BINF2111 – Introduction to Bioinformatics Computing

BASH 101 – while wild loops of function

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RAW Lab

Lecture 11 – Tuesday Sep 26th, 2023

Learning Objectives

- Review quiz/bonus

- Review lab 4

- Review bash for loops

- Bash while loops

- Bash functions

- Quiz 11

Bonus 9

- Write a bash script that prints the working directory, counts all the sequences within a fasta files within the working directory, and prints the first five lines of the file into std_out.txt?

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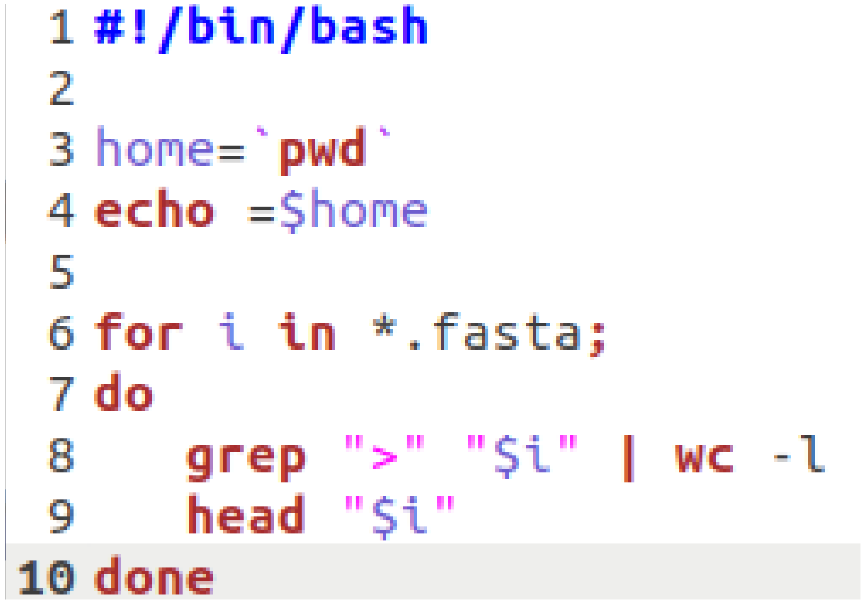

```
#!/bin/bash

home=`pwd`
echo =$home

for i in *.fasta;
do
    grep ">" "$i" | wc -l
    head "$i"
done
```

Quiz 10

My input is:

```
more file.tsv

bill rod david
Xi abdul larry

perl -pi -e 's/\t/,/' file.tsv

more file.tsv
```

My output is:

```
bill,rod,david
Xi,abdul,larry
bill,steve,dave
```

```
perl -pi -e 's/\t/,/' file.tsv

more file.tsv
bill,steve	dave
bill,steve	dave
bill,steve	dave
bill,steve	dave
```

How do I convert all the way?

Quiz 10

My input is:

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more file.tsv

bill rod david
Xi abdul larry

perl -pi -e 's/\t/,/' file.tsv

more file.tsv
```

My output is:

```
bill,rod,david
Xi,abdul,larry
bill,steve,dave
```

```
perl -pi -e 's/\t/,/g' file.tsv

more file.tsv
bill,steve,dave
bill,steve,dave
bill,steve,dave
bill,steve,dave
```

Perl like Grep, Sed and Awk functions

# check perl --help
# -e means single line expression (a raw regular expression is in fact
an executable expression in perl)
# -n means execute on each line
# -p means execute on each line and print the result
# -F... means split the source text using the following pattern ...
# -a is part of -F, and splits the source text into @F[...]
# -l means print everything with a separator, by default newlines

Perl like Grep, Sed and Awk functions

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```

Grep like:

```
perl -ne 'print if /chr1_geneA/' example2.fasta | more
perl -ne 'print if /chr1_geneB/' example2.fasta | more
```

Perl like Grep, Sed and Awk functions

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sed like:

perl -pe 's/chr1/chr2/' example2.fasta | more (without replacement)
perl -i -pe 's/chr1/chr2/' example2.fasta | more (with replacement)

Perl like Grep, Sed and Awk functions

```
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# -l means print everything with a separator, by default newlines
```

awk like:

```
cat /etc/passwd | awk -F: '{ print $1 }'
cat /etc/passwd | perl -F: -lane 'print @F[0]'
```

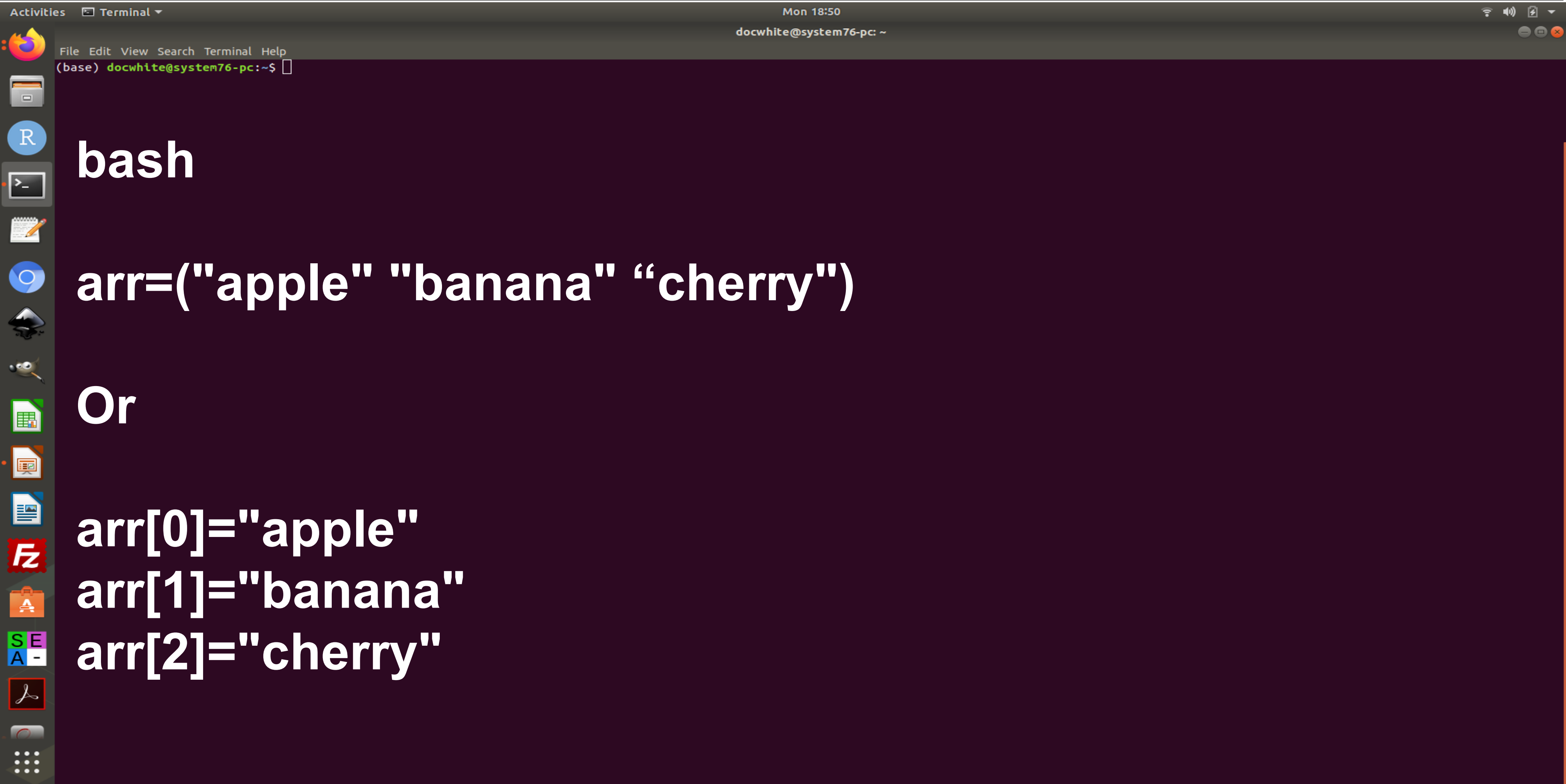
Array Variables in Bash

An array is a variable containing multiple values. Any variable may be used as an array.

There is no maximum limit to the size of an array, nor any requirement that member variables be indexed or assigned contiguously.

Arrays are zero-based: the first element is indexed with the number 0.

BASH arrays



