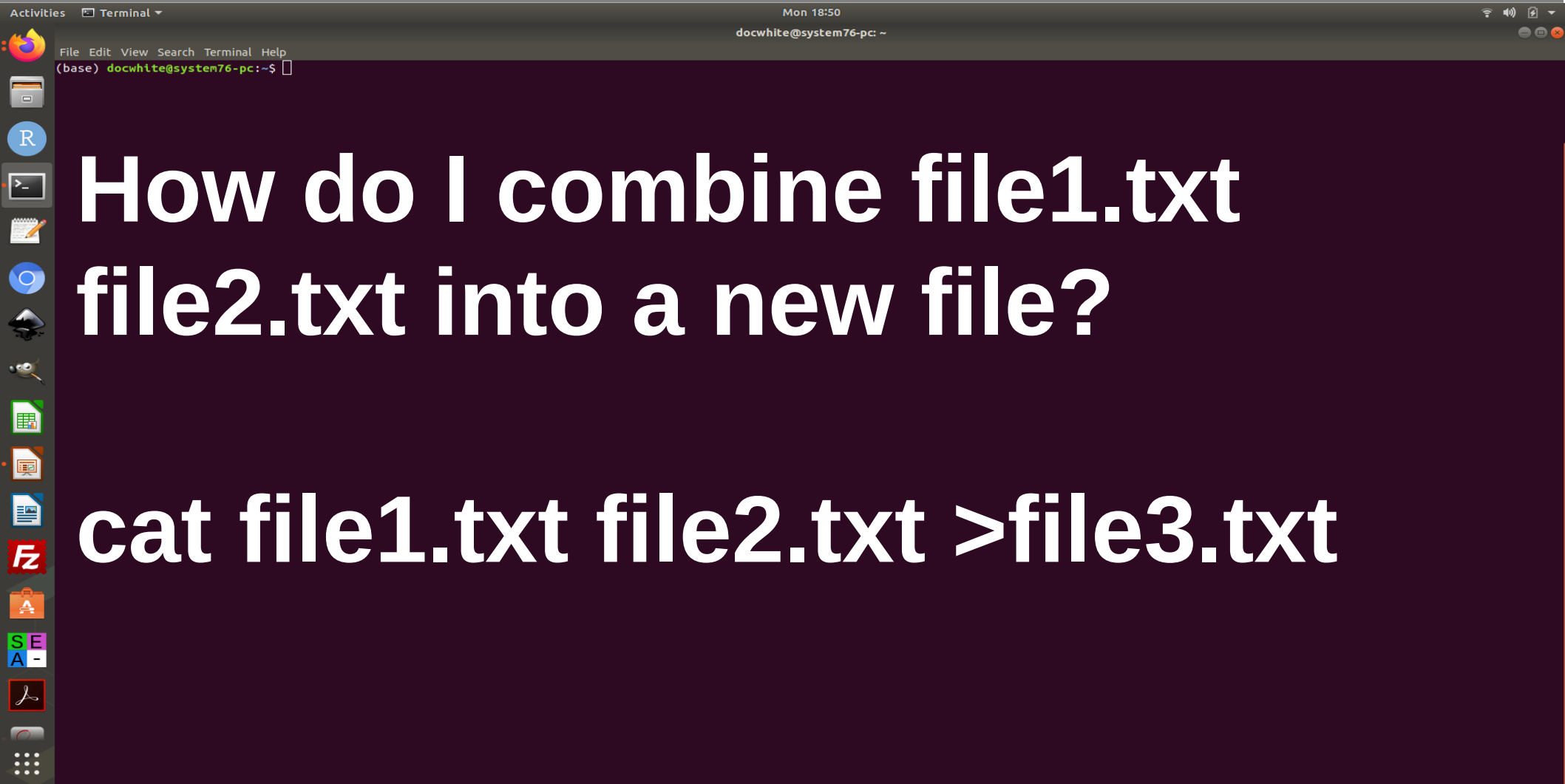
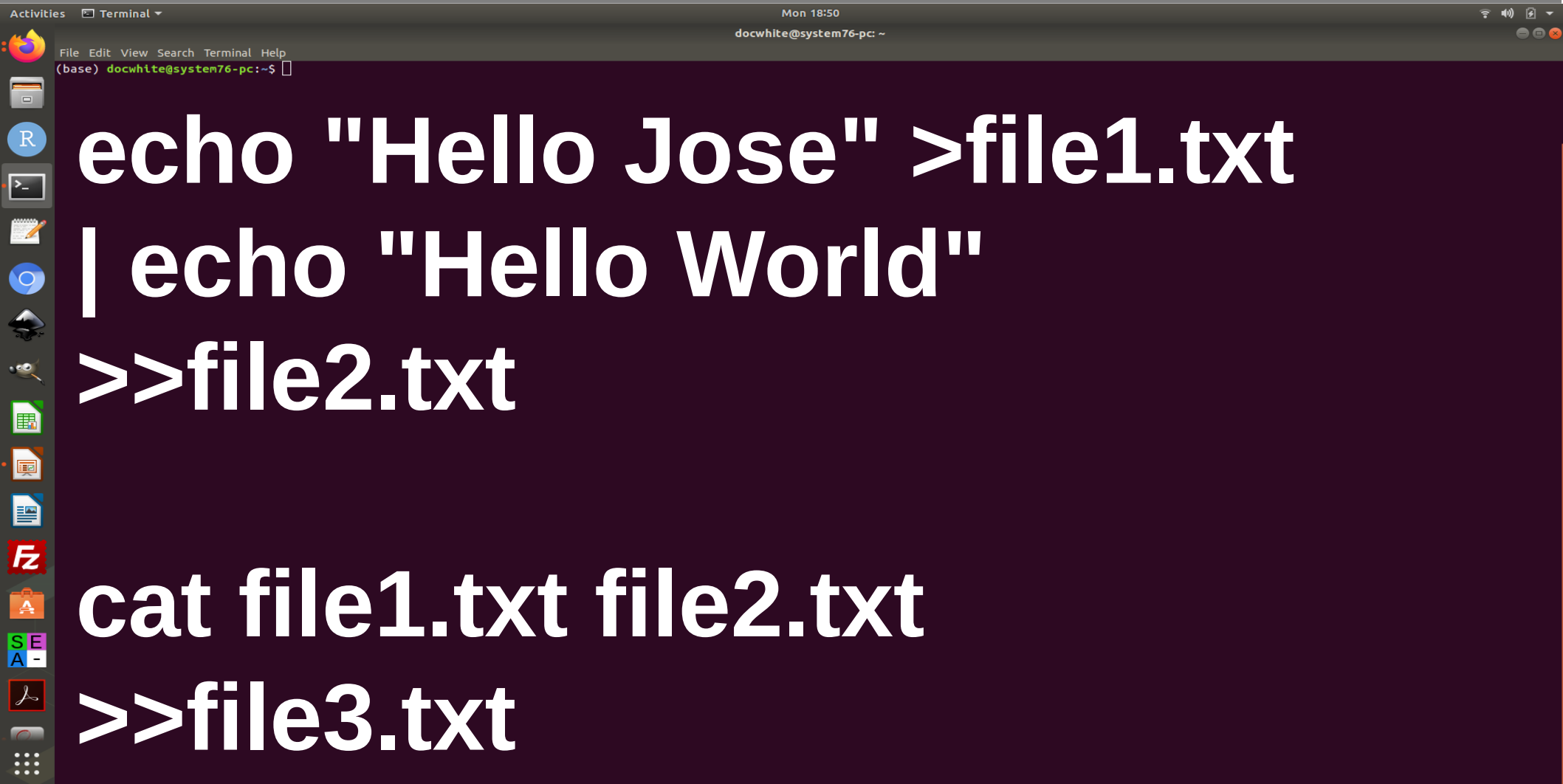


How do I combine file1.txt file2.txt into a new file?

