EXPERIMENT 10

SHELL PROGRAMMING CONTINUED MODULAR AND REUSABLE CODE

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1.Modular and Reusable code

Modular Programming means breaking down a program into smaller, independent and reusable components. In shell scripting, this is achieved through:

Functions

- Named blocks of code that can be called multiple times
- Improve code readability and maintainability
- Reduce code duplication

Sourcing Scripts

- Using `script.sh` or `source script.sh` to include external scripts
- Makes functions and variables from the source file available in current script
- Unlike executing a script ,sourcing runs in current shell

2.Script Optimization Techniques

- AVOID UNNECESSARY SUBSHELLS: Each `$command` creates a new process, which is resource intensive.
- USE BUILT-IN STRING OPERATIONS: Bash has built in string manipulation that'faster than external commands like `expr` , `sed` or `awk` .
- MINIMIZE LOOPS: Use shell expansions and built-in instead of loops when possible

LAB EXERSISES EXPLAINED:

1.STRING LENGTH

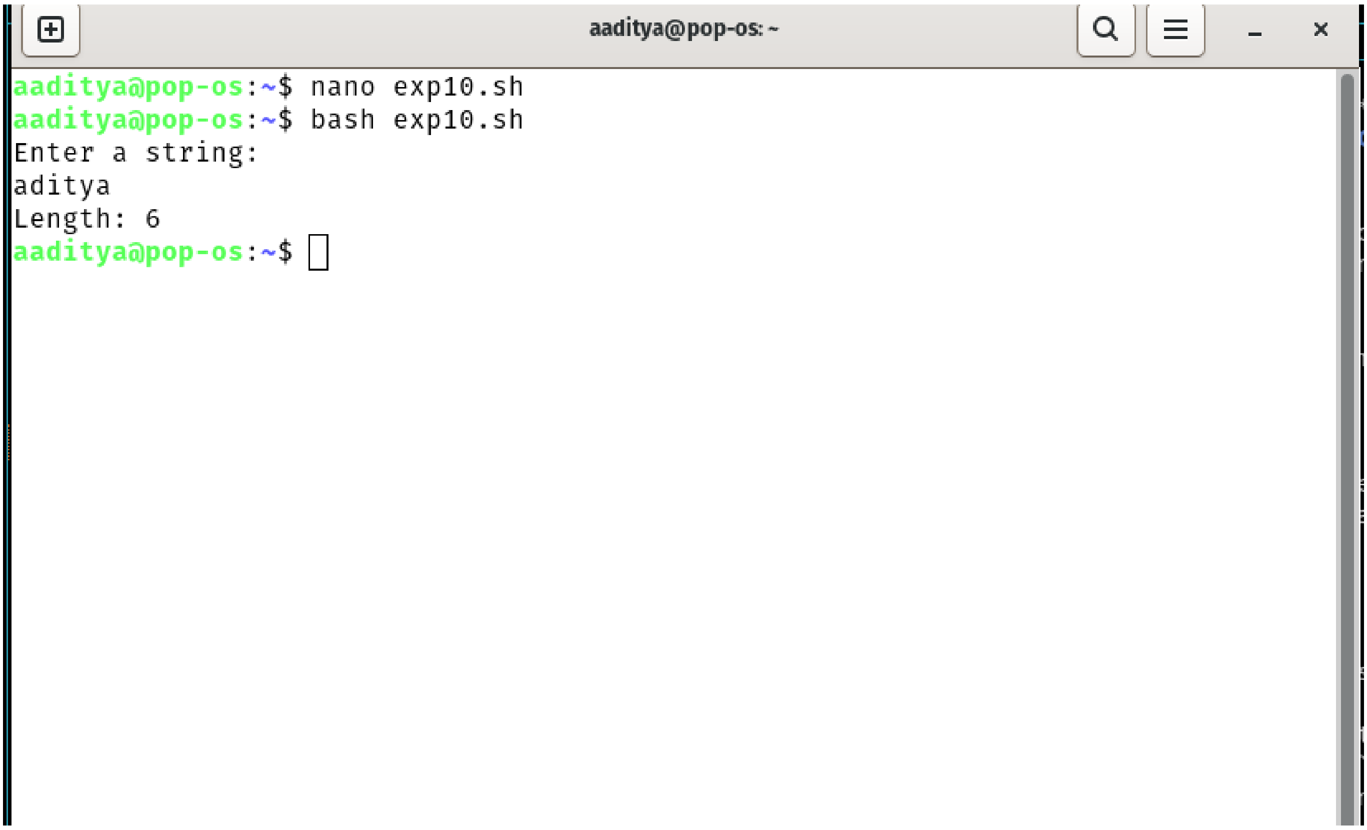
EXPLANATION:

- `${#str}`is a bash parameter expansion that returns the length of the variable
- Much faster than `echo $str | wc -c` (which creates subshells and pipes)

SCRIPT:

```
#!/bin/bash
echo "Enter a string:"
read str
echo "Length: ${#str}"
```

Output:



```
aaditya@pop-os:~$ nano exp10.sh
aaditya@pop-os:~$ bash exp10.sh
Enter a string:
aditya
Length: 6
aaditya@pop-os:~$
```

2.REVERSE STRING

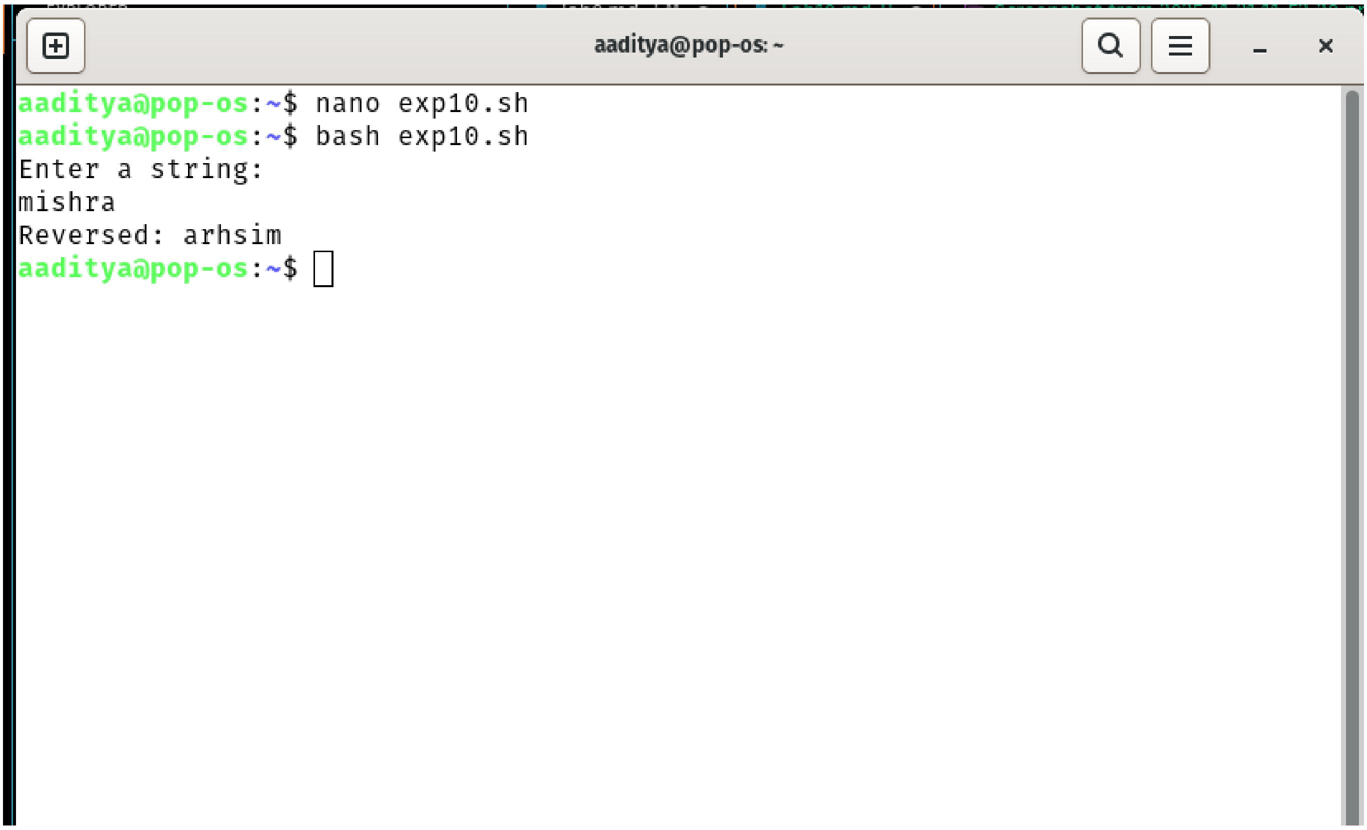
EXPLANATION:

Explanation:

- `${str:$i:1}` extracts 1 character from position `$i` (string slicing)
- Loop runs from last character to first
- Alternative: `echo $str | rev` (if `rev` command is available). SCRIPT:

```
#!/bin/bash
echo "Enter a string:"
read str
rev=""
len=${#str}
for (( i=$len-1; i>=0; i-- ))
do
    rev="$rev${str:$i:1}"
done
echo "Reversed: $rev"
```

Output:



```
aaditya@pop-os:~$ nano exp10.sh
aaditya@pop-os:~$ bash exp10.sh
Enter a string:
mishra
Reversed: arhsim
aaditya@pop-os:~$ 
```

3.Concatenate Strings

EXPLANATION:

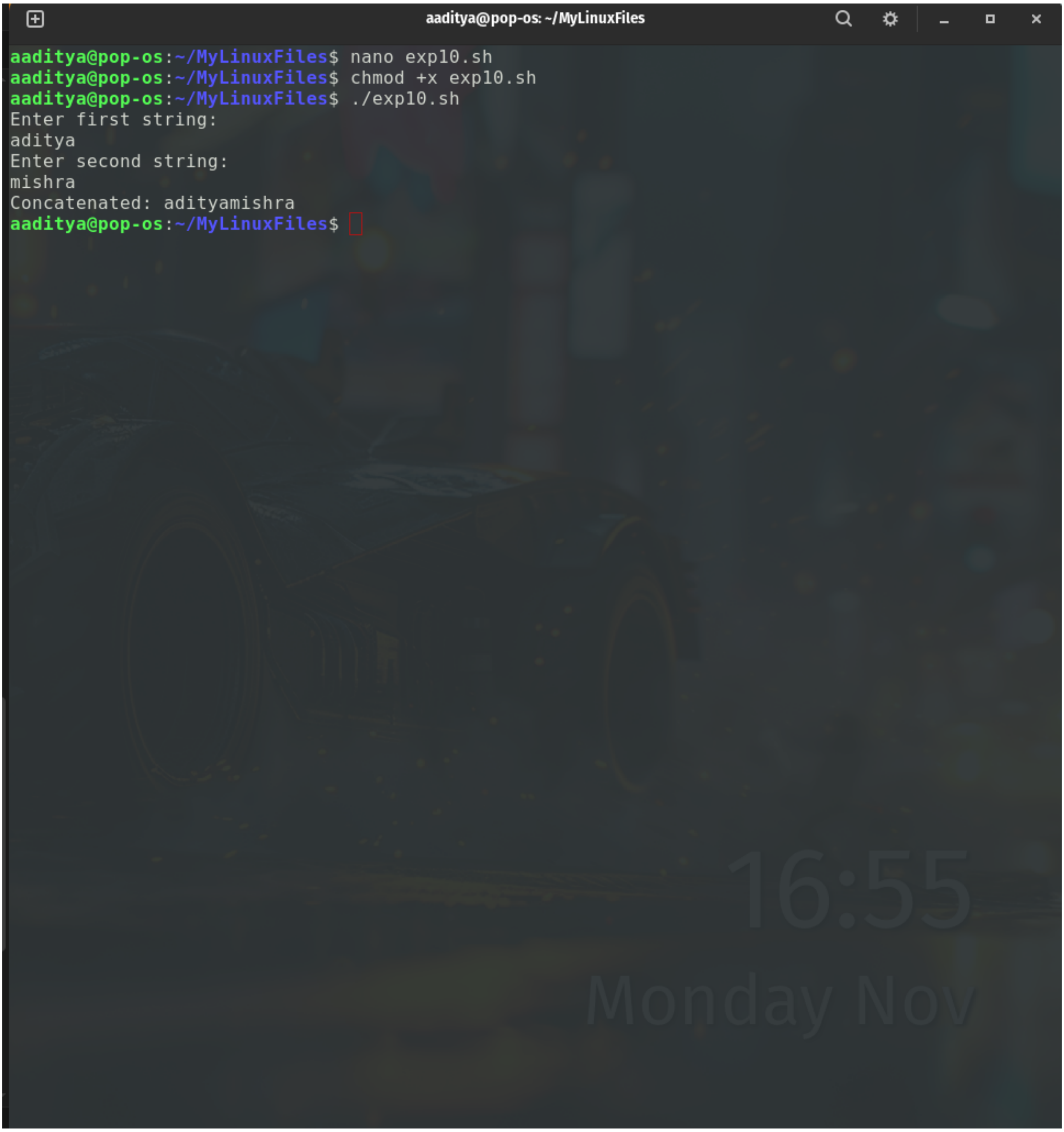
Explanation:

- In bash, simple variable juxtaposition concatenates strings
- No need for special operators or functions

SCRIPT:

```
#!/bin/bash
echo "Enter first string:"
read s1
echo "Enter second string:"
read s2
echo "Concatenated: $s1$s2"
```

Output:



```
aaditya@pop-os:~/MyLinuxFiles$ nano exp10.sh
aaditya@pop-os:~/MyLinuxFiles$ chmod +x exp10.sh
aaditya@pop-os:~/MyLinuxFiles$ ./exp10.sh
Enter first string:
aditya
Enter second string:
mishra
Concatenated: adityamishra
aaditya@pop-os:~/MyLinuxFiles$ 
```

Assignments solutions

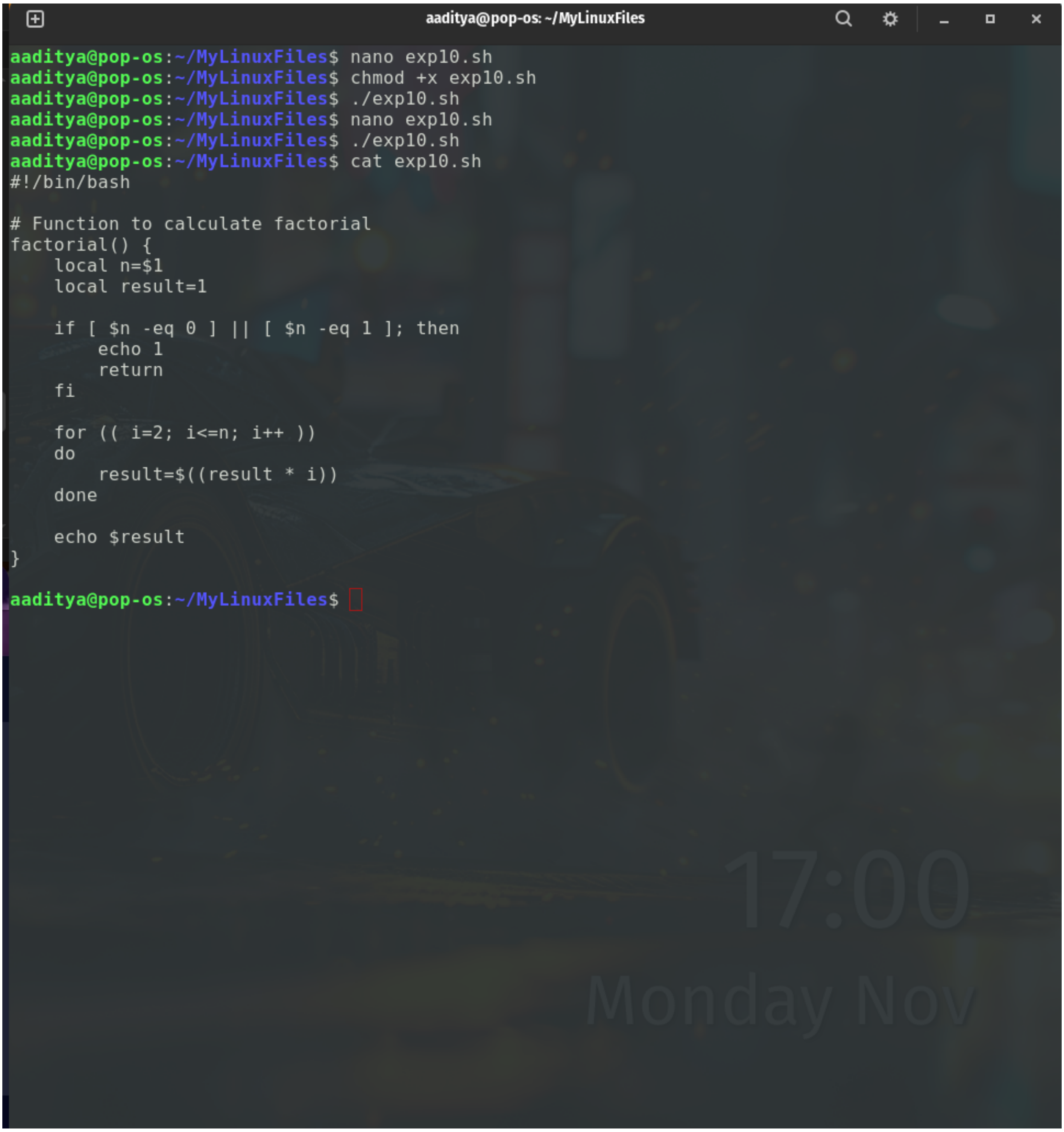
1.Factorial Function(Modular Approach)