```
(base) docwhite@system76-pc:~$
```

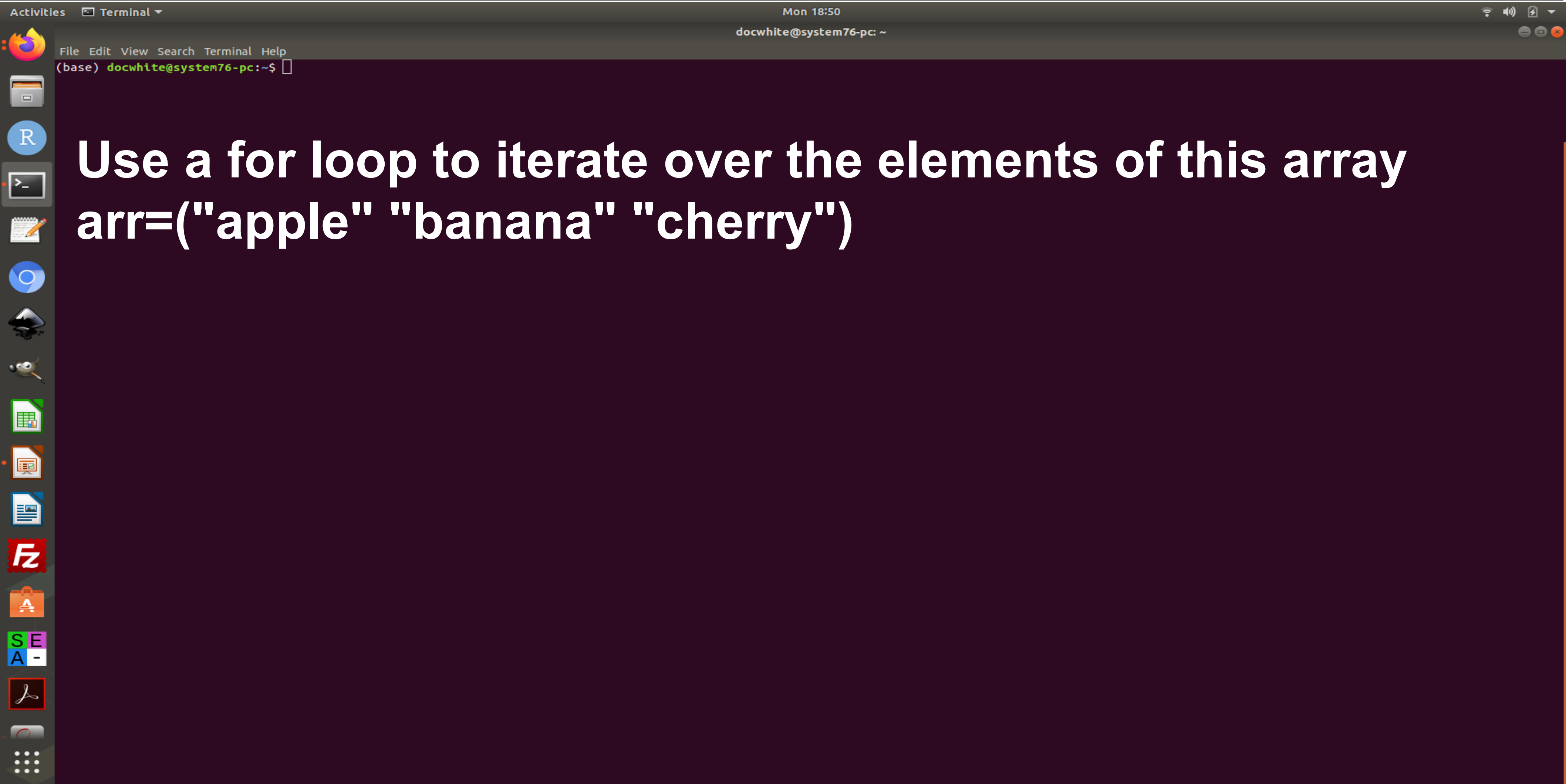
```
bash

arr=("apple" "banana" “cherry")

Or

arr[0]="apple"
arr[1]="banana"
arr[2]="cherry"
```

BASH for loop in arrays

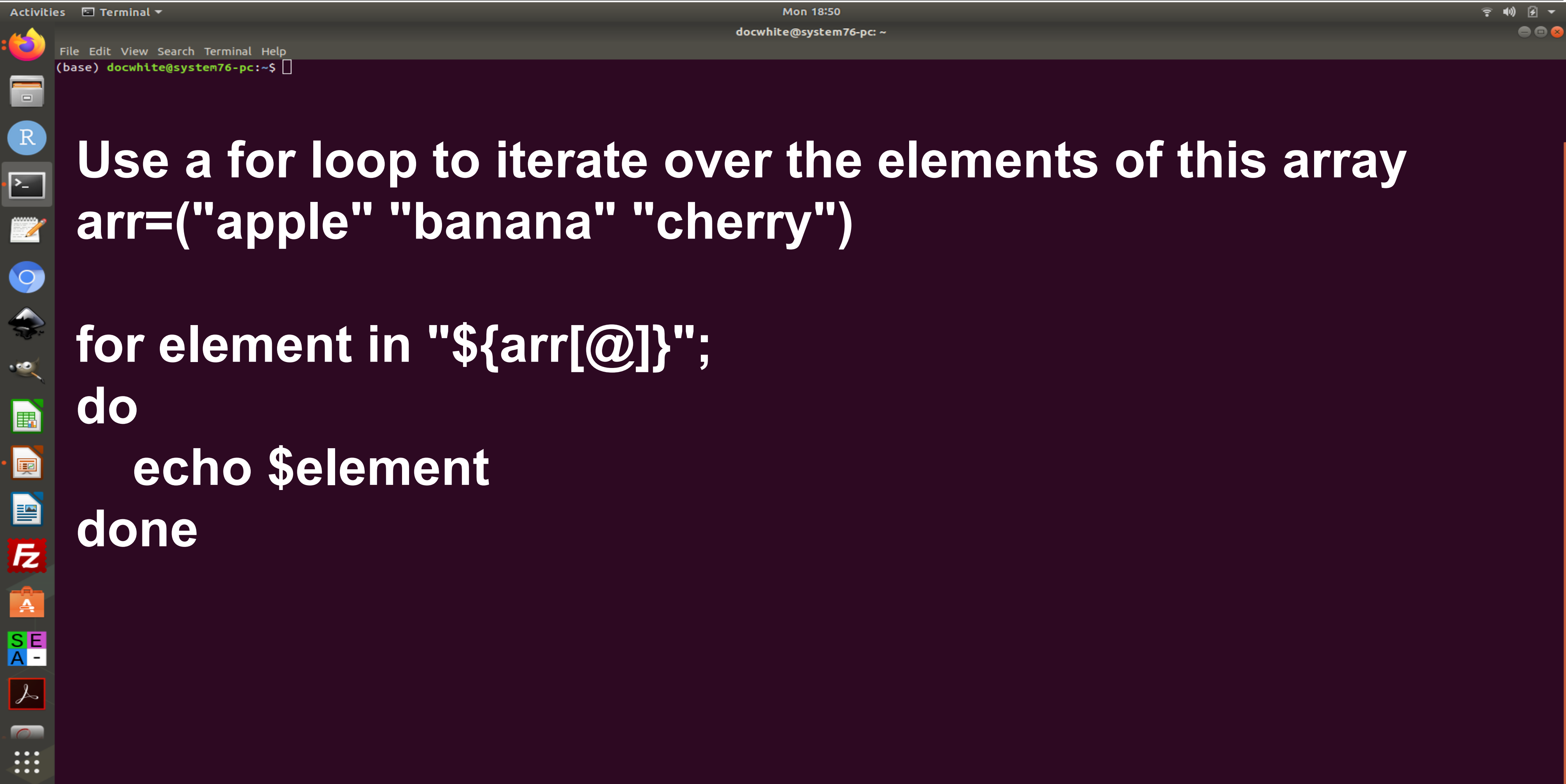


```
(base) docwhite@system76-pc:~$
```

Use a for loop to iterate over the elements of this array

arr=("apple" "banana" "cherry")

BASH for loop in arrays



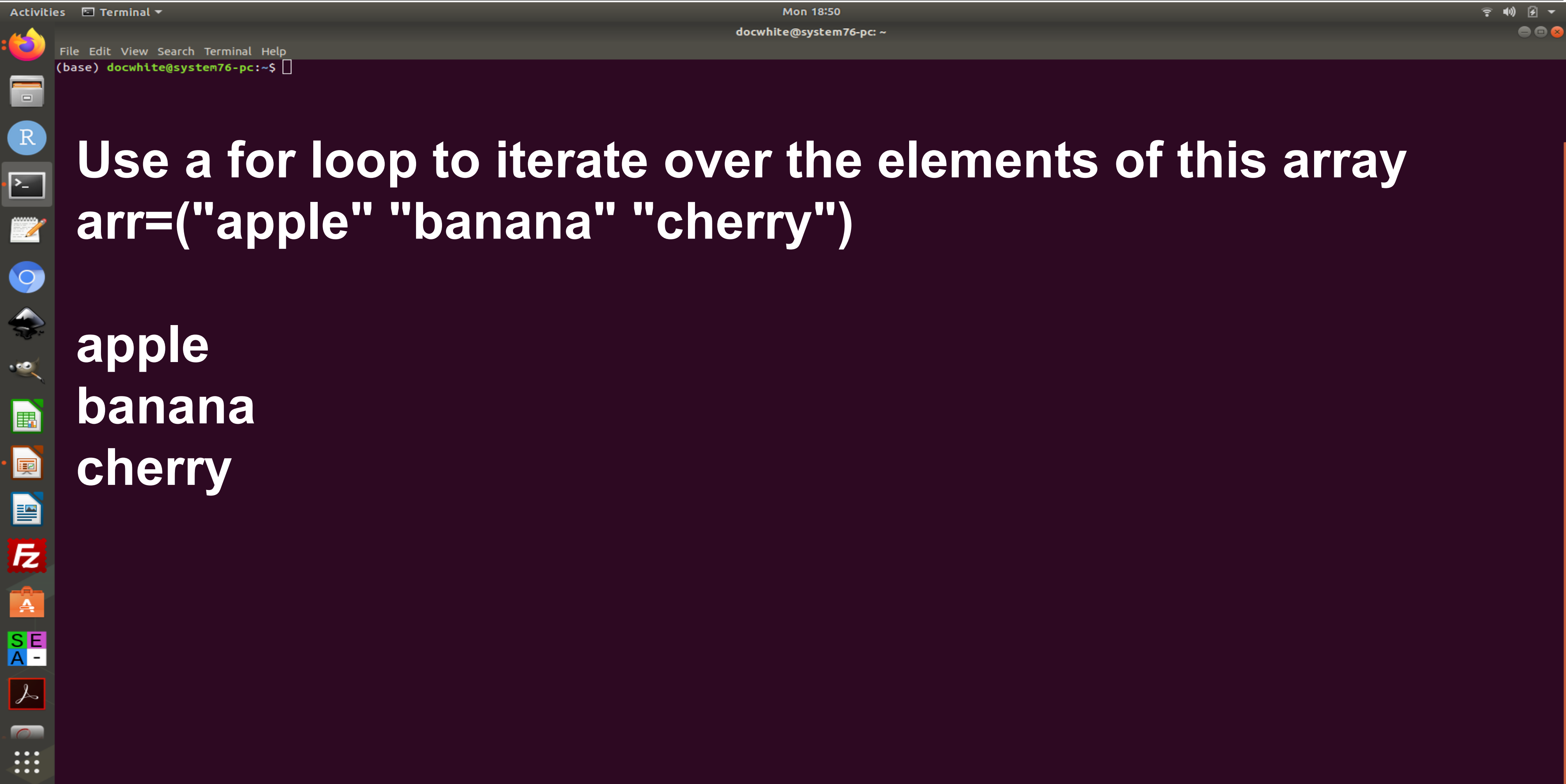
```
(base) docwhite@system76-pc:~$
```

Use a for loop to iterate over the elements of this array