cat file1.txt file2.txt >file3.txt

Lab assignment 1



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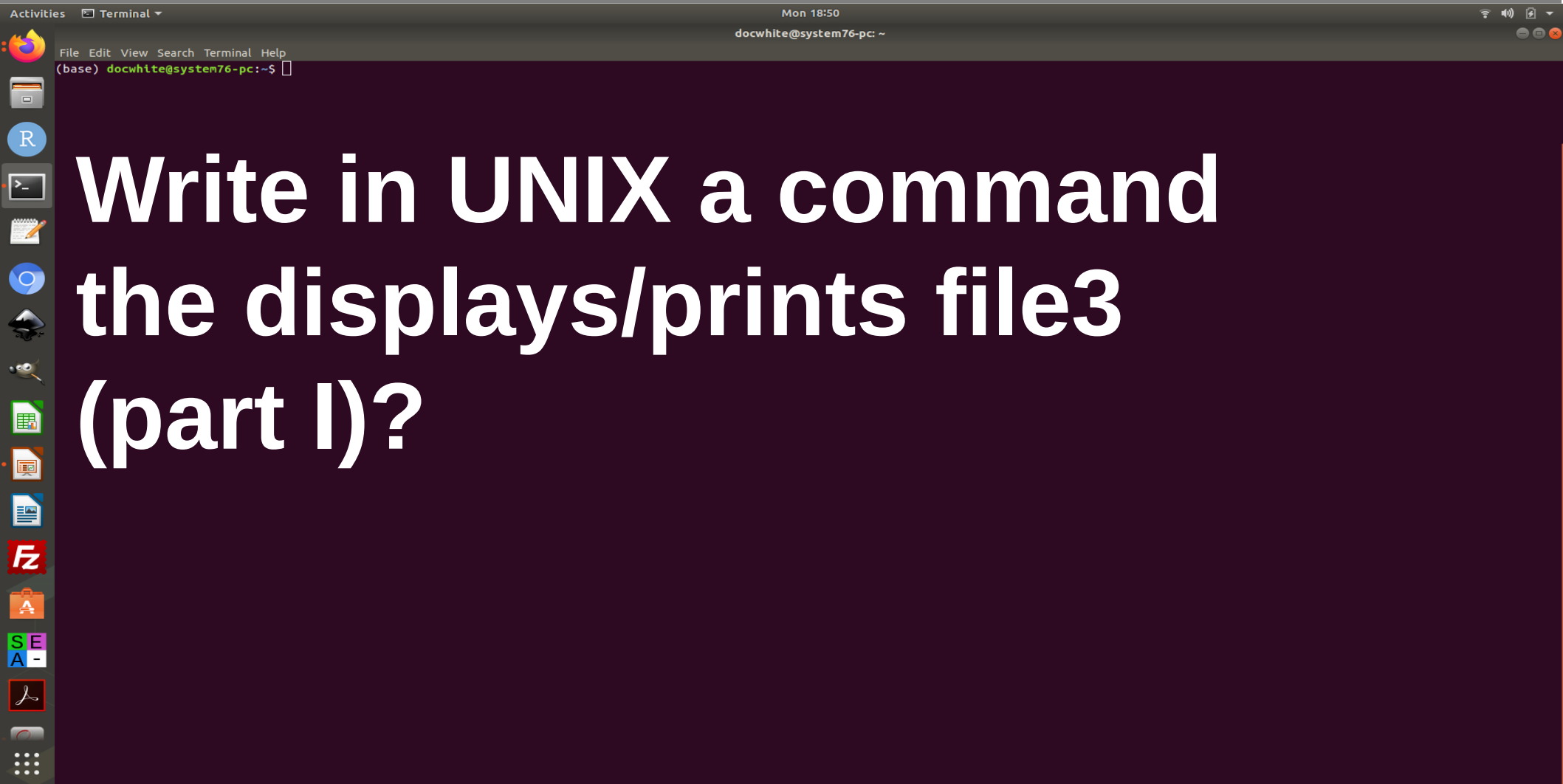
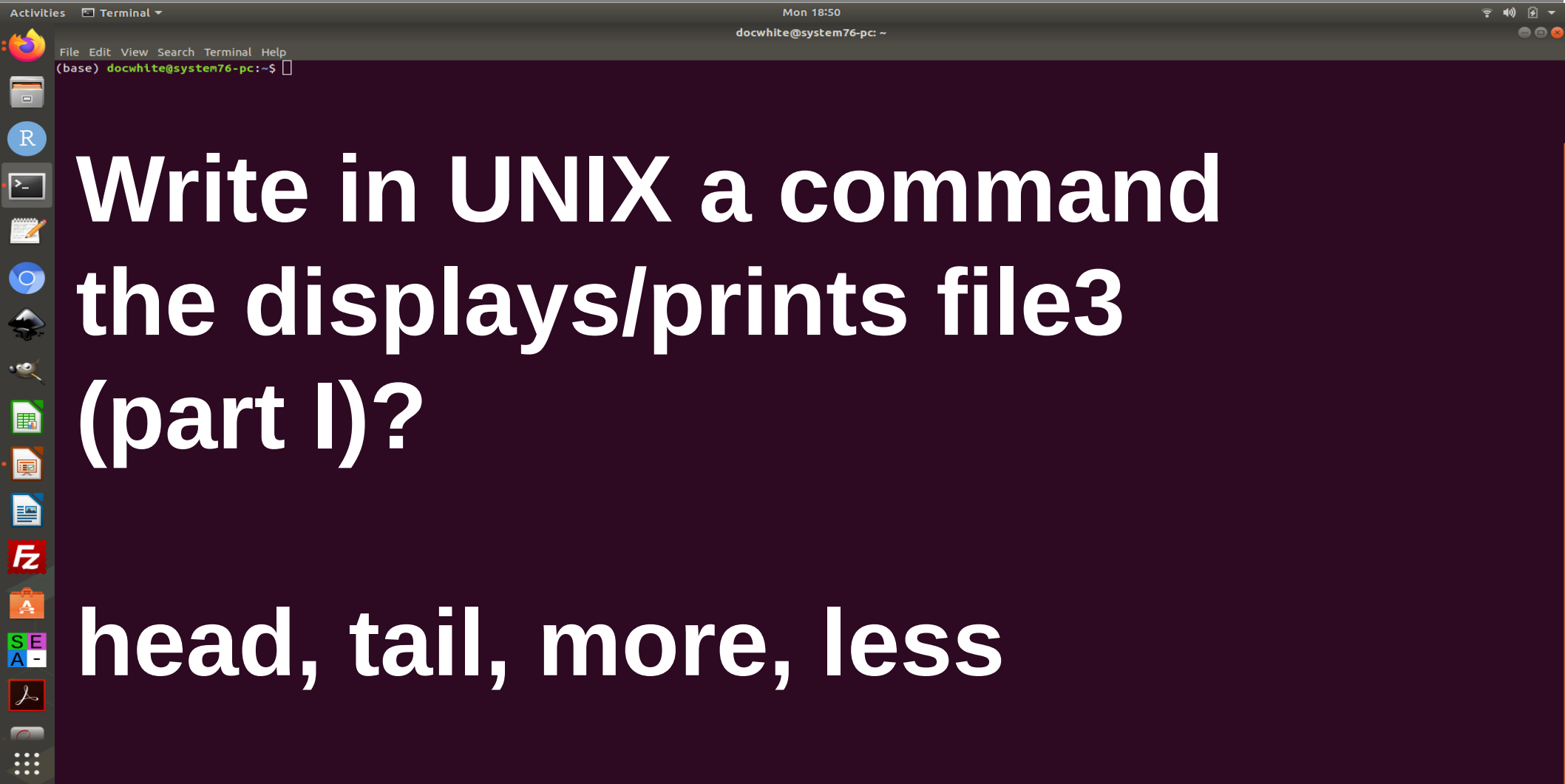


Write in UNIX a command the displays/prints file3 (part I)?

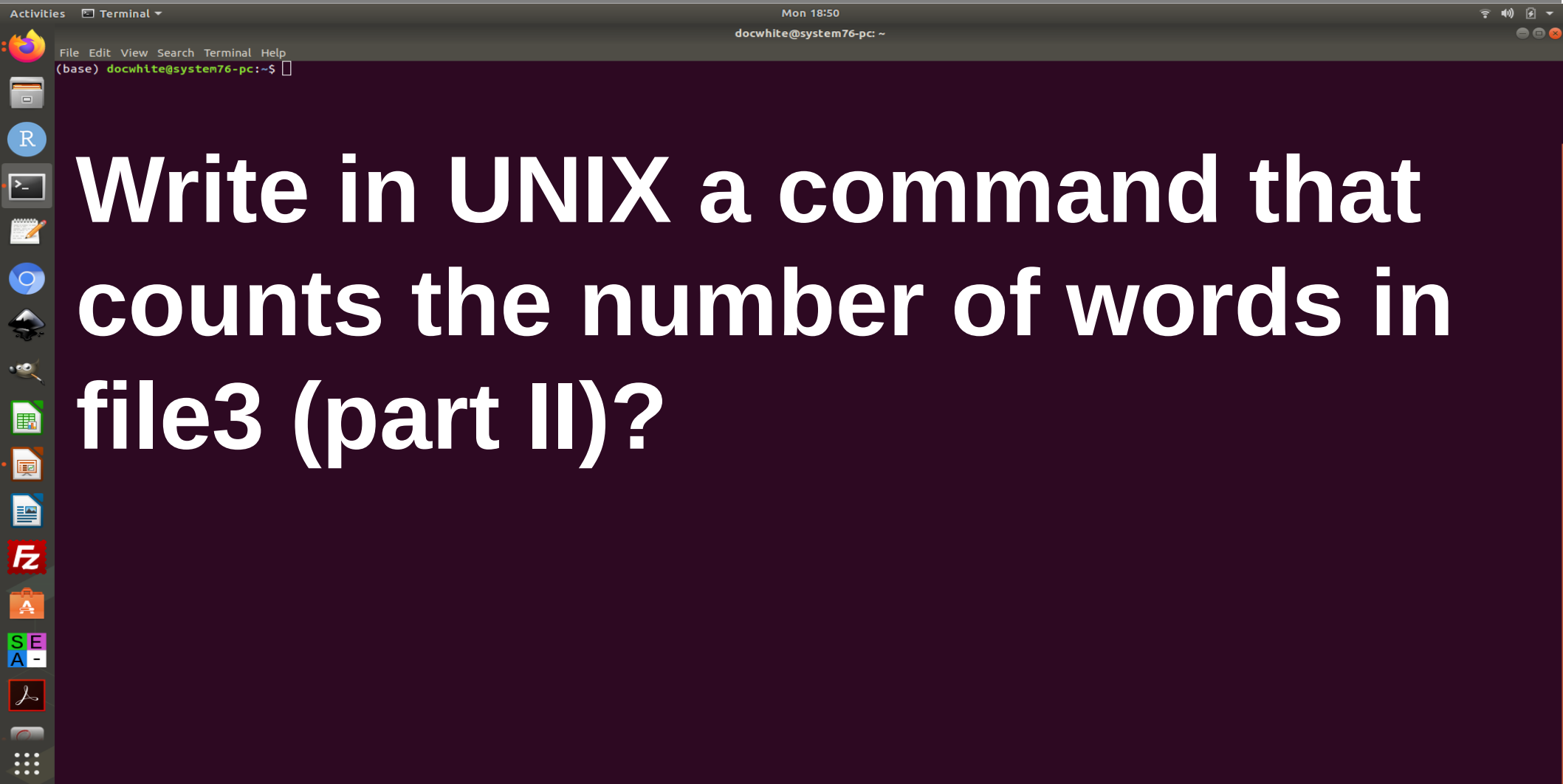
Lab assignment 1



Write in UNIX a command the displays/prints file3 (part I)?