math.sh:

Script:

```
#!/bin/bash

# Function to calculate factorial
factorial() {
    local n=$1
    local result=1

    if [ $n -eq 0 ] || [ $n -eq 1 ]; then
        echo 1
        return
    fi

    for (( i=2; i<=n; i++ ))
    do
        result=$((result * i))
    done

    echo $result
}
```

output:



```
aaditya@pop-os:~/MyLinuxFiles$ nano exp10.sh
aaditya@pop-os:~/MyLinuxFiles$ chmod +x exp10.sh
aaditya@pop-os:~/MyLinuxFiles$ ./exp10.sh
aaditya@pop-os:~/MyLinuxFiles$ nano exp10.sh
aaditya@pop-os:~/MyLinuxFiles$ ./exp10.sh
aaditya@pop-os:~/MyLinuxFiles$ cat exp10.sh
#!/bin/bash

# Function to calculate factorial
factorial() {
    local n=$1
    local result=1

    if [ $n -eq 0 ] || [ $n -eq 1 ]; then
        echo 1
        return
    fi

    for (( i=2; i<=n; i++ ))
    do
        result=$((result * i))
    done

    echo $result
}

aaditya@pop-os:~/MyLinuxFiles$ 
```

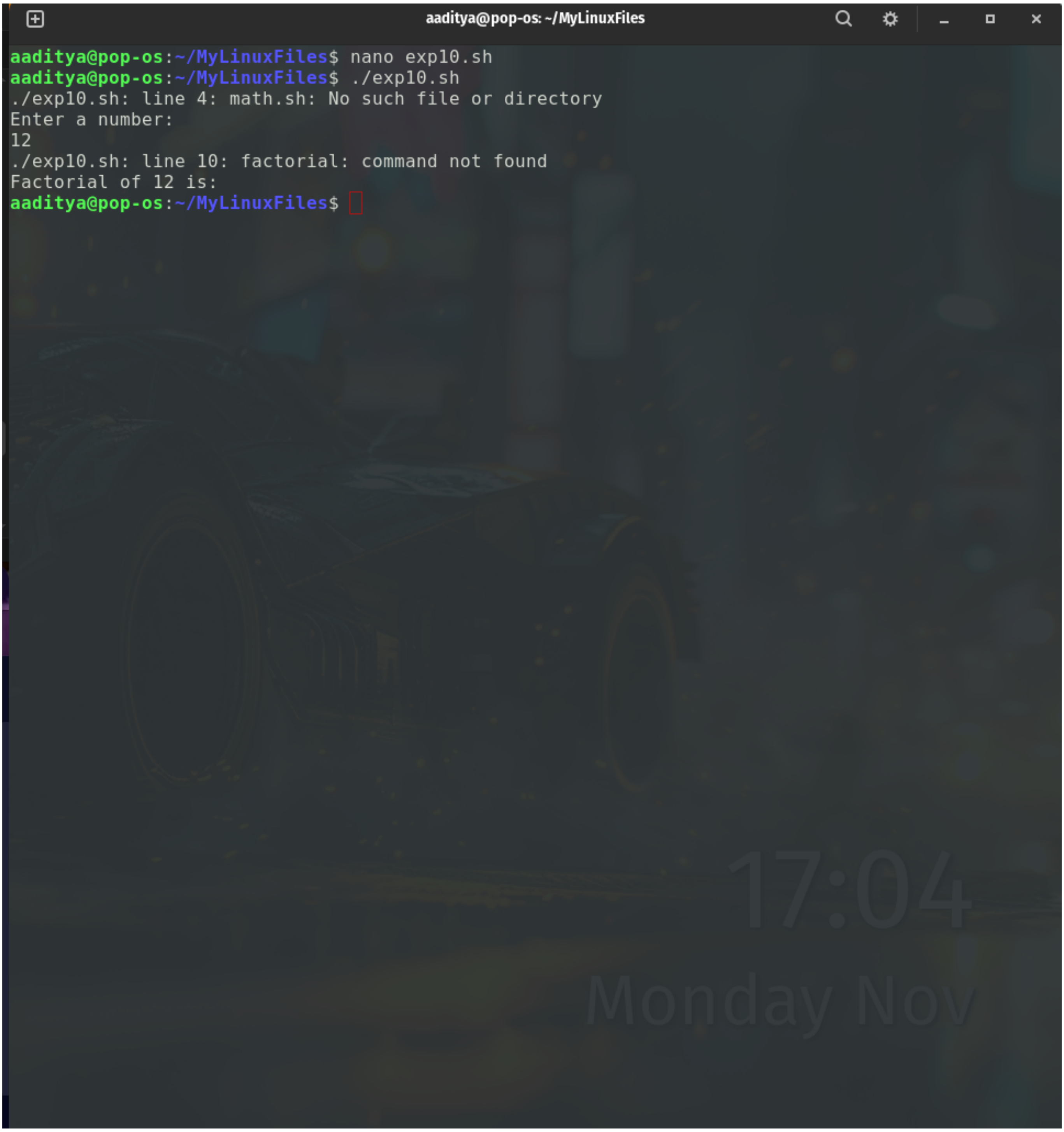
main_script.sh

Script:

```
#!/bin/bash

# Source the external script
source math.sh

echo "Enter a number:"
read num

# Call the imported function
```

```
result=$(factorial $num)
echo "Factorial of $num is: $result"
```

Output:



```
aaditya@pop-os:~/MyLinuxFiles$ nano exp10.sh
aaditya@pop-os:~/MyLinuxFiles$ ./exp10.sh
./exp10.sh: line 4: math.sh: No such file or directory
Enter a number:
12
./exp10.sh: line 10: factorial: command not found
Factorial of 12 is:
aaditya@pop-os:~/MyLinuxFiles$
```

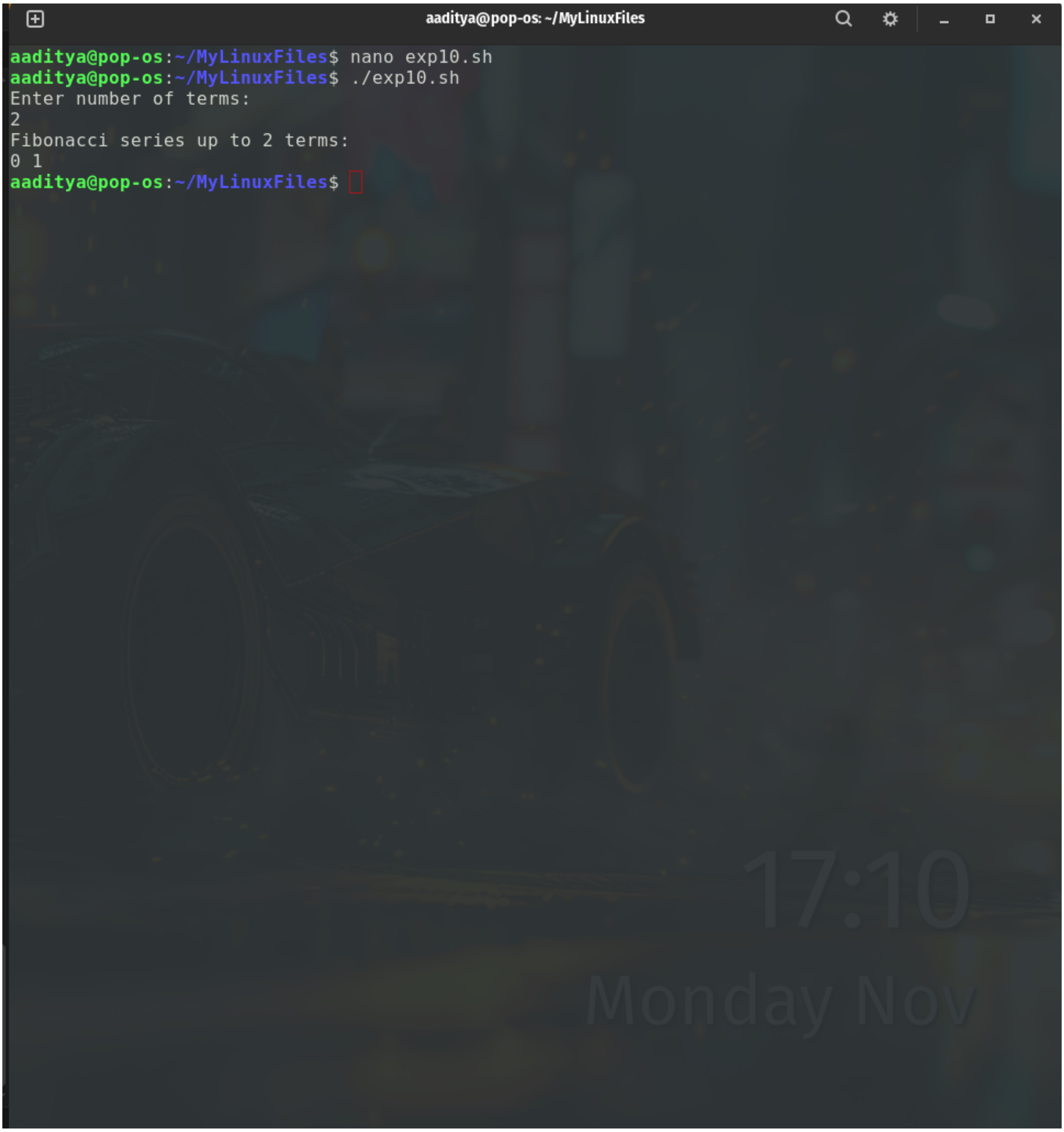
2. Optimized Fibonacci Script with function