```
arr=("apple" "banana" "cherry")

for element in "${arr[@]}";
do
    echo $element
done
```

BASH for loop in arrays



```
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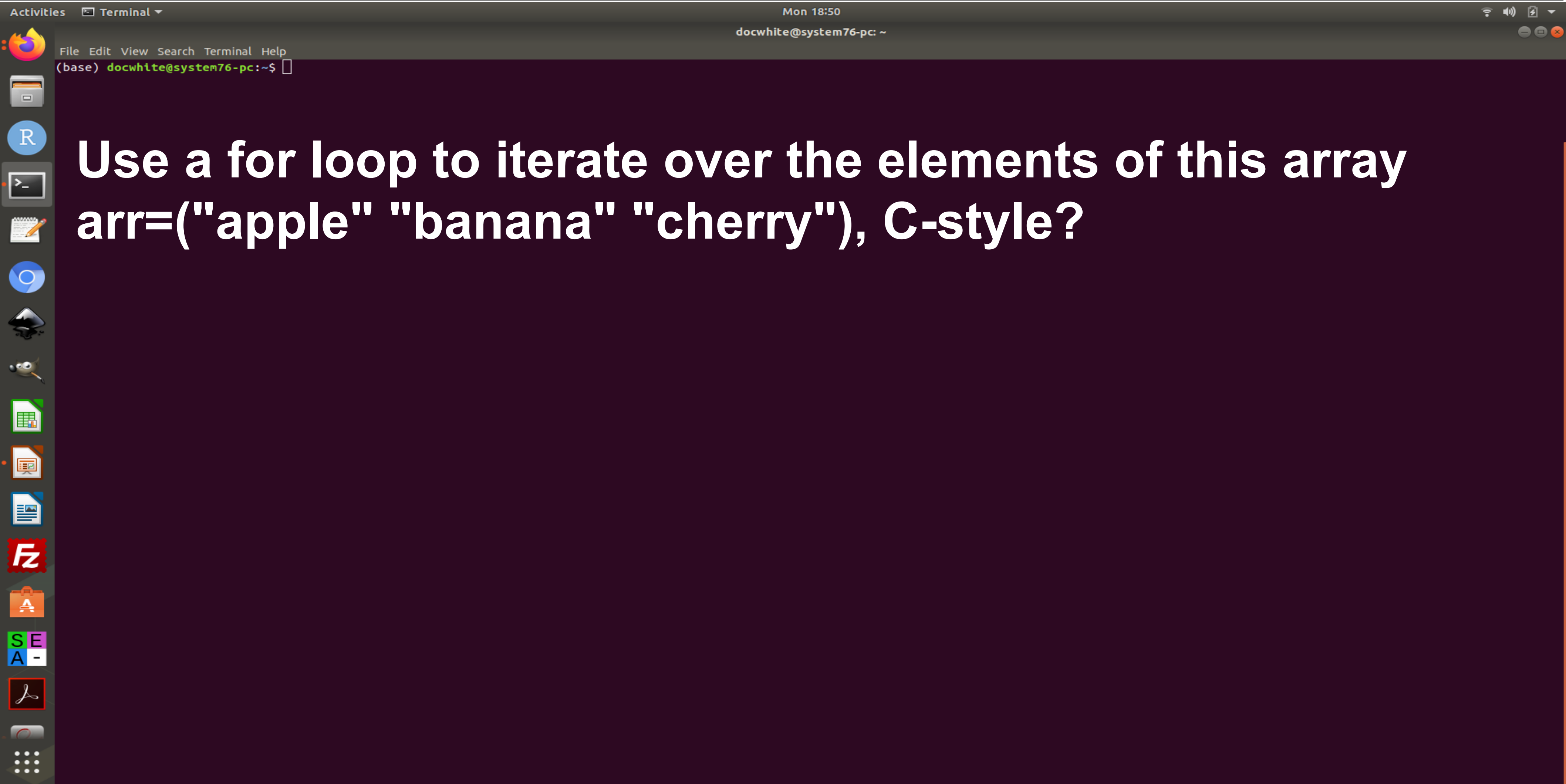
```

Use a for loop to iterate over the elements of this array
arr=("apple" "banana" "cherry")

```
apple
banana
cherry
```

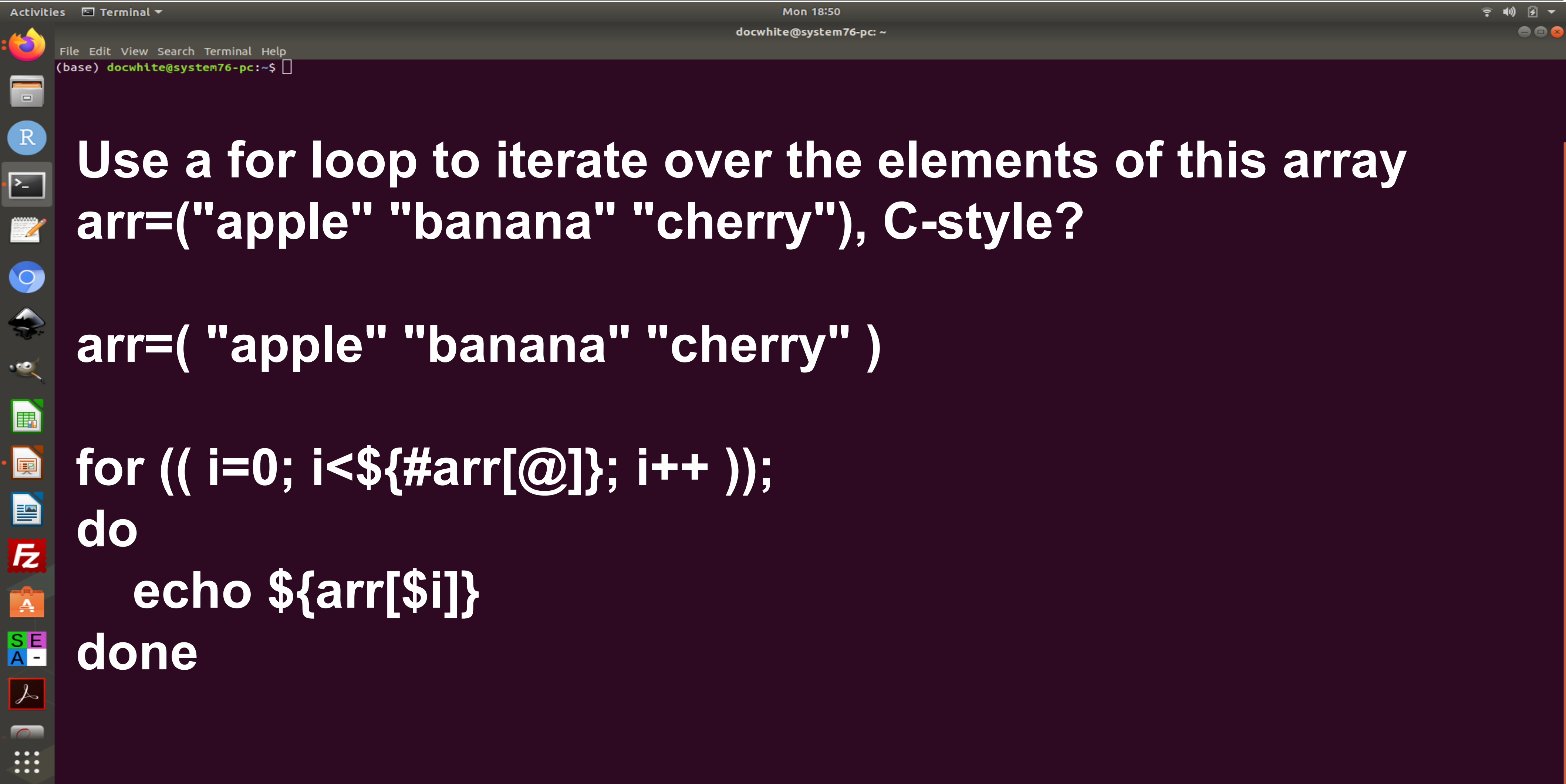
BASH for loop in arrays



```
(base) docwhite@system76-pc:~$ 
```

Use a for loop to iterate over the elements of this array arr=("apple" "banana" "cherry"), C-style?

BASH for loop in arrays



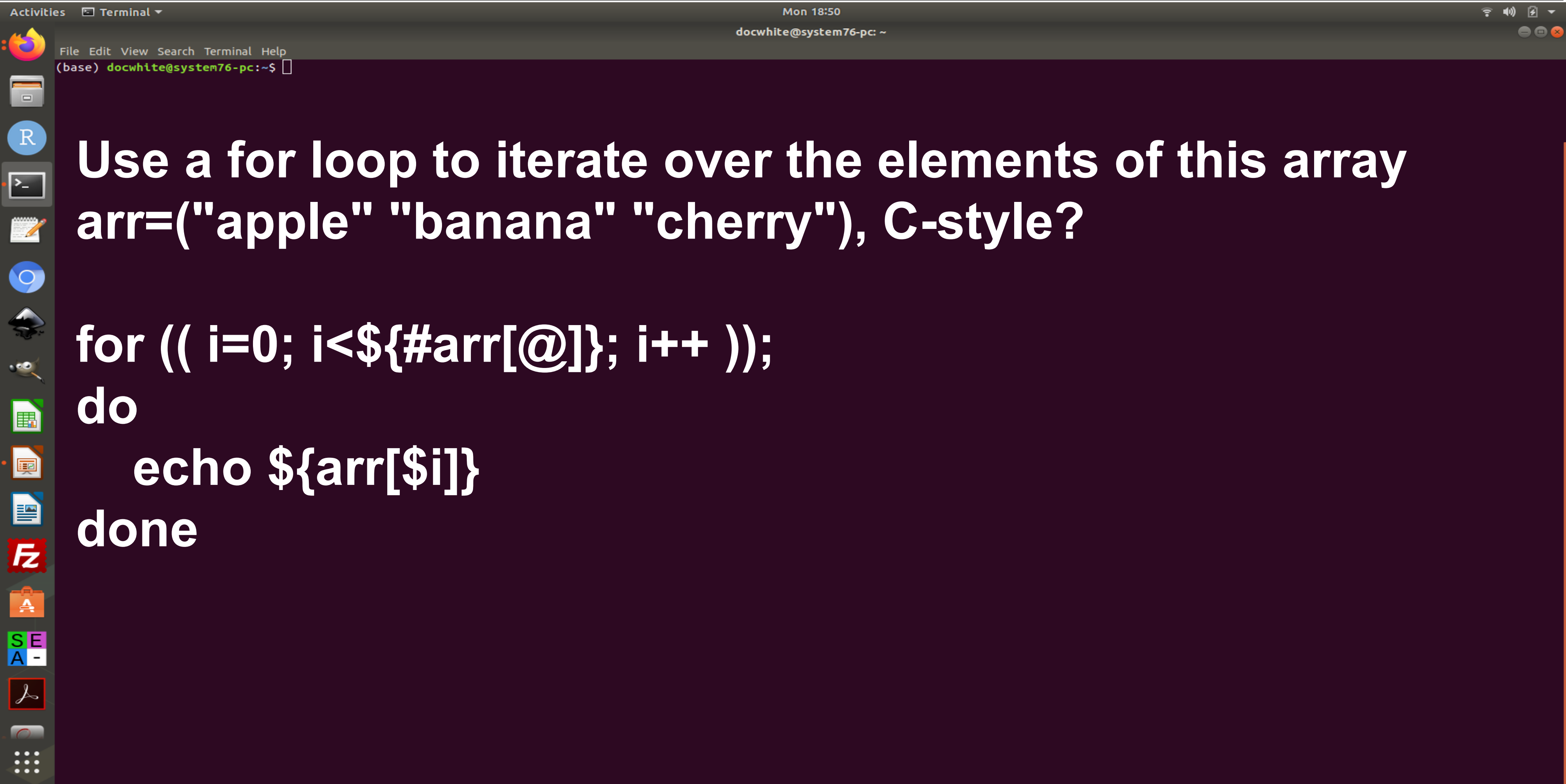
```
(base) docwhite@system76-pc:~$
```

Use a for loop to iterate over the elements of this array arr=("apple" "banana" "cherry"), C-style?