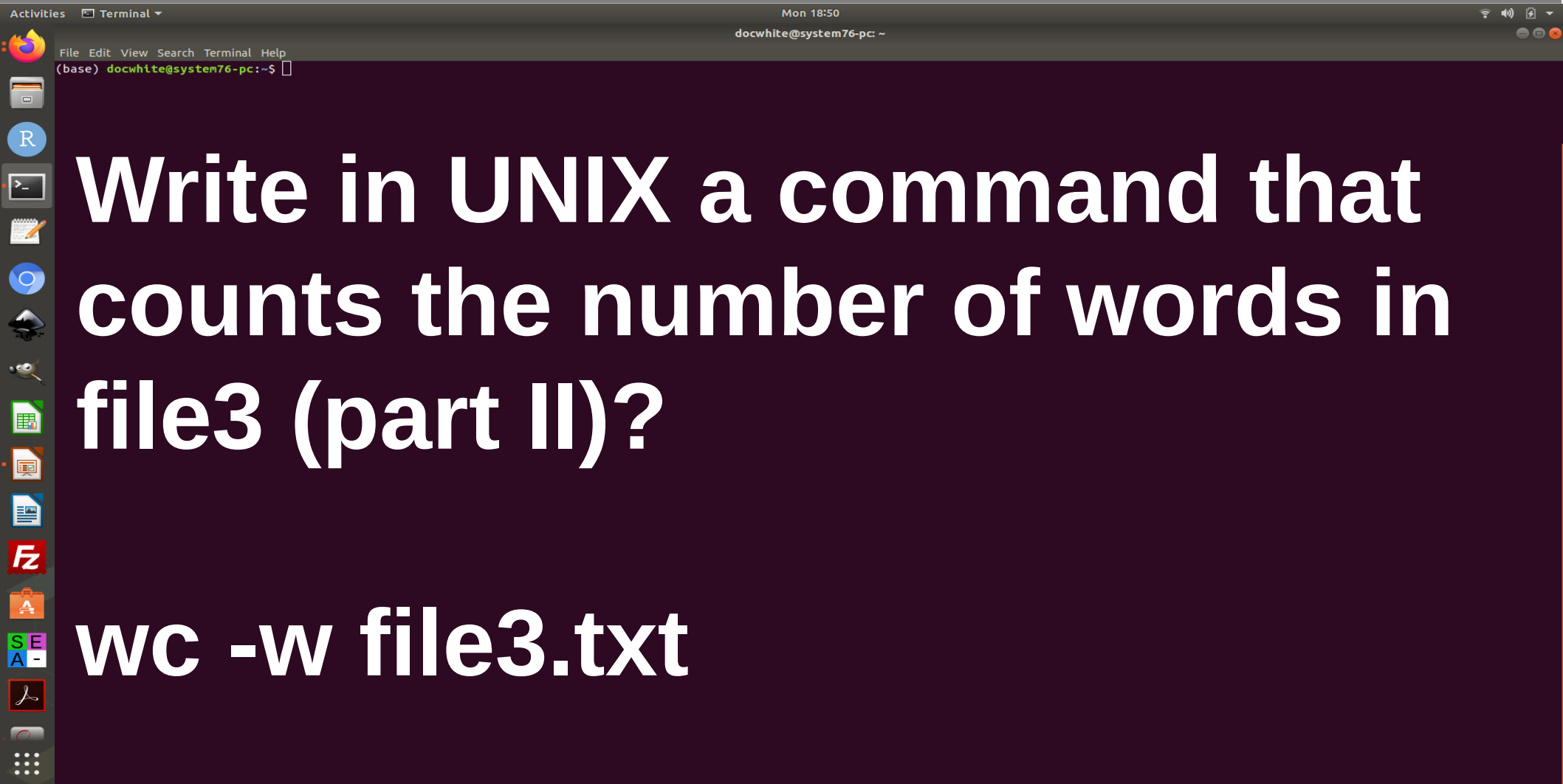
head, tail, more, less

Lab assignment 1



Write in UNIX a command that counts the number of words in file3 (part II)?

Lab assignment 1



Write in UNIX a command that counts the number of words in file3 (part II)?

wc -w file3.txt

Bonus 1

- Write a single line UNIX to count the number of “>” in file

File is on the github
https://github.com/raw-lab/BINF2111/tree/main/course-materials/example.fasta

Bonus 1

- Write a single line UNIX to count the number of “>” in file

cat example.fasta | grep “>” | wc -l

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grep “>” example.fasta | wc -l (better)

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cat example.fasta | grep “>” | wc -l

grep “>” example.fasta | wc -l (better)

grep -c “>” example.fasta **(best)**

Whats the answer?

Bonus 1

- Write a single line UNIX to count the number of “>” in file

cat example.fasta | grep “>” | wc -l

grep “>” example.fasta | wc -l (better)

grep -c “>” example.fasta **(best)**

Whats the answer?

Count the number of “T’s” in the file?

Grep vs. Python

- Linux terminal (bash) commands:

```
grep '>' one.fasta | wc
–l
Or:
grep -c '>' one.fasta
```

- Python Script:

```
#!/usr/bin/env python

import sys

count = 0
with open(sys.argv[1]) as reader:
    for line in reader:
        if line.startswith('>'):
            count += 1
print(count)
```

- Python – One Line

```
#!/usr/bin/env python
import sys
print( len( [ x for x in open(sys.argv[1]) if x.startswith('>') ] )
 )
```

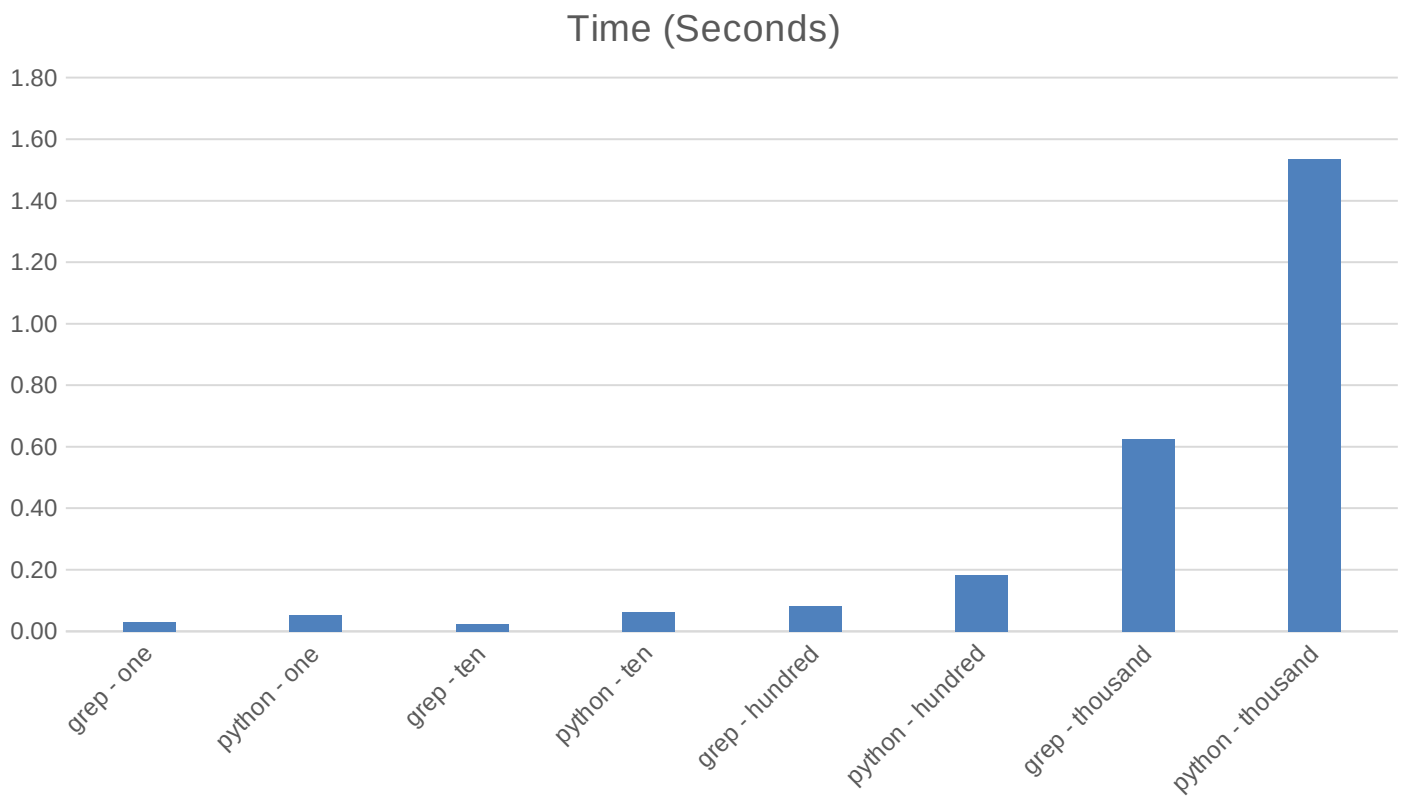
- Test script to time everything:

```
#!/usr/bin/env bash

time grep -c '>' one.fasta
time grep -c '>' ten.fasta
time grep -c '>' hundred.fasta
time grep -c '>' thousand.fasta

time ./count.py one.fasta
time ./count.py ten.fasta
time ./count.py hundred.fasta
time ./count.py thousand.fasta
```

Grep vs. Python

Filename	Count
one.fasta	1041
ten.fasta	10604
hundred.fasta	131349
thousand.fasta	1857307

Test Name	Time (s)
grep - one	0.0301667
grep - ten	0.0243333
grep - hundred	0.0813333
grep - thousand	0.6248333
python - one	0.0525000
python - ten	0.0626667
python - hundred	0.1816667
python - thousand	1.5358333



grep – master command of UNIX

Today, I will show you how to use grep -‘*the hands of the UNIX gods*’

Chris Grassa Ph.D.
2010

grep – master command of UNIX

grep =

grep – master command of UNIX

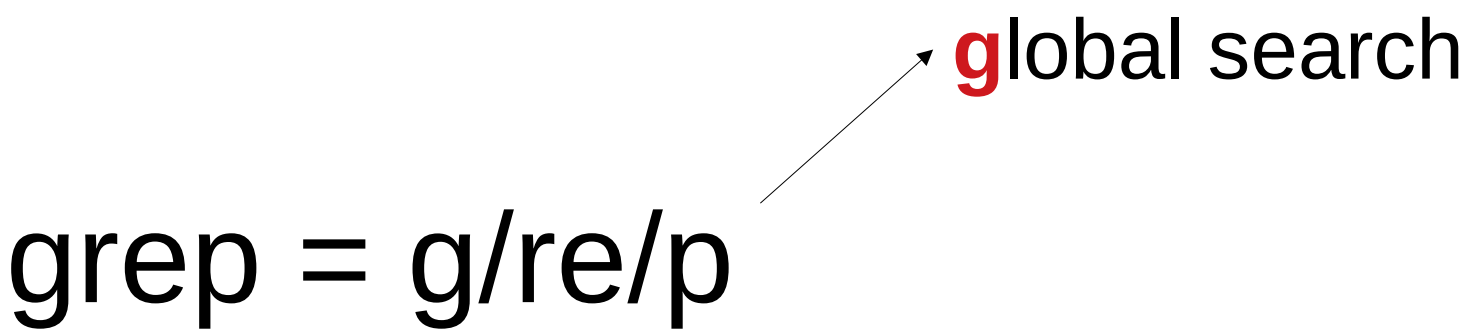
grep =

Ken Thompson
AT&T Bell Laboratories
Initial release - November 1973 (47 years ago)

grep – master command of UNIX

grep = g/re/p

grep – master command of UNIX



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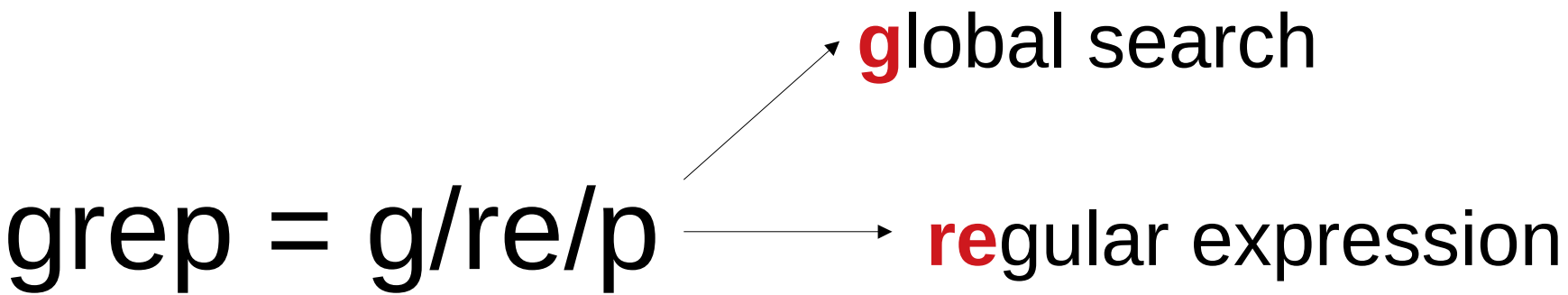