Script:

```
#!/bin/bash

# Function to calculate Fibonacci series
```

```
fibonacci() {
    local n=$1
    local a=0
    local b=1
    local temp

    echo "Fibonacci series up to $n terms:"

    for (( i=0; i<n; i++ ))
    do
        echo -n "$a "
        temp=$((a + b))
        a=$b
        b=$temp
    done
    echo
}

# Main script
echo "Enter number of terms:"
read terms

# Input validation
if [[ ! $terms =~ ^[0-9]+$ ]] || [ $terms -lt 1 ]; then
    echo "Error: Please enter a positive integer"
    exit 1
fi

# Call the function
fibonacci $terms
```

Output:



```
aaditya@pop-os:~/MyLinuxFiles$ nano exp10.sh
aaditya@pop-os:~/MyLinuxFiles$ ./exp10.sh
Enter number of terms:
2
Fibonacci series up to 2 terms:
0 1
aaditya@pop-os:~/MyLinuxFiles$
```

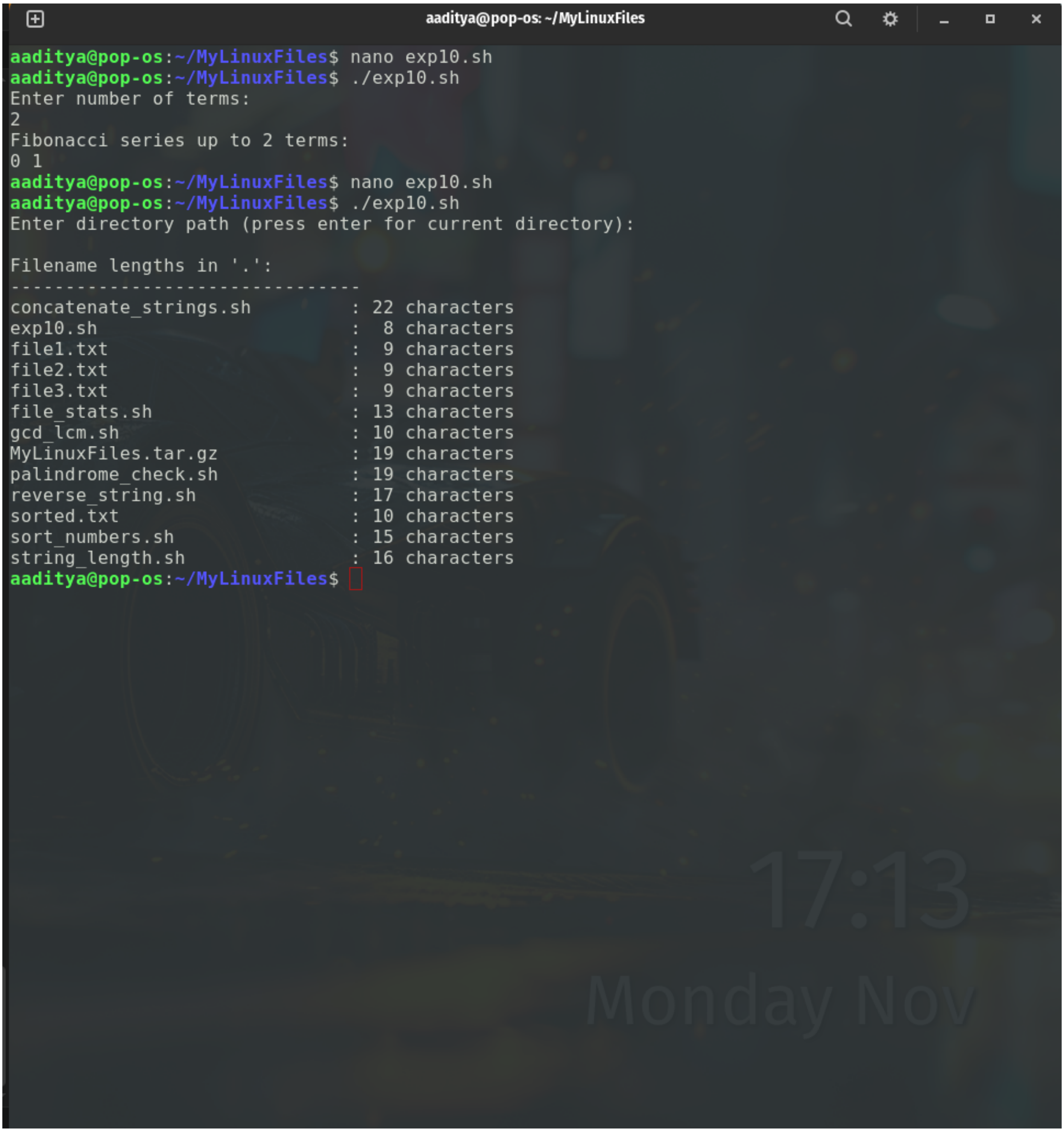
3. Filename lengths in Directory

Script:

```
#!/bin/bash

echo "Enter directory path (press enter for current directory):"
read dirpath

# Use current directory if empty
if [ -z "$dirpath" ]; then
    dirpath="."
fi
```

```
# Check if directory exists
if [ ! -d "$dirpath" ]; then
    echo "Error: Directory '$dirpath' does not exist"
    exit 1
fi

echo "Filename lengths in '$dirpath':"
echo "--------------------------------"

# Process each file in the directory
for file in "$dirpath"/*
do
    if [ -e "$file" ]; then  # Check if file exists
        filename=$(basename "$file")
        length=${#filename}
        printf "%-30s : %2d characters\n" "$filename" "$length"
    fi
done
```