```
arr=( "apple" "banana" "cherry" )

for (( i=0; i<${#arr[@]}; i++ ));
do
    echo ${arr[$i]}
done
```

BASH for loop in arrays



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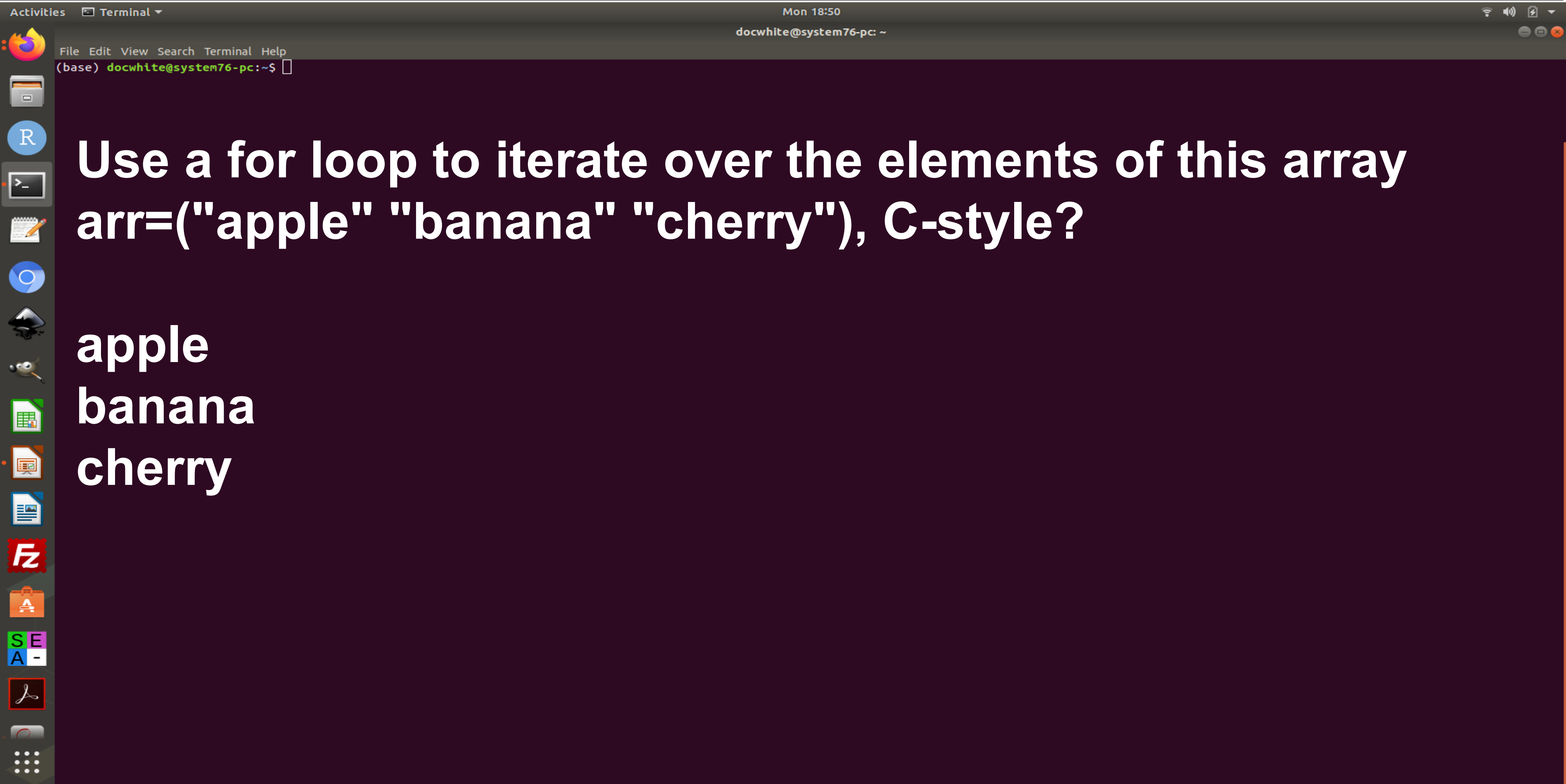

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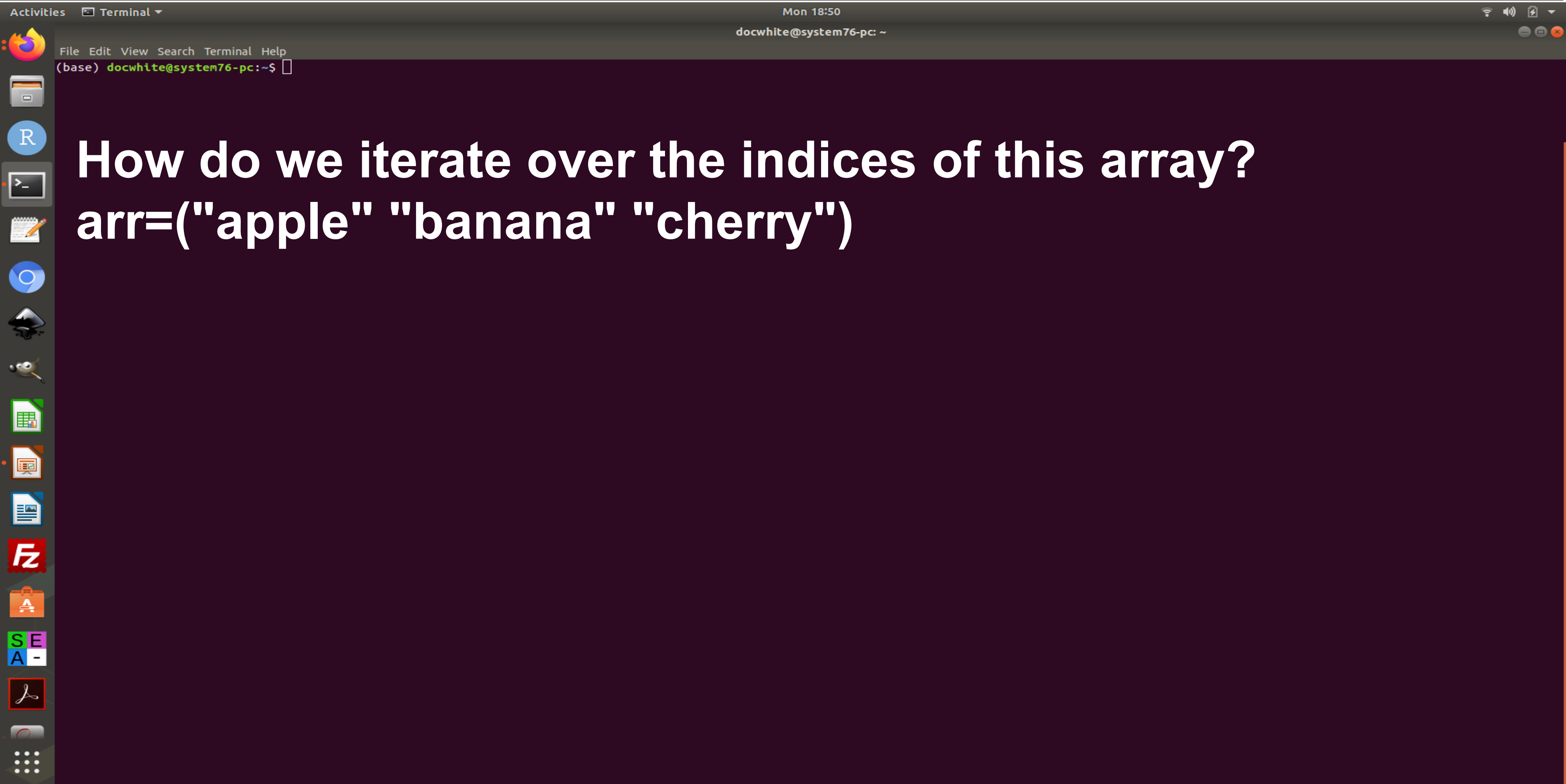
Use a for loop to iterate over the elements of this array arr=("apple" "banana" "cherry"), C-style?