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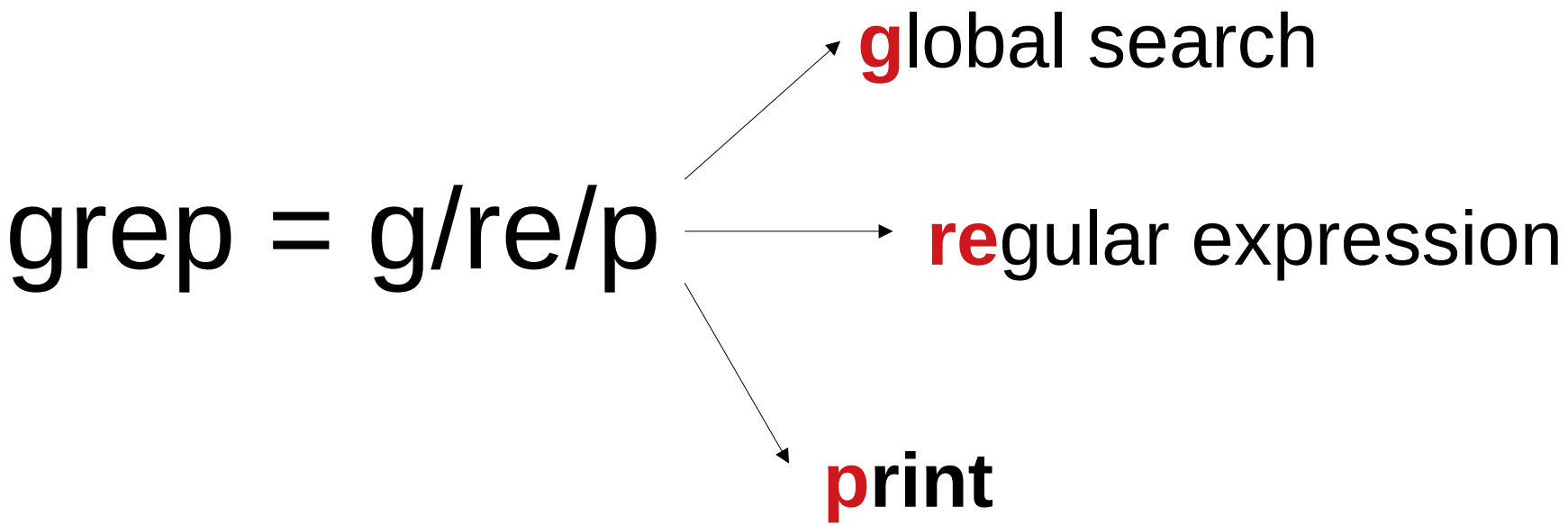

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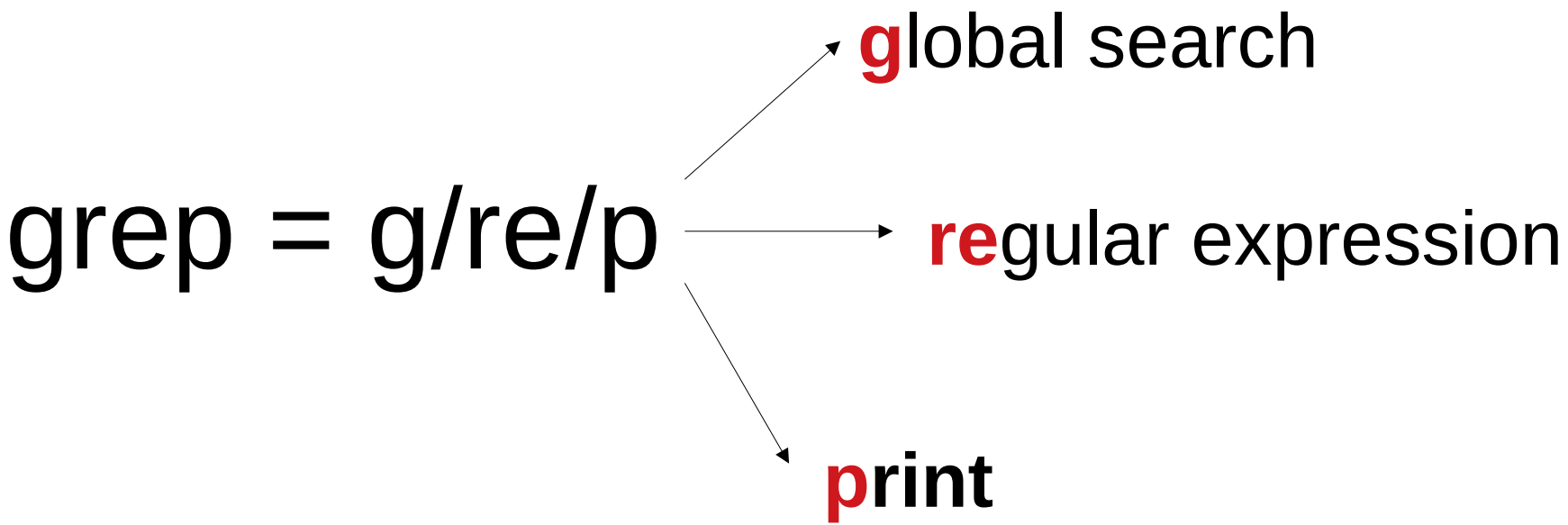

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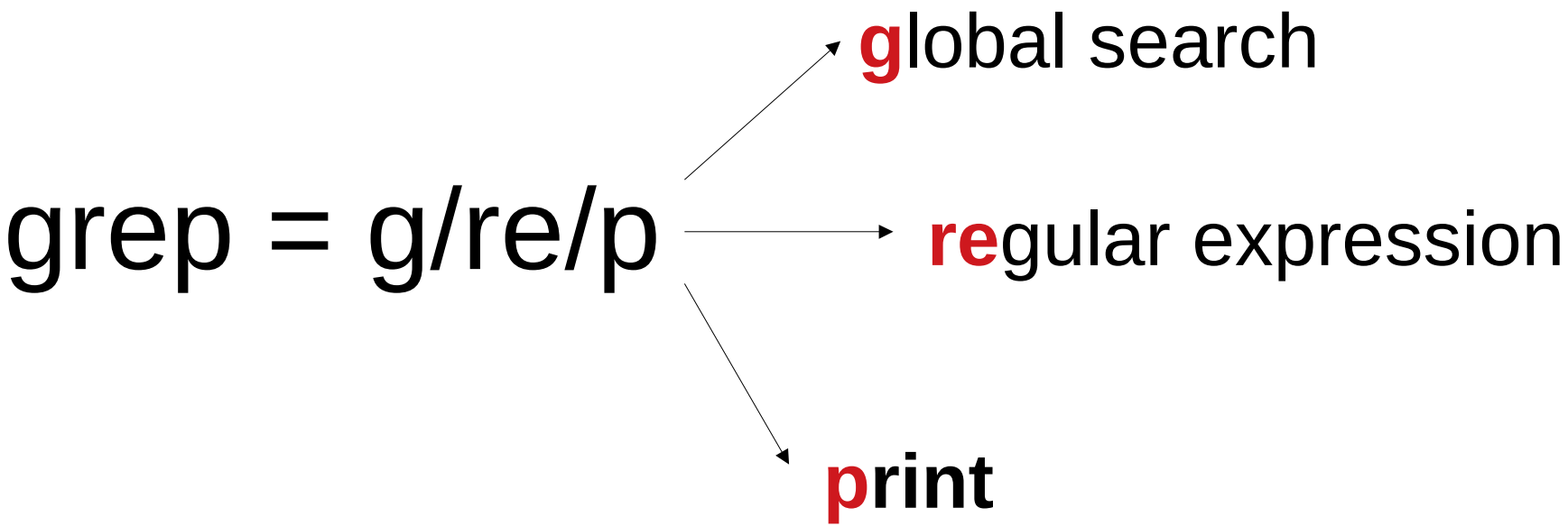
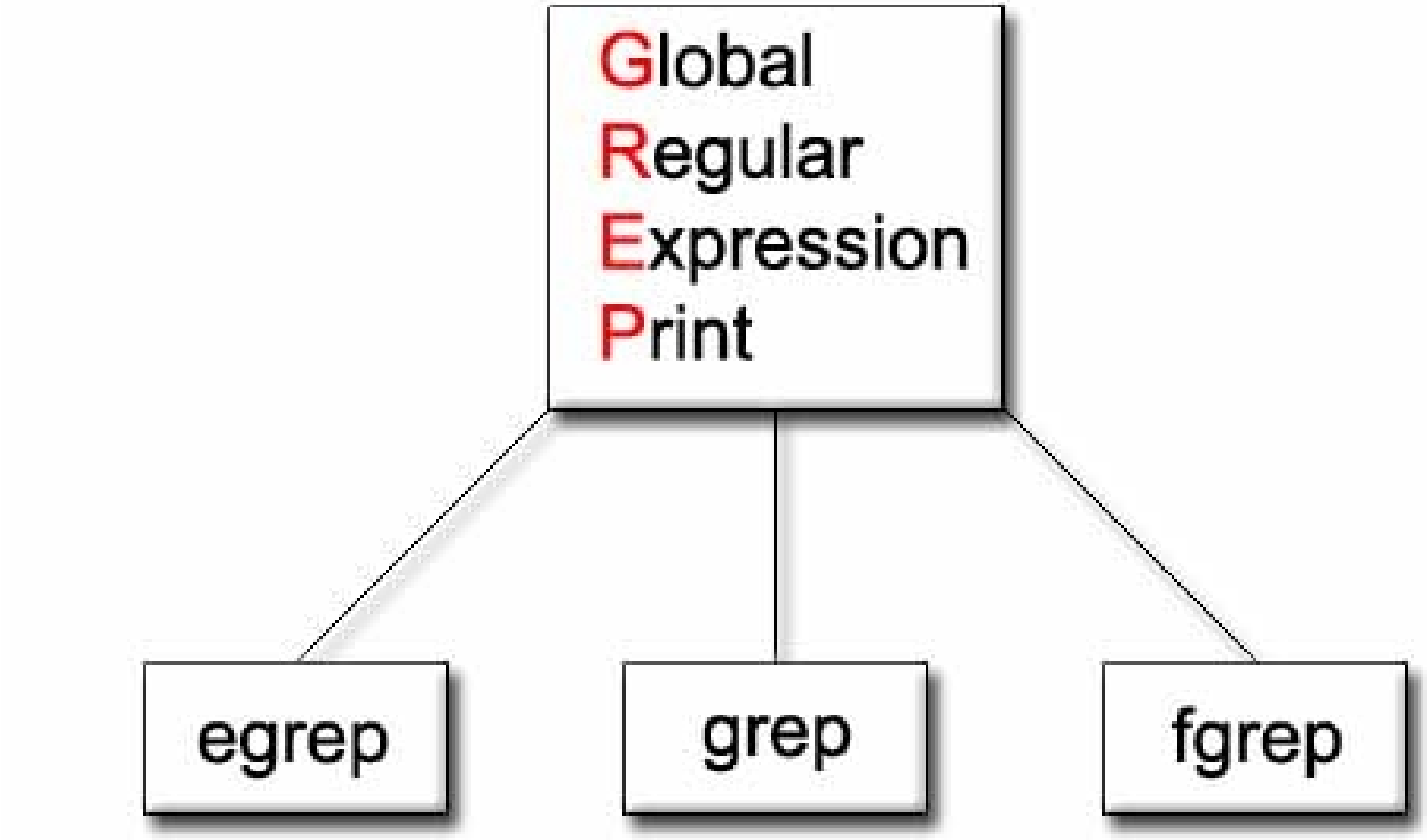