Output:



```
aaditya@pop-os:~/MyLinuxFiles$ nano exp10.sh
aaditya@pop-os:~/MyLinuxFiles$ ./exp10.sh
Enter number of terms:
2
Fibonacci series up to 2 terms:
0 1
aaditya@pop-os:~/MyLinuxFiles$ nano exp10.sh
aaditya@pop-os:~/MyLinuxFiles$ ./exp10.sh
Enter directory path (press enter for current directory):

Filename lengths in '.':
--------------------------------
concatenate_strings.sh          : 22 characters
exp10.sh                        :  8 characters
file1.txt                       :  9 characters
file2.txt                       :  9 characters
file3.txt                       :  9 characters
file_stats.sh                   : 13 characters
gcd_lcm.sh                      : 10 characters
MyLinuxFiles.tar.gz             : 19 characters
palindrome_check.sh             : 19 characters
reverse_string.sh               : 17 characters
sorted.txt                      : 10 characters
sort_numbers.sh                 : 15 characters
string_length.sh                : 16 characters
aaditya@pop-os:~/MyLinuxFiles$ 
```

String operations:

```
str="hello"
echo ${#str}           # Length: 5
echo ${str:1:3}        # Substring: ell
echo ${str#he}         # Remove prefix: llo
echo ${str%lo}         # Remove suffix: hel
```

File Test Operators:

- -f file : True if file exists and is regular file
- -d file : True if file exists and is directory

- -r file : True if file exists and is readable
- -w file : True if file exists and is writable
- -x file : True if file exists and is executable