```
apple
banana
cherry
```

BASH for loop in arrays

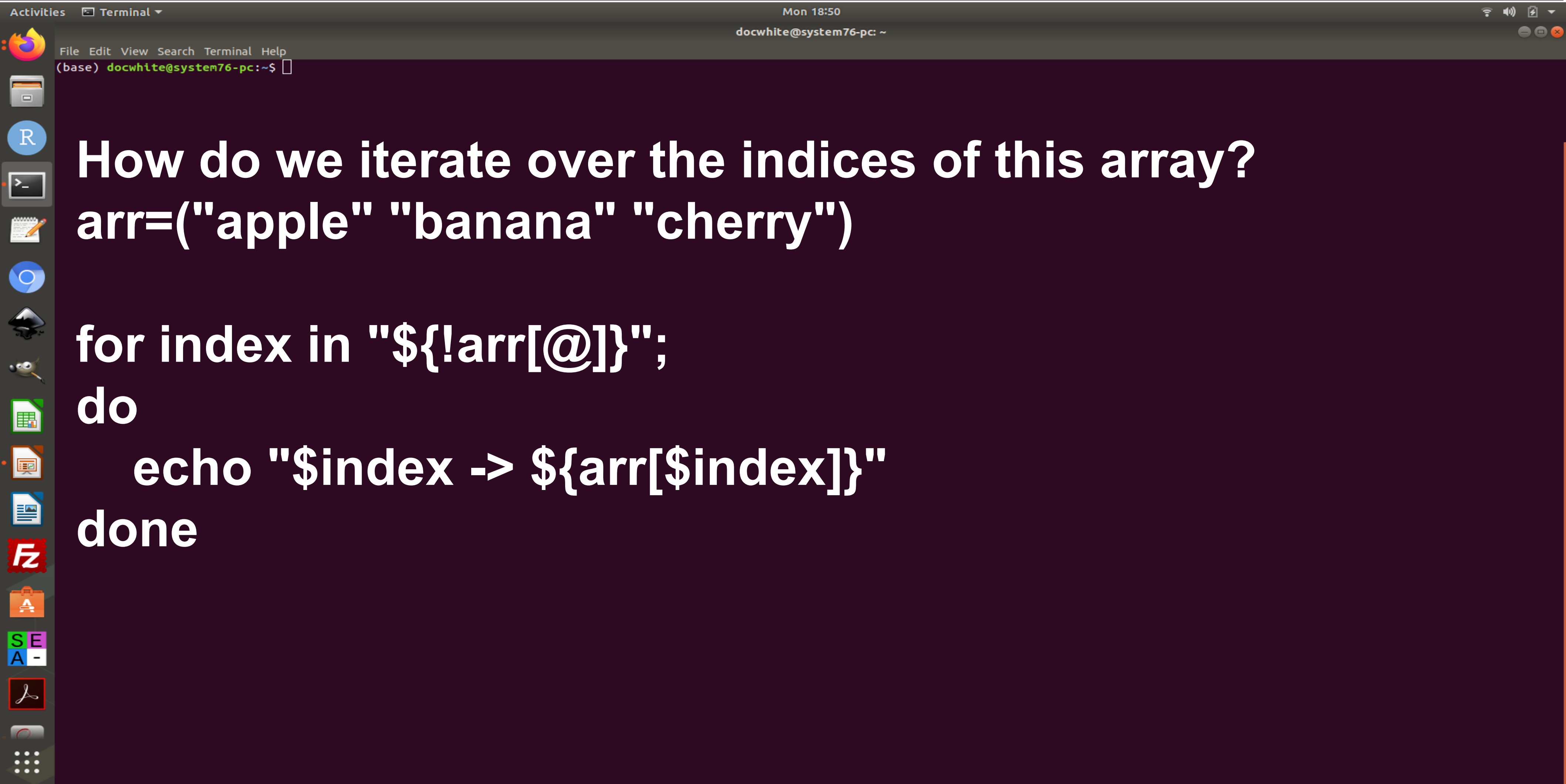


```
(base) docwhite@system76-pc:~$ 
```

How do we iterate over the indices of this array?

```
arr=("apple" "banana" "cherry")
```

BASH for loop in arrays



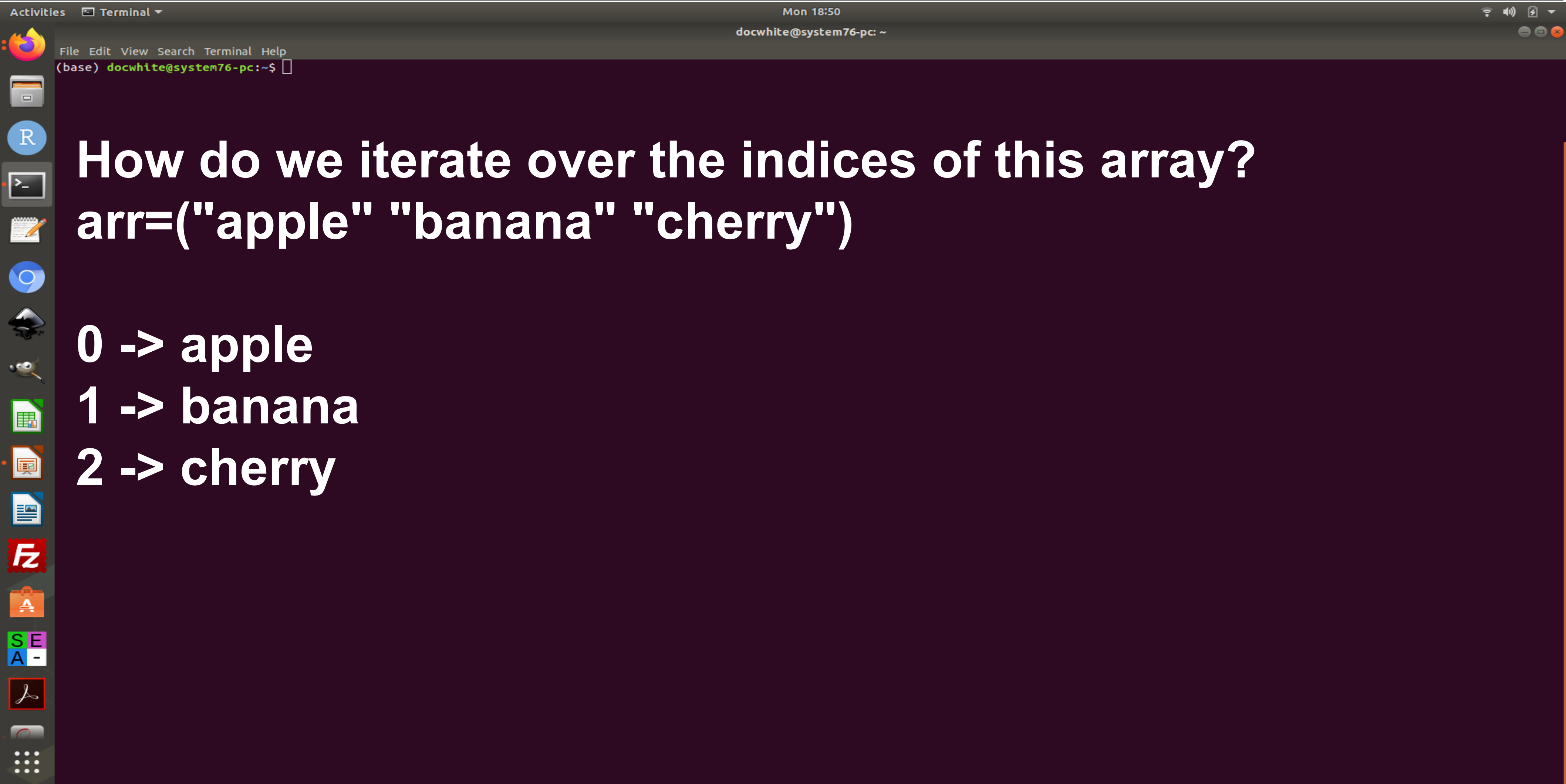
```
(base) docwhite@system76-pc:~$
```

How do we iterate over the indices of this array?

```
arr=("apple" "banana" "cherry")

for index in "${!arr[@]}";
do
    echo "$index -> ${arr[$index]}"
done
```

BASH for loop in arrays