grep = **g**lobal search for **re**gular expression and **p**rint the result

grep – master command of UNIX



grep command options

-c Print only a count of the lines that contain the pattern.
-i Ignore upper/lower case distinction during comparisons.
-l Print only the names of file.txt with matching lines,separated by NEWLINE characters.
Does not repeat the names of file.txt when the pattern is found more than once.
-n Precede each line by its line number in the file (first line is 1).
-v Print all lines except those that contain the pattern.
-r It recursively search the pattern in all the file.txt in the current directory and all it’s subdirectory.
-w It searches the exact word
--color colors the matched text for easy visualization
-F interprets the pattern as a literal string
-H,-h print, don’t print the matched filename
-o only print the matching pattern
-x forces patterns to match the whole line
-E or -e provides extended functions to egrep (multiple exact matches)

grep – syntax to hands of UNIX

grep [option] pattern file

grep – syntax to hands of UNIX

grep [option] pattern file

Understanding Regular Expressions:

^ (Caret) match expression at the start of a line, as in ^A.

$ (Question) match expression at the end of a line, as in A$.

\ (Back Slash) turn off the special meaning of the next character, as in \^. To look for a Caret "^" at the start of a line, the expression is ^\^.

[ ] (Brackets) match any one of the enclosed characters, as in [aeiou]. Use Hyphen "-" for a range, as in [0-9].

[^] match any one character except those enclosed in [ ], as in [^0-9].

. (Period) match a single character of any value, except end of line. So b.b will match "bob", "bib", "b-b", etc.

* (Asterisk) match zero or more of the preceding character or expression. An asterisk matches zero or more of what precedes it. Thus [A-Z]* matches any number of upper-case letters, including none, while [A-Z][A-Z]* matches one or more upper-case letters.

grep – syntax to hands of UNIX

grep [option] pattern file

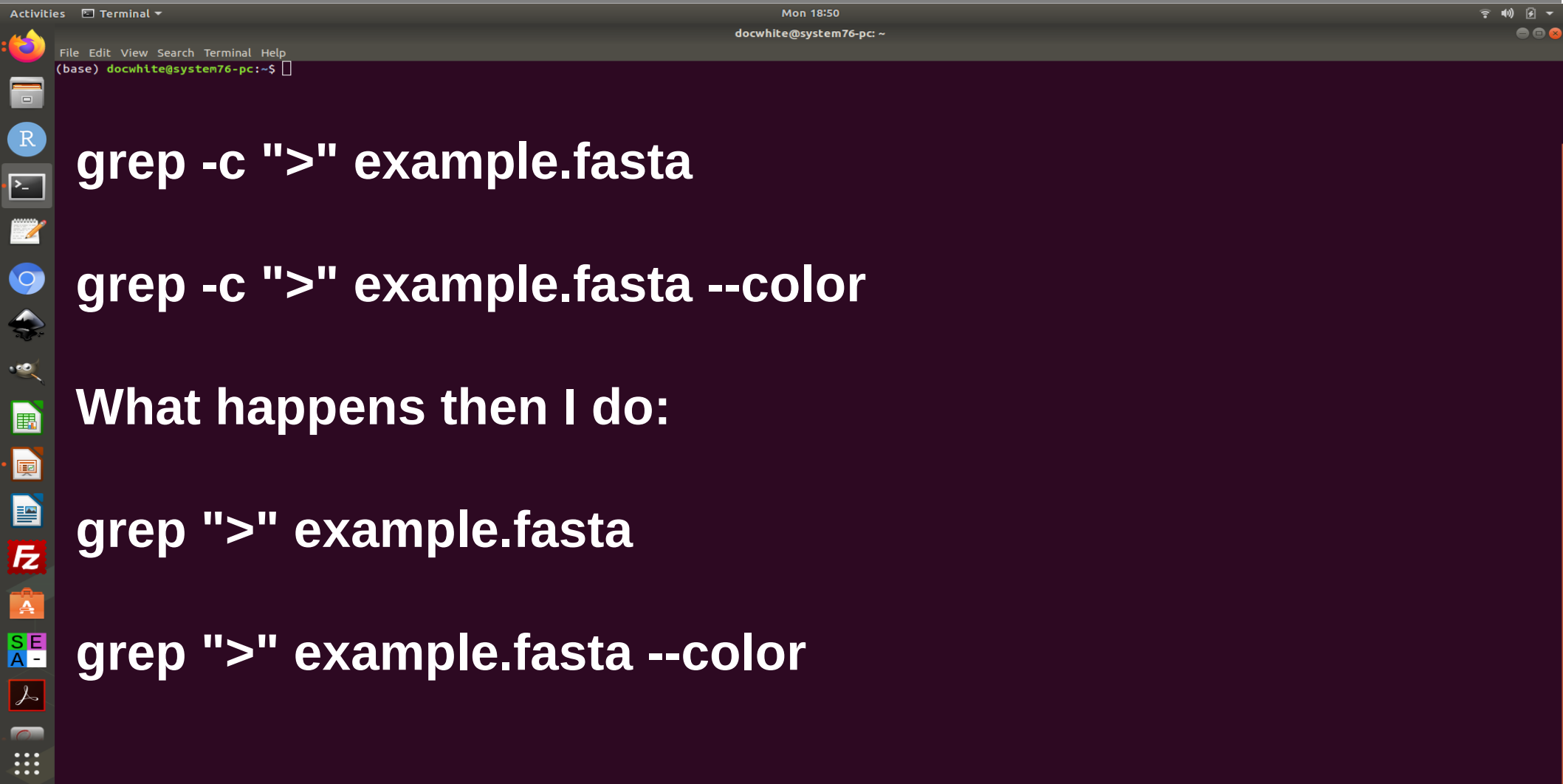
Kite rats kite cash REd kite
kite rats kite red caSh rats
kite rats kite caSh red green

grep ‘^kite’ file.txt | wc -l **(front of the line)**

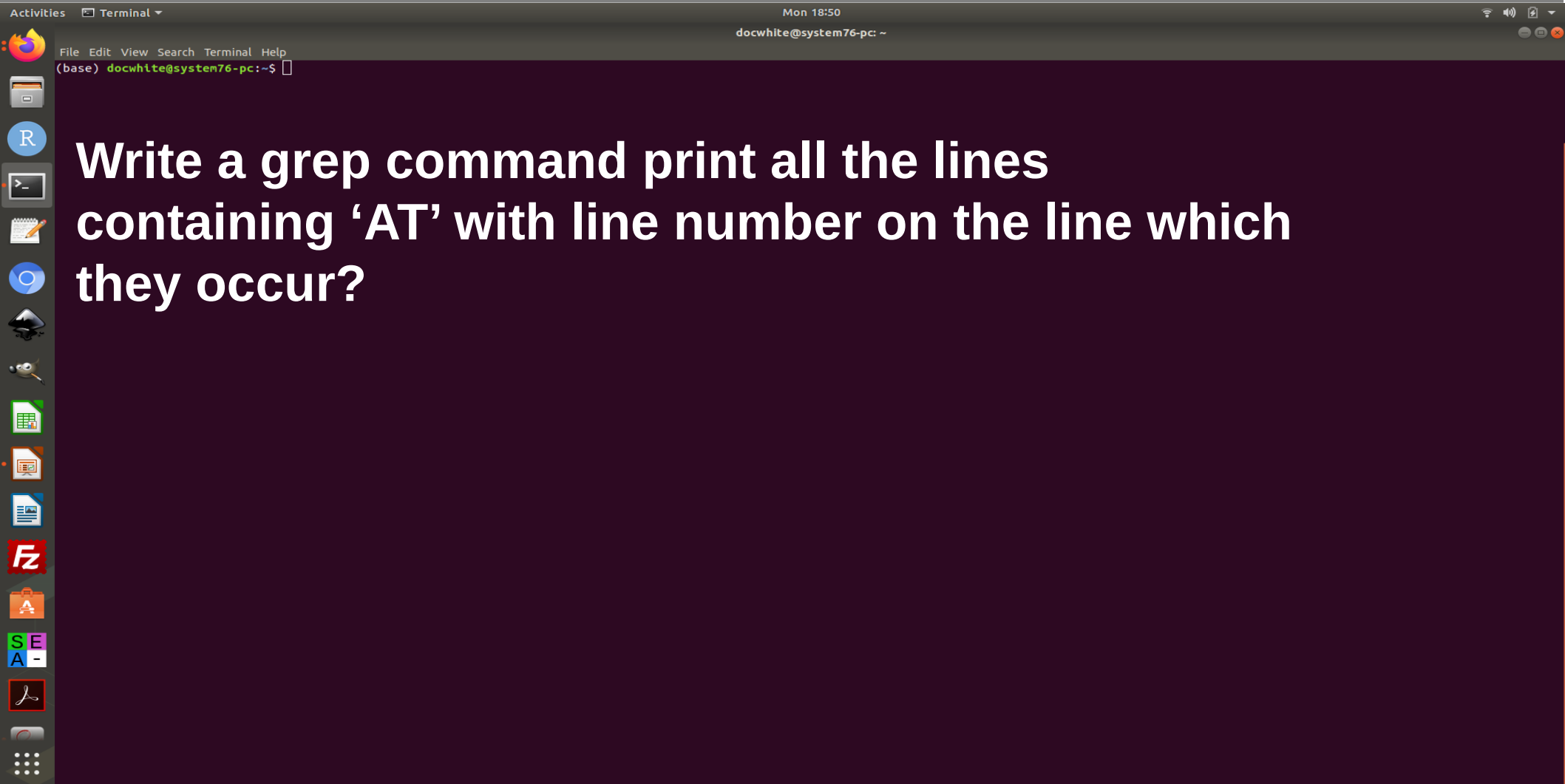
grep ‘kite$’ file.txt | wc -l **(end of the line)**