```
(base) docwhite@system76-pc:~$ 
```

How do we iterate over the indices of this array?

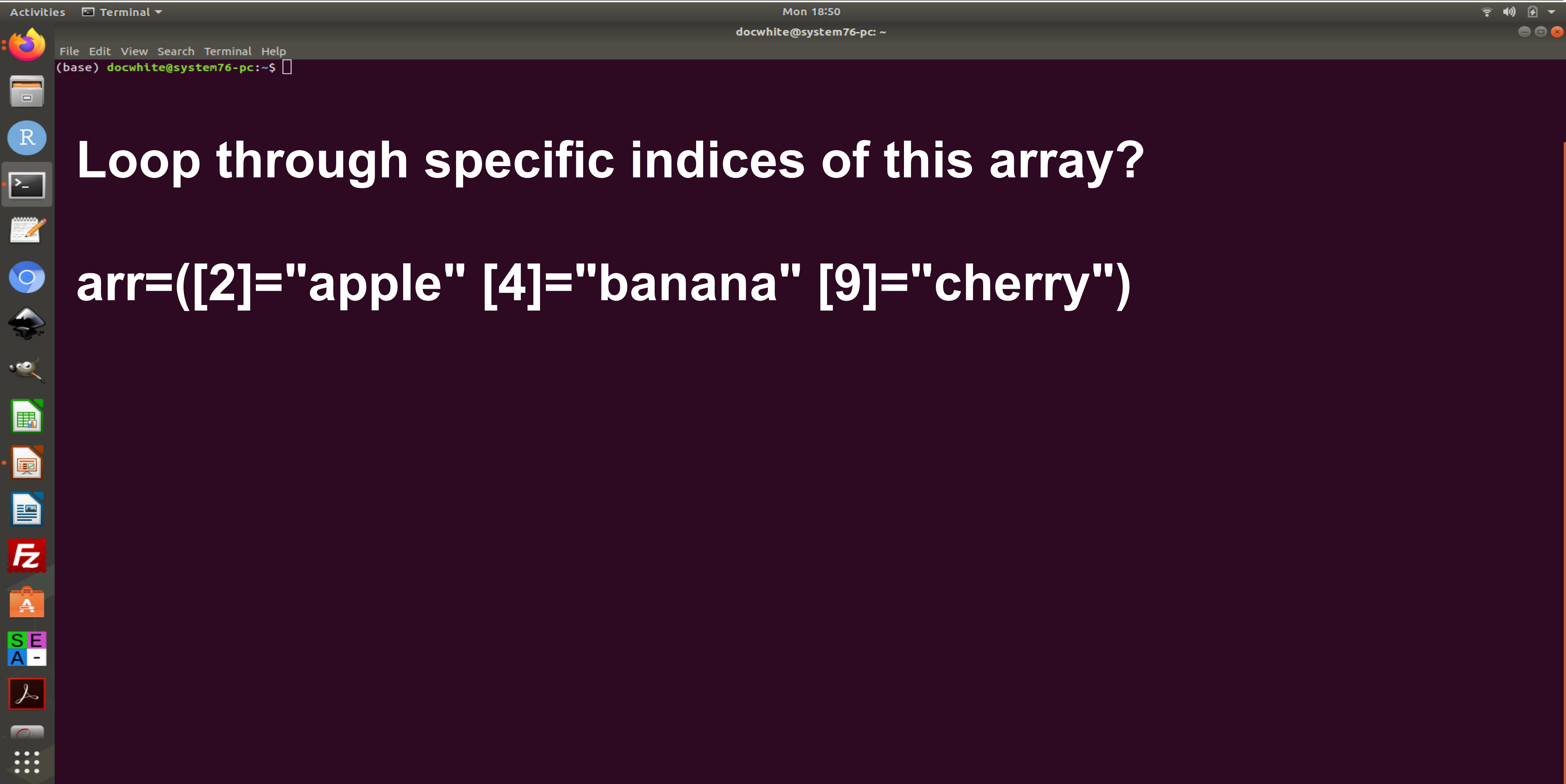
arr=("apple" "banana" "cherry")

0 -> apple

1 -> banana

2 -> cherry

BASH for loop in arrays

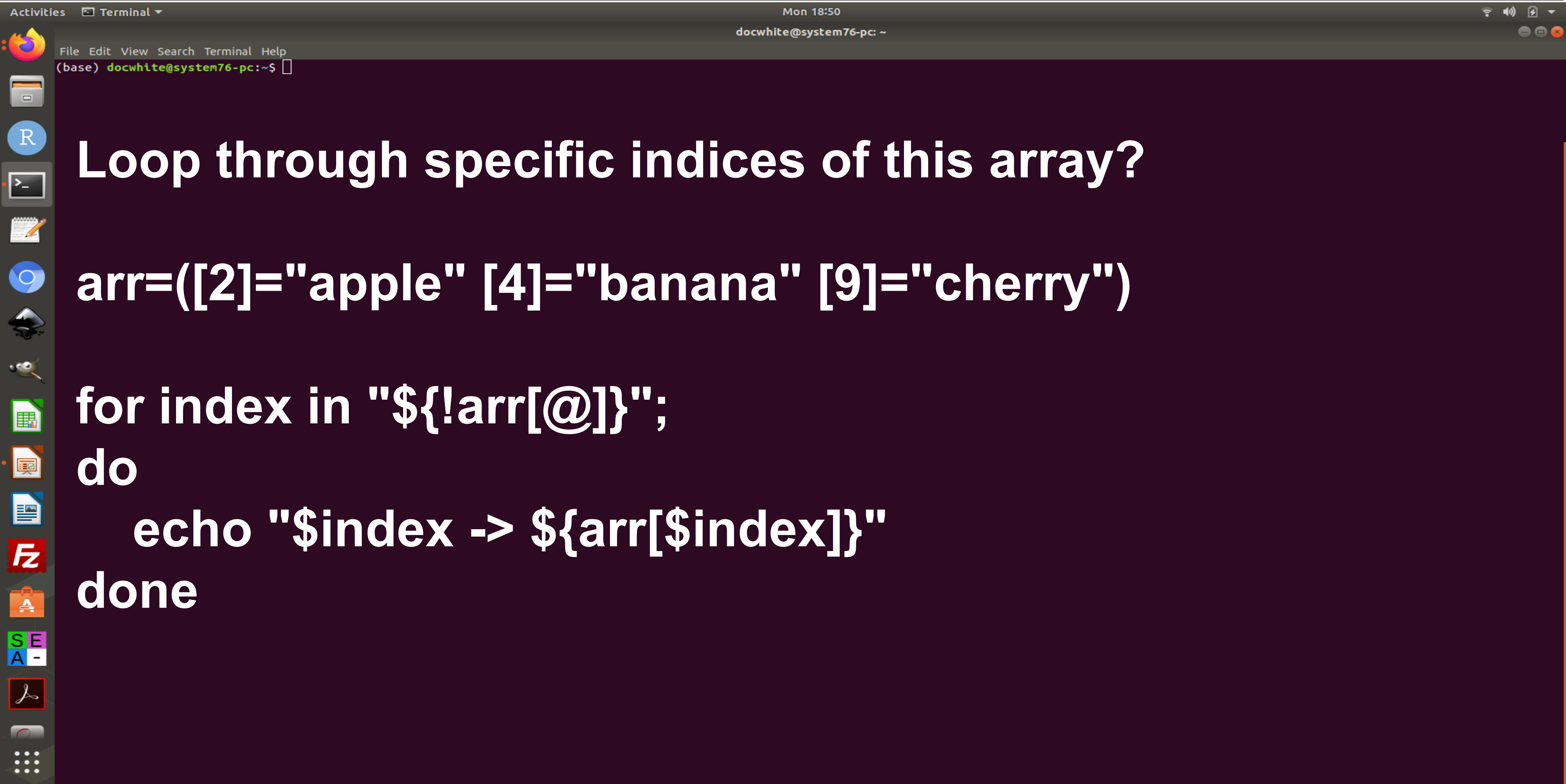


```
(base) docwhite@system76-pc:~$
```

Loop through specific indices of this array?

```
arr=([2]="apple" [4]="banana" [9]="cherry")
```

BASH for loop in arrays



```
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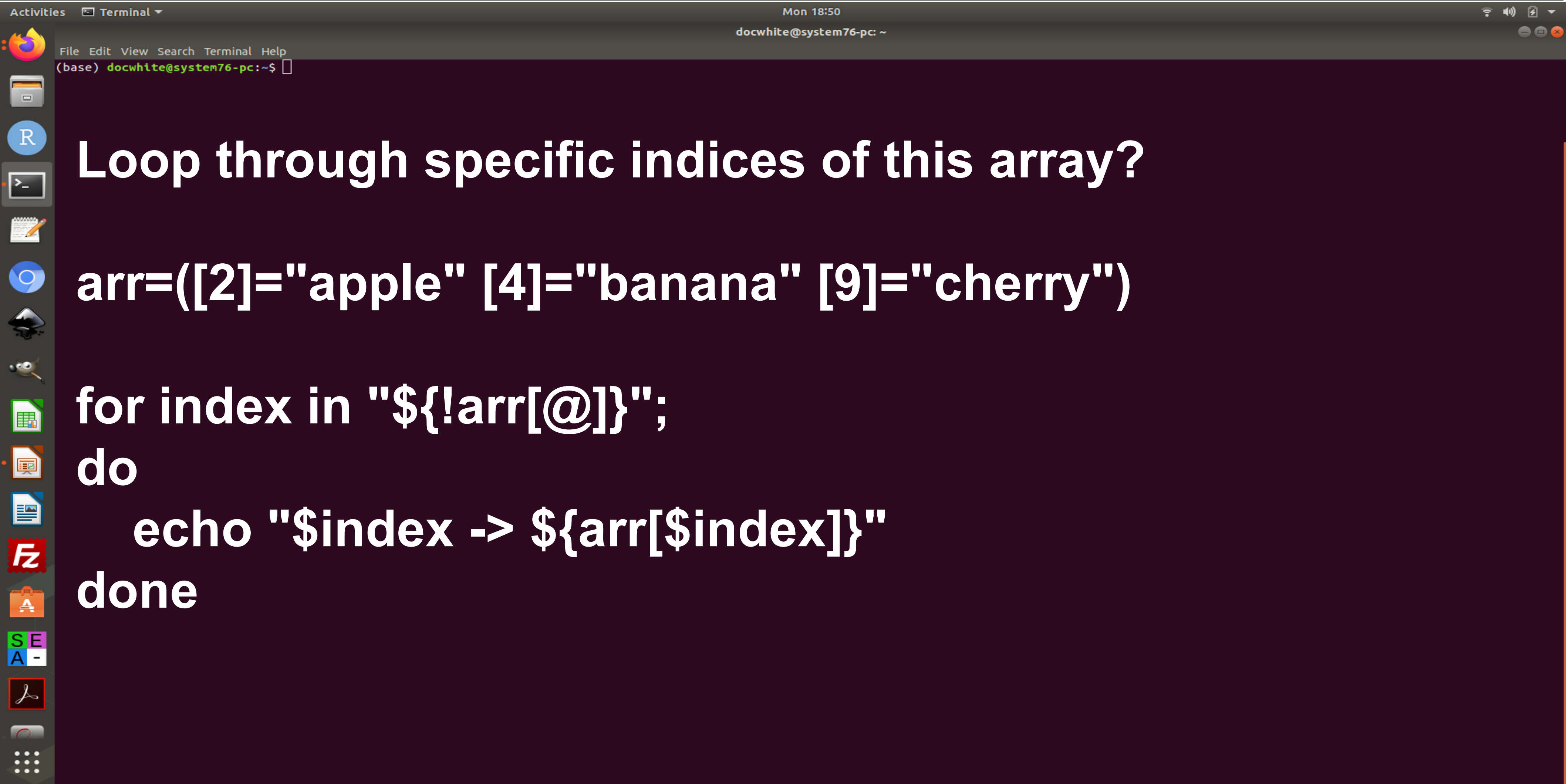
Loop through specific indices of this array?

```
arr=([2]="apple" [4]="banana" [9]="cherry")

for index in "${!arr[@]}";
do
    echo "$index -> ${arr[$index]}"
done
```