grep ‘[Kk]ite’ file.txt | wc -l **(match all)**

grep examples

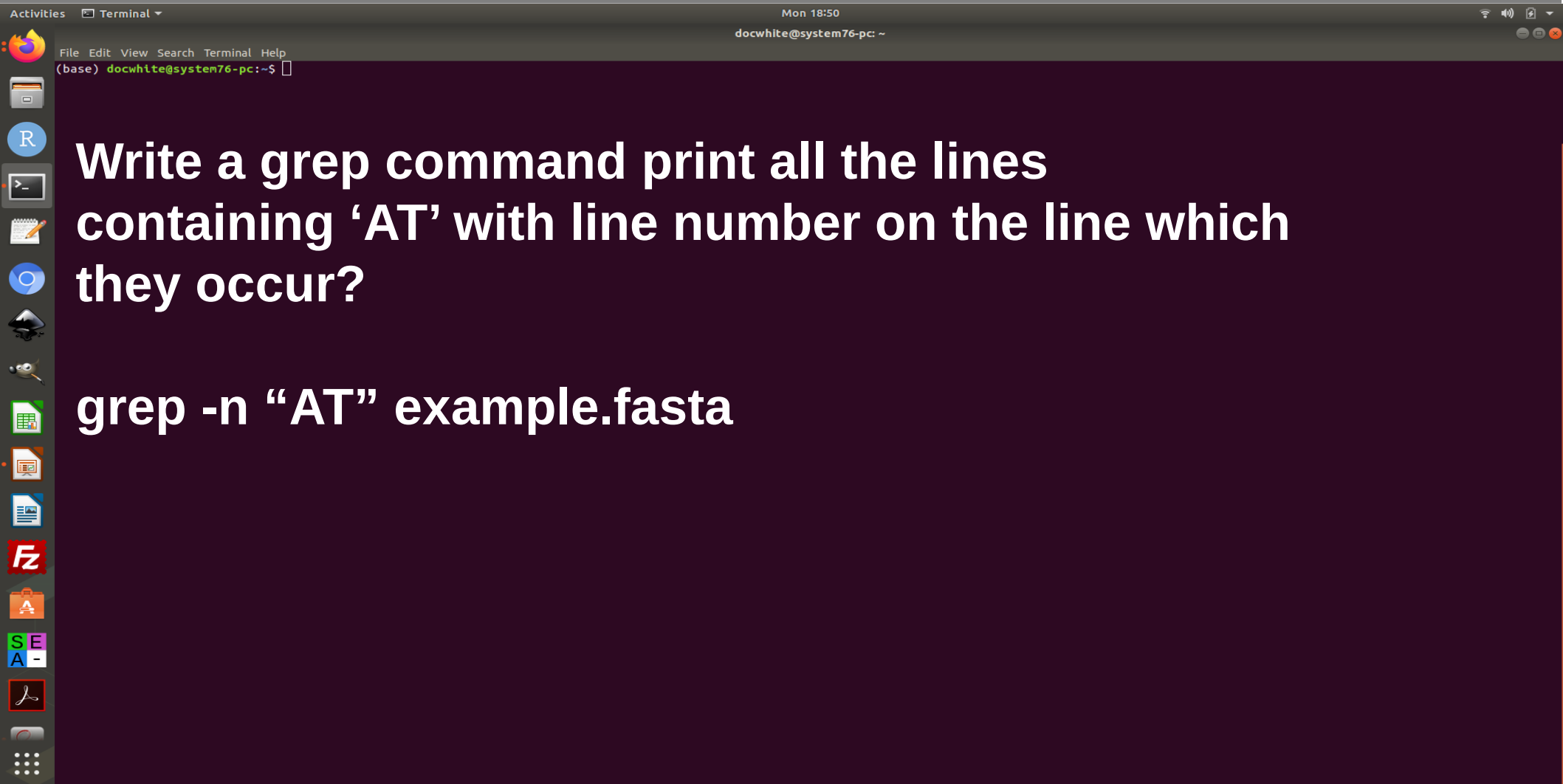


grep examples



Write a grep command print all the lines containing ‘AT’ with line number on the line which they occur?

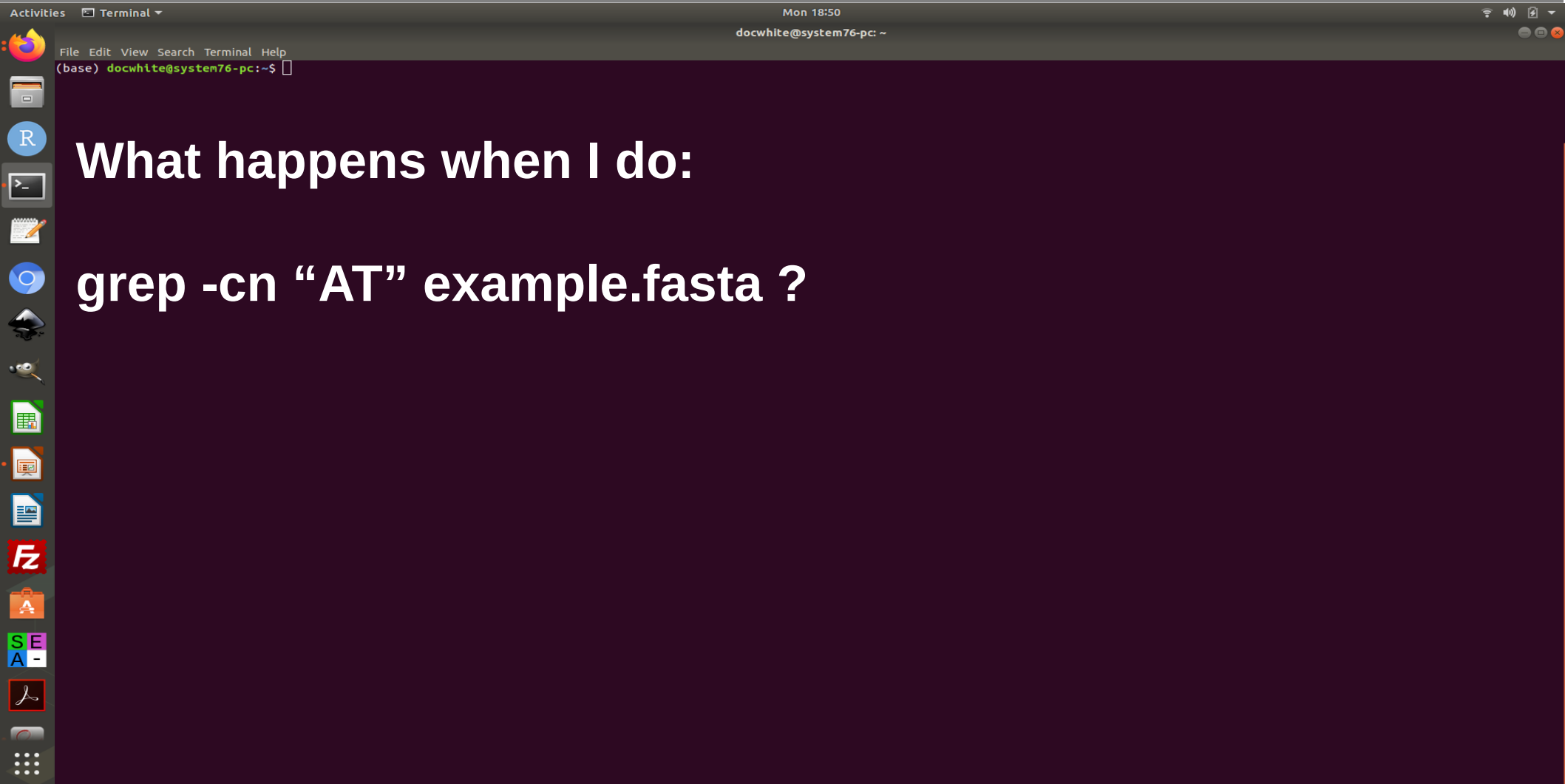
grep examples



Write a grep command print all the lines containing ‘AT’ with line number on the line which they occur?

grep -n “AT” example.fasta

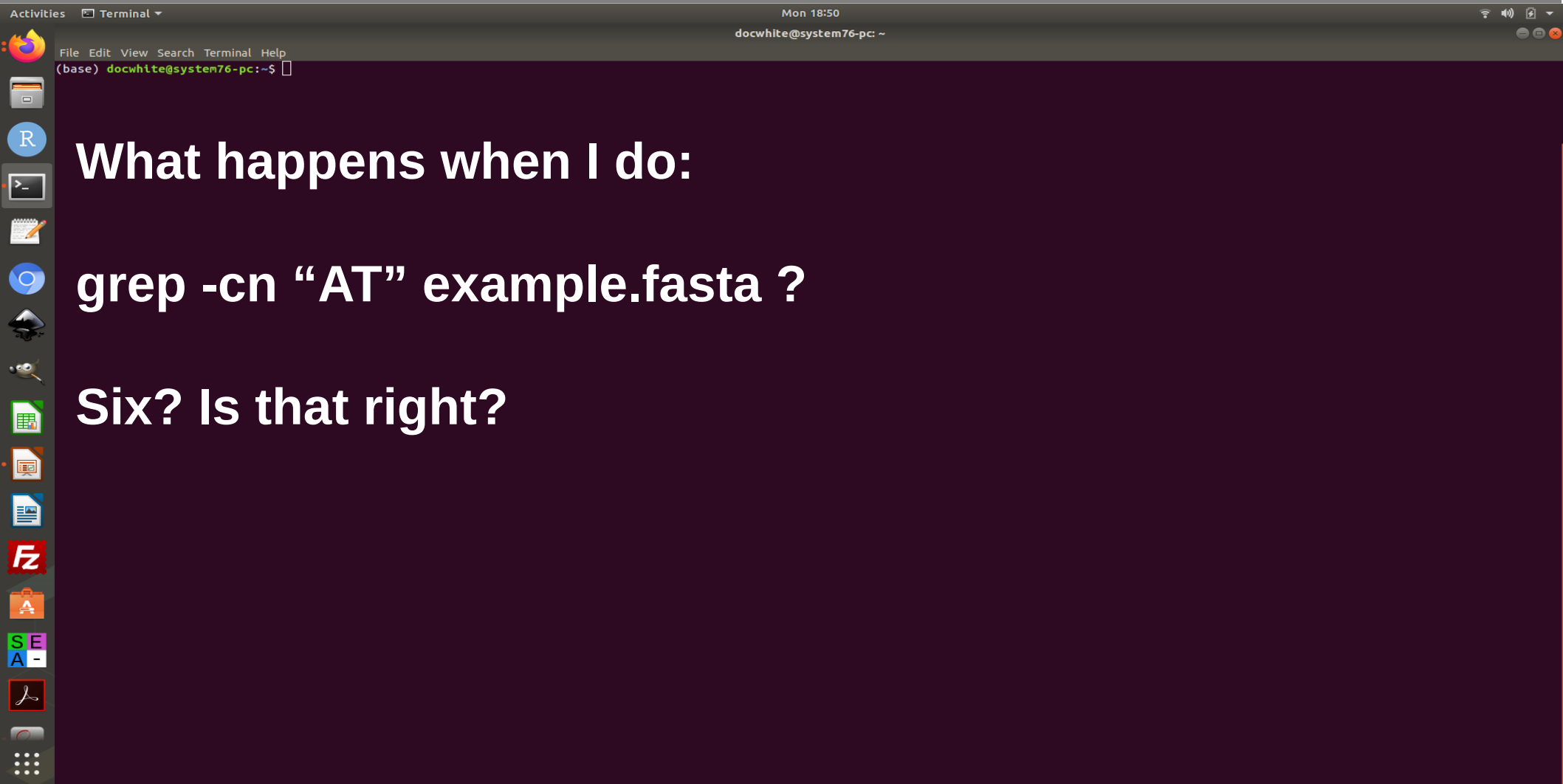
grep examples



What happens when I do:

grep -cn “AT” example.fasta ?

grep examples

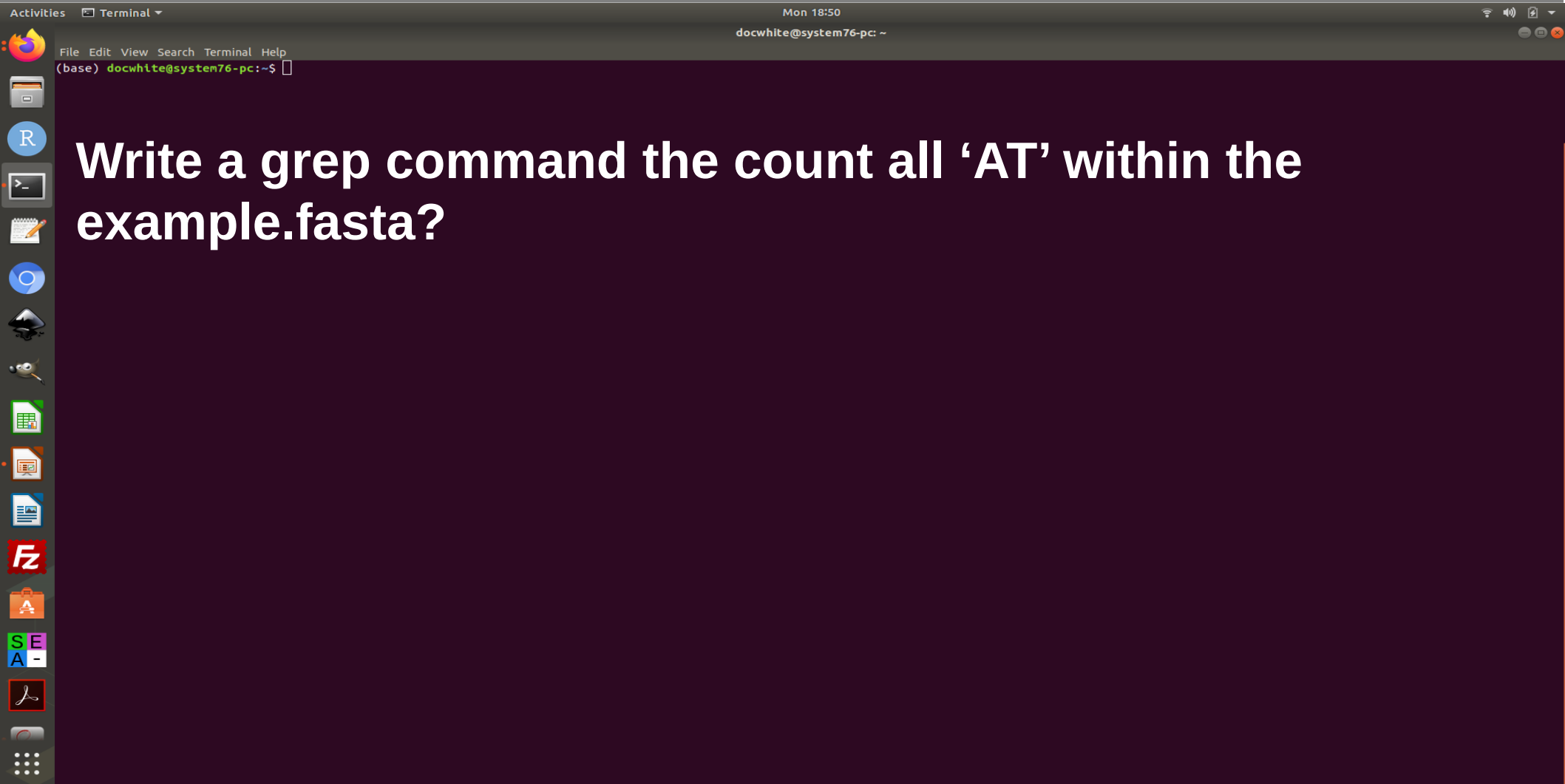


What happens when I do:

grep -cn “AT” example.fasta ?

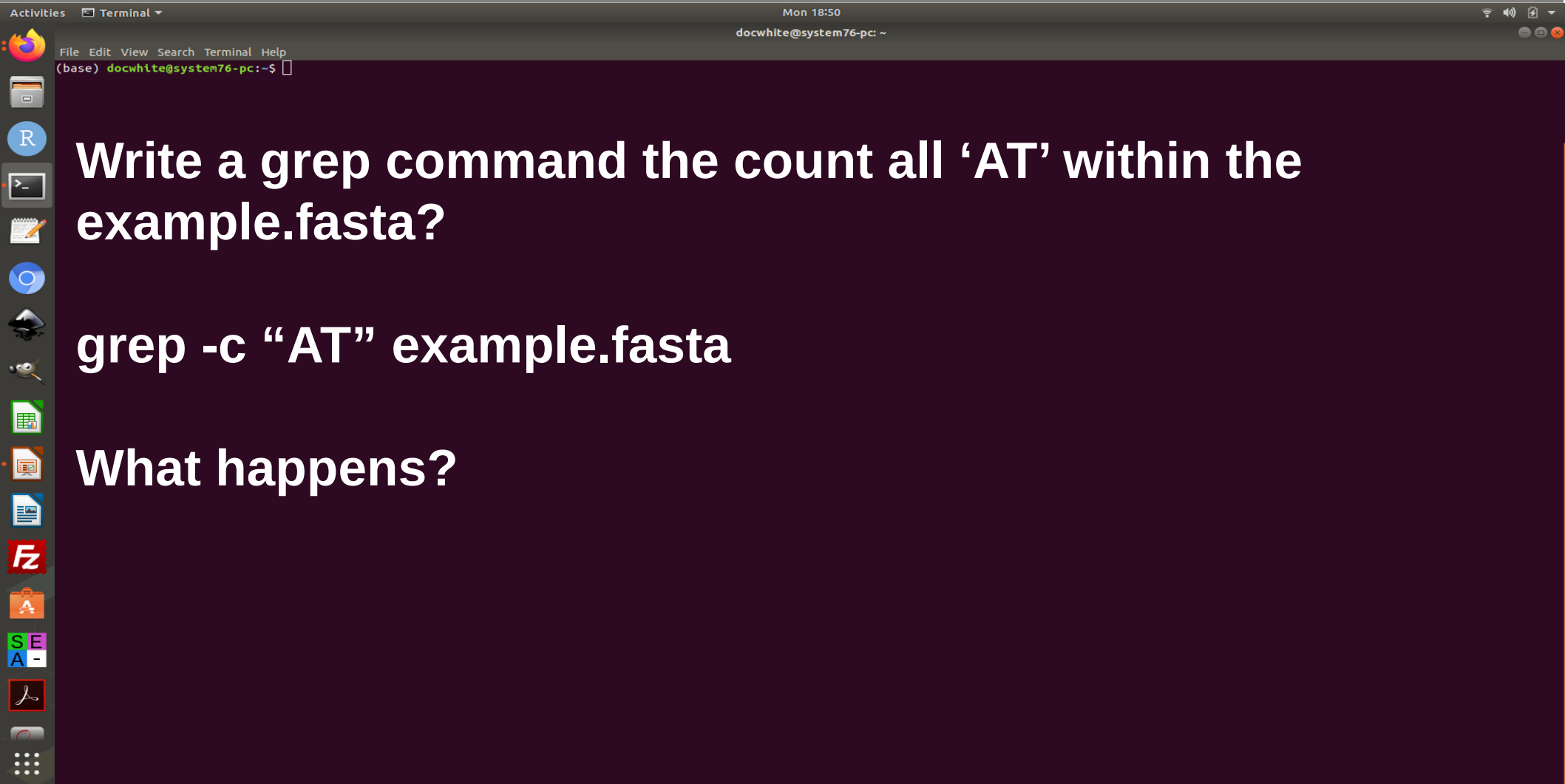
Six? Is that right?

grep examples



Write a grep command the count all ‘AT’ within the example.fasta?