BASH for loop in arrays



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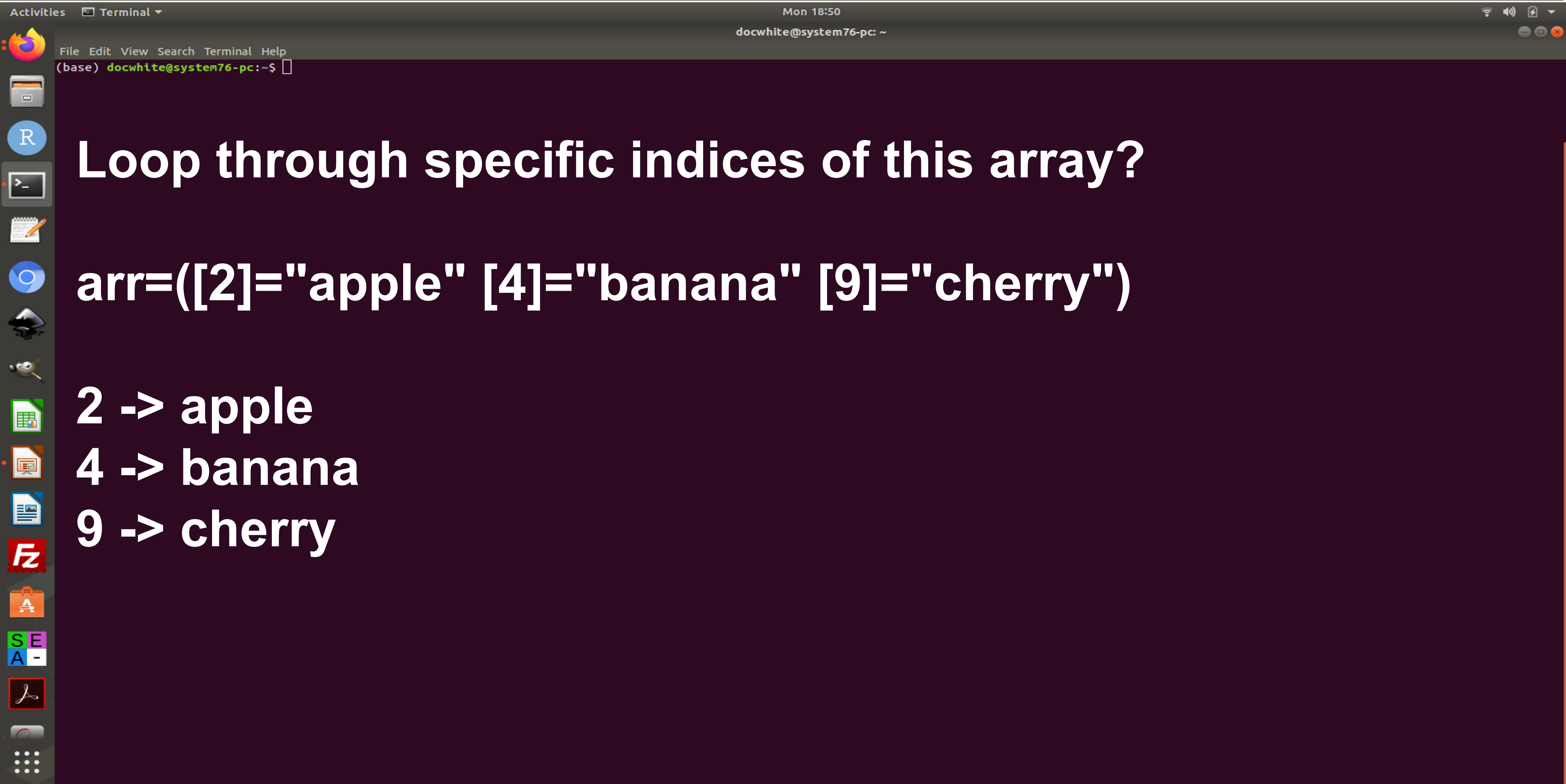
BASH for loop in arrays



```
(base) docwhite@system76-pc:~$
```

Loop through specific indices of this array?

```
arr=([2]="apple" [4]="banana" [9]="cherry")
```

```
2 -> apple
4 -> banana
9 -> cherry
```

Question

Write a bash script to count the number of ATG (starts) and TAA, TAG, TGA (stops) from the example2.fasta file.

Remember that ATG encodes for methionine so the only count the from the beginning of the sequence or the end for the stops.

HOW WOULD YOU DO THIS?

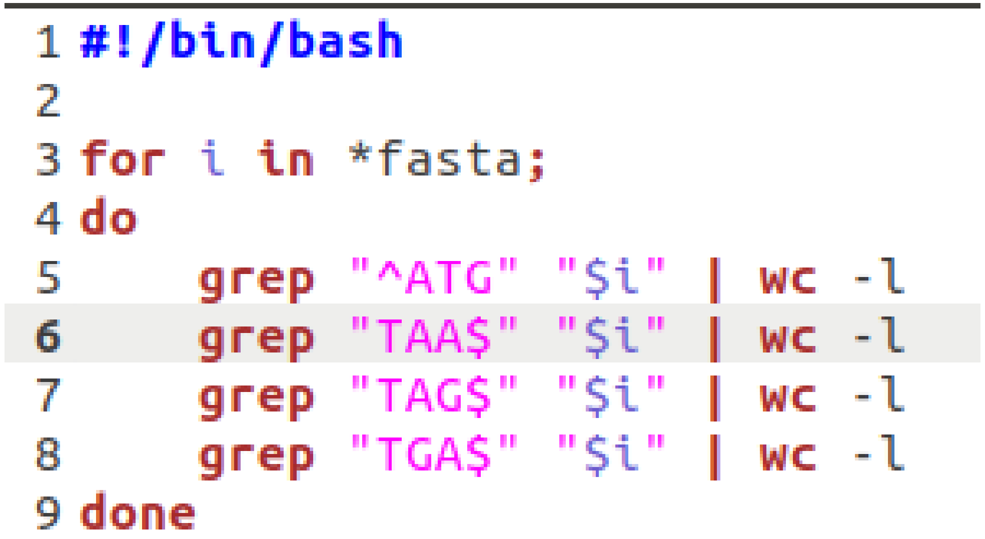
Question

Write a bash script to count the number of ATG (starts) and TAA, TAG, TGA (stops) from the example2.fasta file.

Remember that ATG encodes for methionine so the only count the from the beginning of the sequence or the end for the stops.

HOW WOULD YOU DO THIS?

BETTER WAY?



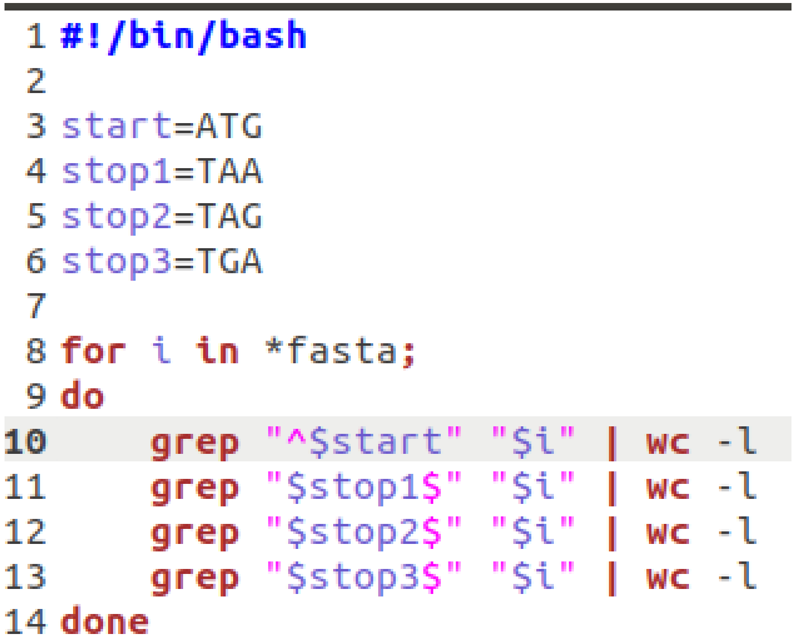
```bash
#!/bin/bash

for i in *fasta;
do
	grep "^ATG" "$i" | wc -l
	grep "TAA$" "$i" | wc -l
	grep "TAG$" "$i" | wc -l
	grep "TGA$" "$i" | wc -l
done
```

Question

Write a bash script to count the number of ATG (starts) and TAA, TAG, TGA (stops) from the example2.fasta file.

Remember that ATG encodes for methionine so the only count the from the beginning of the sequence or the end for the stops.