grep examples

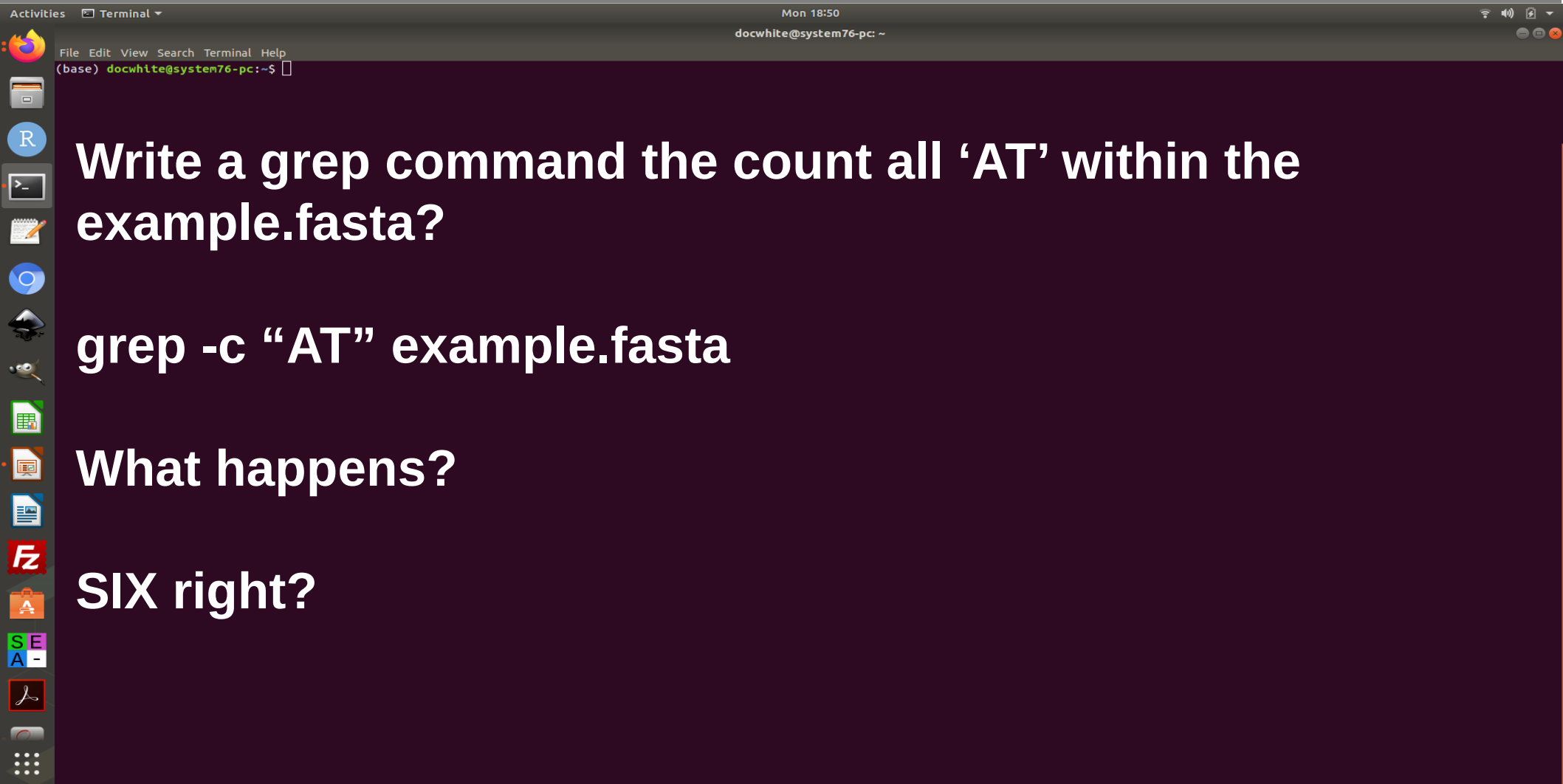


Write a grep command the count all ‘AT’ within the example.fasta?

grep -c “AT” example.fasta

What happens?

grep examples



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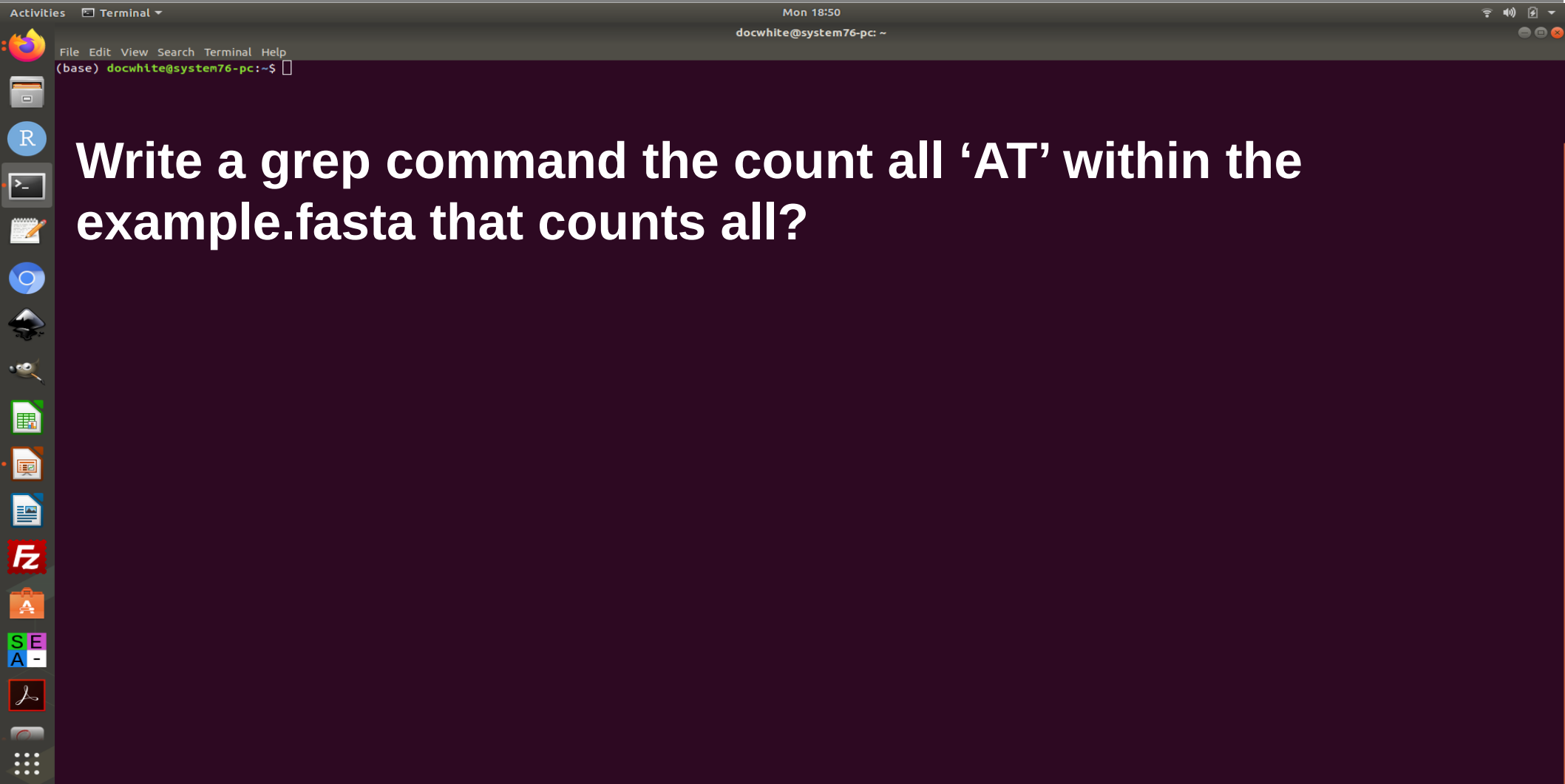
grep -c “AT” example.fasta

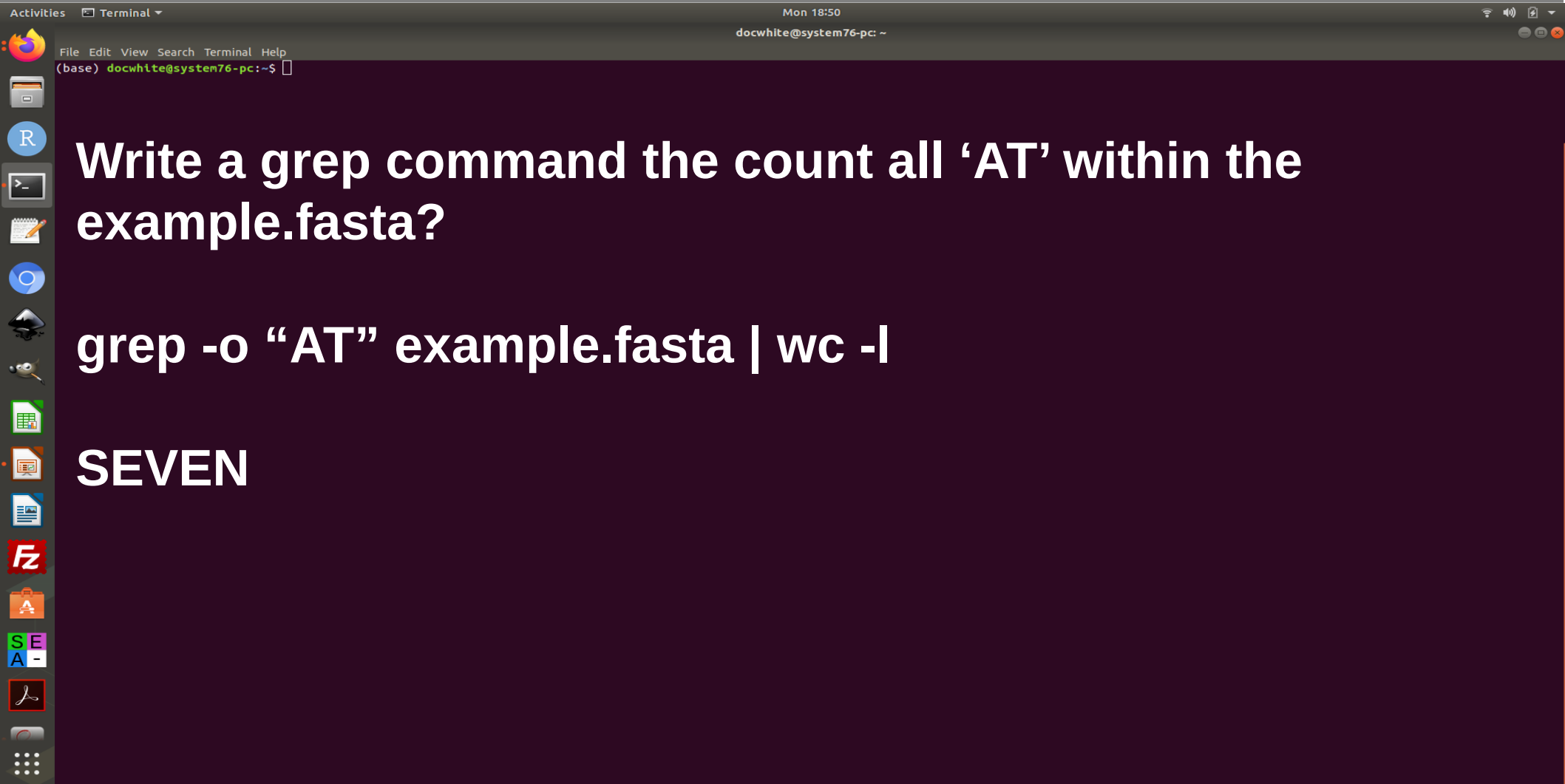
What happens?

SIX right?

grep examples



grep examples



Write a grep command the count all ‘AT’ within the example.fasta?

grep -o “AT” example.fasta | wc -l

SEVEN

Bonus 2

- Count both the number of AT and GC in one grep command and in another command print the line number which they appear?

Quiz 3

- On canvas now

Bonus 2

- Count both the number of AT and GC in one grep command and in another command print the line number which they appear?

Command 1
grep -Eo "GC|AT" example.fasta | wc -l

Command 2
grep -nEo "GC|AT" example.fasta --color >>file.txt