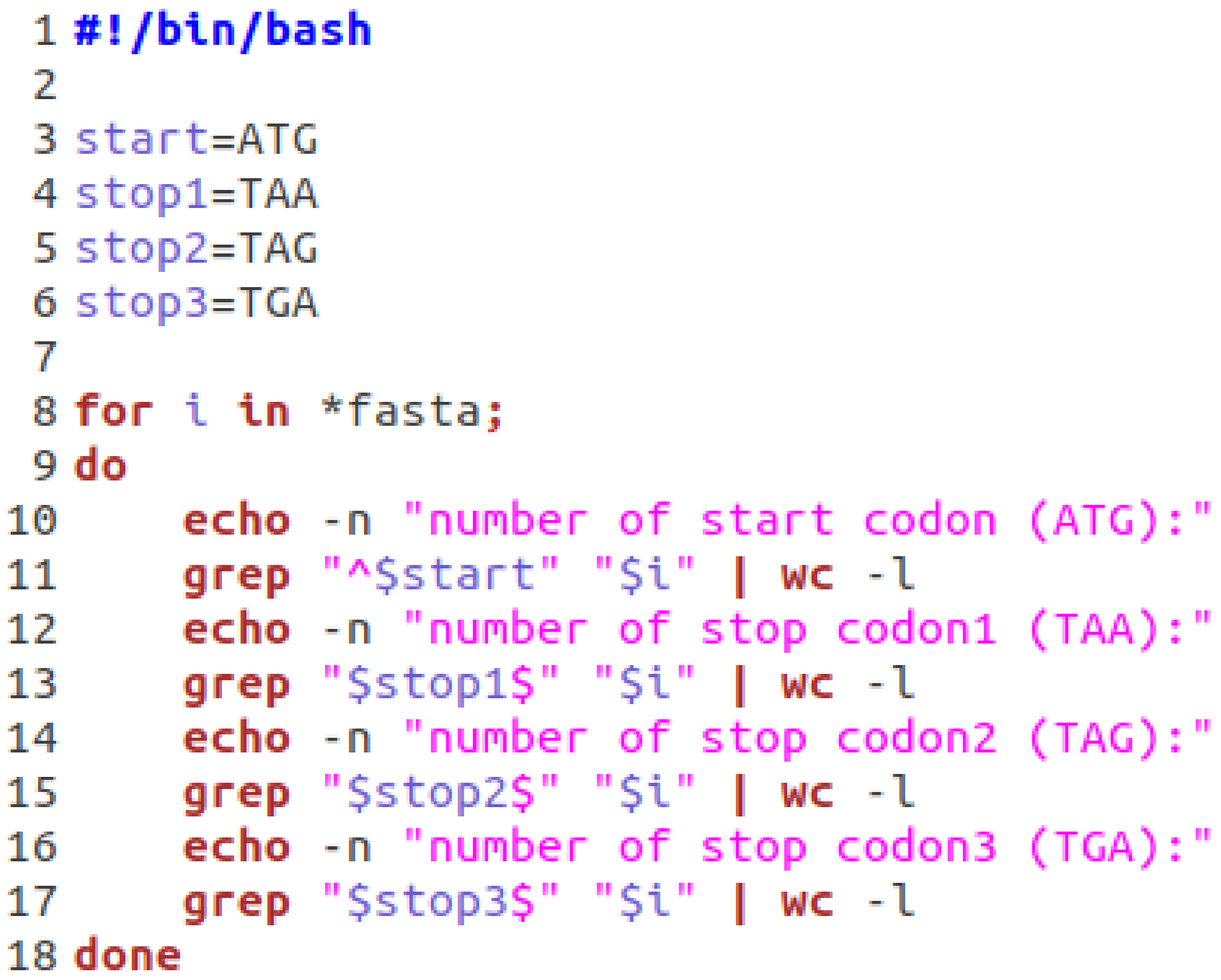
EVEN BETTER?



```
#!/bin/bash

start=ATG
stop1=TAA
stop2=TAG
stop3=TGA

for i in *fasta;
do
     grep "^$start" "$i" | wc -l
     grep "$stop1$" "$i" | wc -l
     grep "$stop2$" "$i" | wc -l
     grep "$stop3$" "$i" | wc -l
done
```

Question

EVEN BETTER?



```
#!/bin/bash

start=ATG
stop1=TAA
stop2=TAG
stop3=TGA

for i in *fasta;
do
        echo -n "number of start codon (ATG):"
        grep "^$start" "$i" | wc -l
        echo -n "number of stop codon1 (TAA):"
        grep "$stop1$" "$i" | wc -l
        echo -n "number of stop codon2 (TAG):"
        grep "$stop2$" "$i" | wc -l
        echo -n "number of stop codon3 (TGA):"
        grep "$stop3$" "$i" | wc -l
done
```

Question

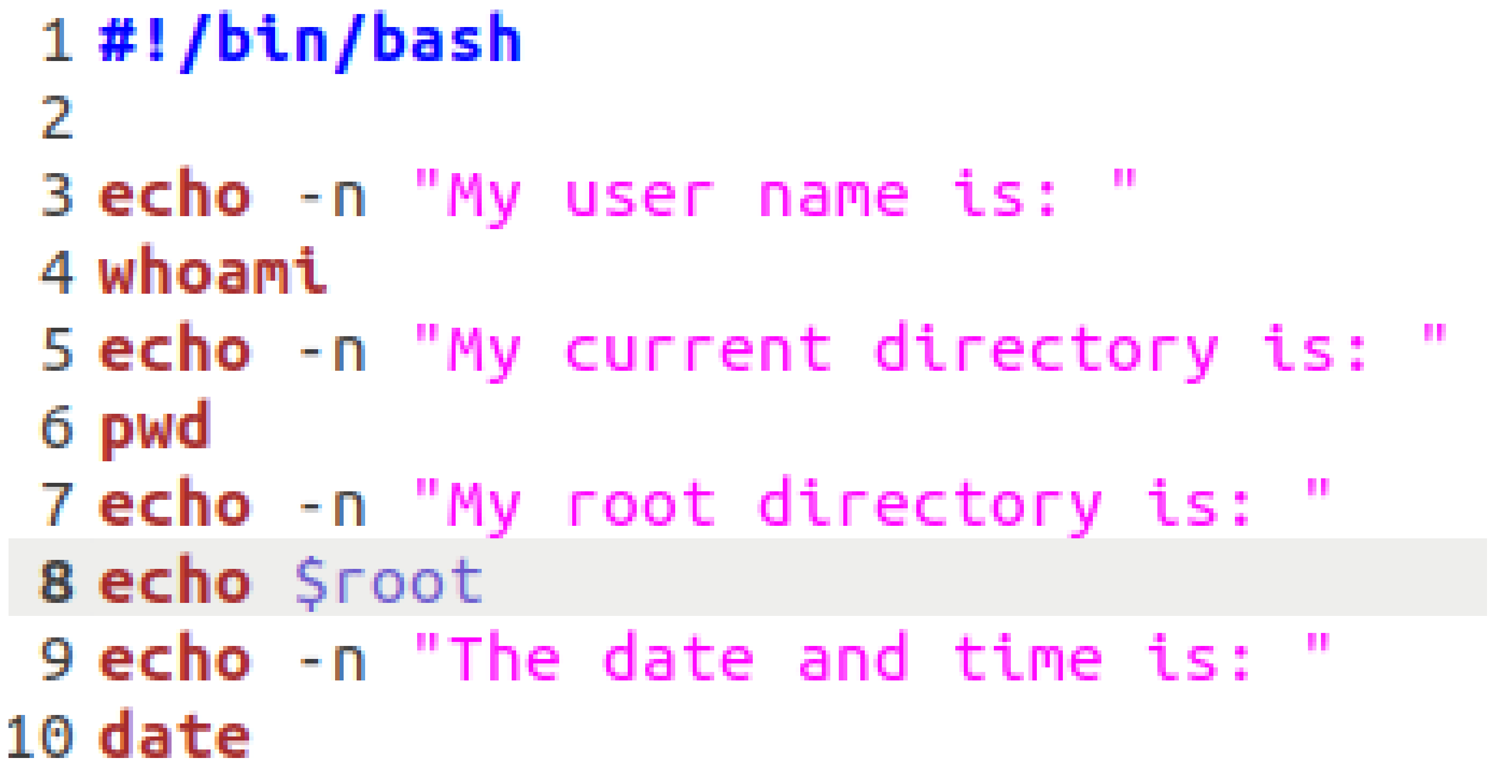
Write a bash script that tells me my username, current directory, the location of my root directory, and the date/time

HOW WOULD YOU DO THIS?

Question

Write a bash script that tells me my username, current directory, the location of my root directory, and the date/time

HOW WOULD YOU DO THIS?



```bash
#!/bin/bash

echo -n "My user name is: "
whoami
echo -n "My current directory is: "
pwd
echo -n "My root directory is: "
echo $root
echo -n "The date and time is: "
date
```

Question

Write a bash script that tells me my username, current directory, the location of my root directory, and the date/time

HOW WOULD YOU DO THIS?

```
bash script_date.sh
```

```
My user name is: docwhite
My current directory is: /home/docwhite/Desktop
My root directory is:
The date and time is: Tue Sep 28 19:40:29 EDT 2021
```

BASH - for loop

```
for i in file.*;do
  command $i
done
```

BASH - while loop

```
while[ condition ]
do
   command1
   command2
   command3
done
```

BASH - while loop

Command1 to Command3 will be executed repeatedly till condition is false. The argument for a while loop can be any boolean expression. Infinite loops occur when the conditional never evaluates to false. The while loop should be used as long as a certain condition is true, such as the a counter is less than a maximum value or the ping time to a server is lower than a threshold or forever if you loop while TRUE or while 1.

Here is the while loop one-liner syntax:

while [condition]; **do** commands; **done**

while control-command; **do** COMMANDS; **done**

BASH - while loop

```
#!/bin/bash
x=1
while [ $x -le 5 ]
do
  echo "Welcome $x
times"
  x=$(( $x + 1 ))
done
```

BASH - while loop (one - liner)

```
x=1; while [ $x -le 5 ]; do echo "Welcome
$x times" $(( x++ )); done
```

BASH - while loop (read line by line)

```
#!/bin/bash
FILE=$1
# read $FILE using the file descriptors
exec 3<&0
exec 0<$FILE
while read line
do
        # use $line variable to process line
        echo $line
done
exec 0<&3
```

BASH - while loop (in array)

```
#!/bin/bash
arr=( "apple" "banana" "cherry" )

i=0
len=${#arr[@]}
while [ $i -lt $len ];
do
    echo ${arr[$i]}
    let i++
done
```

BASH - until loop

The until loop is similar to the while loop but with reverse logic. Instead of looping while a condition is true you are assuming the condition is false and looping until it becomes true. They are reverse of each other in logical expression.

```
until [ CONDITION ]; do
  LINES OF CODE
  MORE LINES OF CODE
done
```

BASH - until loop

```
#!/bin/bash
NUM=1
until [ “$NUM” -gt 1000 ]; do
	echo $NUM
	let NUM=NUM*2
done
```

BASH - functions

```
Function_name( ){
        command
}
```

Think of a function as a small script within a script. It's a small chunk of code which you may call multiple times within your script.

MY FAVORITE WAY! (There is another way)

BASH - functions

```
Function function_name( ){
    command
}
```

Not my favorite. But, you may like it?

BASH - functions

```
Function function_name( ){
    command
}
```

Not my favorite. But, you may like it?

BASH – Passing Arguments/Return values

```
#!/bin/bash

print_this() {
  echo Hello $1
    return 5
}
print_this Mars
print_this Jupiter
echo The previous function has a return value of $?
```

BASH – Passing Arguments/Return values

Output

```
Hello Mars
Hello Jupiter
print_this Jupiter
The previous function has a return value of 5
```

Quiz 11

- On canvas now

Bonus 11

- Write a function that will return the number of lines it has in it?

Bonus 11

- Write a function that will return the number of lines it has in it?