Project Name	Hopeful - A First Programming Language
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Document Title	User Manual
Summary	This project, Hopeful - A First Programming Language, will involve the development of a programming language. This language will be aimed at beginning programmers in an undergraduate setting. It will have a simple and clean syntax that will allow students to focus on the fundamentals of programming, instead of a complicated syntax.

Installation

Hopeful itself does not need to be installed, as it comes in the form of a *jar* file. However, in order for the *jar* file to run, LLVM needs to be installed on that environment first. LLVM can be downloaded using the following link: http://releases.llvm.org/download.html. Since Hopeful is contained in a *jar* file, Java also needs to be installed in said environment.

User Guide

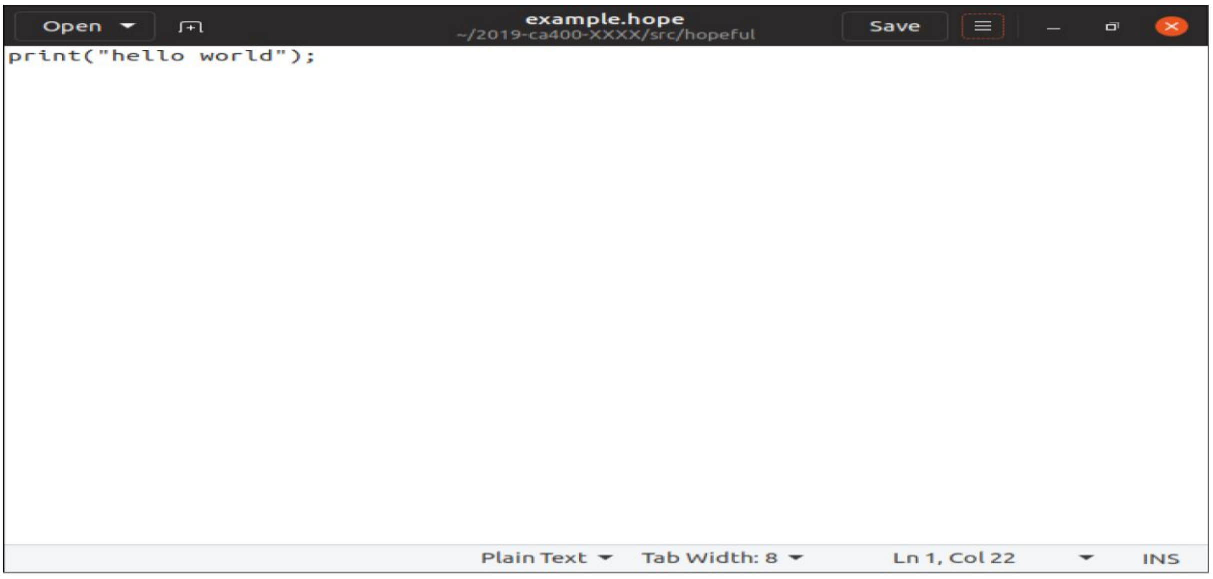
Since Hopeful is a programming language, I have created a language guide for users, which explains how to create a Hopeful program. It covers all of the details necessary to learn about Hopeful and use it to its fullest potential.

A Hopeful program is executed using the command: *java -jar HOPEFUL.jar file_name.hope*. Any output from the program will be printed on the terminal. Hopeful runs a number of semantic checks on the program before executing it. Any failed semantic checks will also be printed on the terminal and an explanation of what was wrong with the program.

Since Hopeful itself is a compiled language, the execution of this command creates a file containing the intermediate code in the directory in which the command was run, the file is contained in *file_name.hope.ll*. This file is the reason that LLVM is needed to execute the Hopeful program.

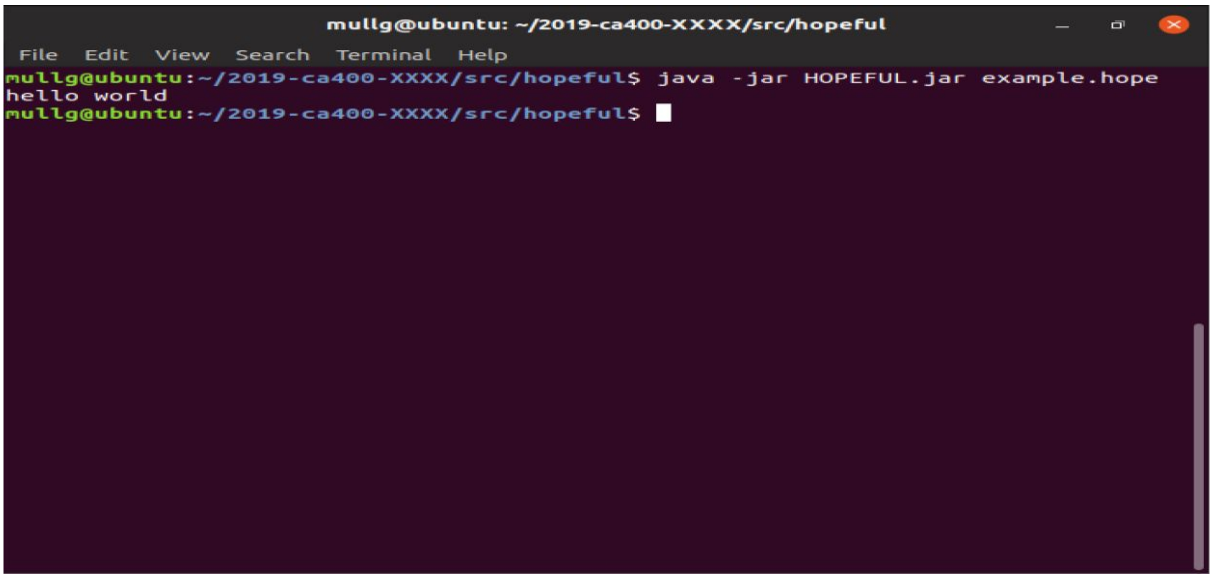
Screenshots

Hopeful program that prints “hello world”:



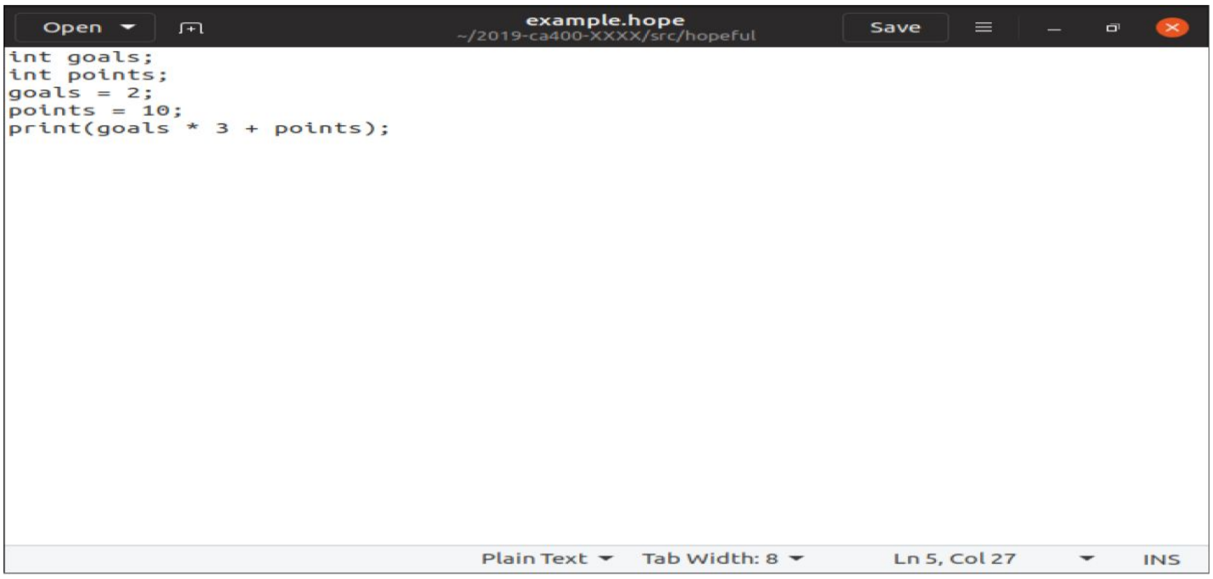
```
print("hello world");
```

Execution of above program:


mullg@ubuntu: ~/2019-ca400-XXXX/src/hopeful
File Edit View Search Terminal Help

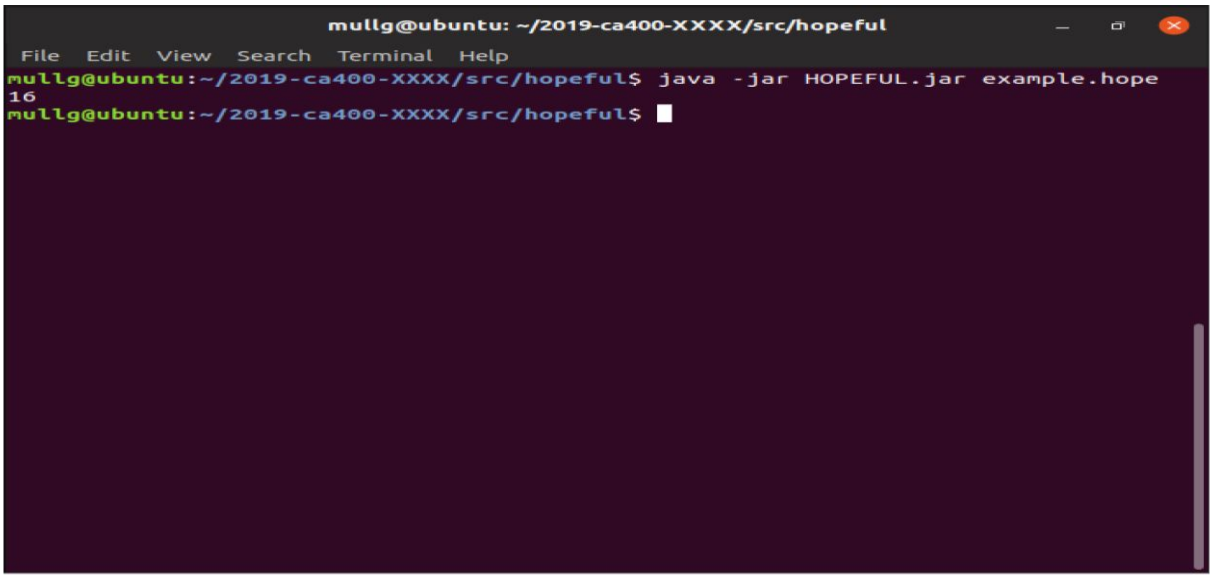
```
mullg@ubuntu:~/2019-ca400-XXXX/src/hopeful$ java -jar HOPEFUL.jar example.hope
hello world
mullg@ubuntu:~/2019-ca400-XXXX/src/hopeful$
```

Hopeful program that prints the total points scored by a GAA team:



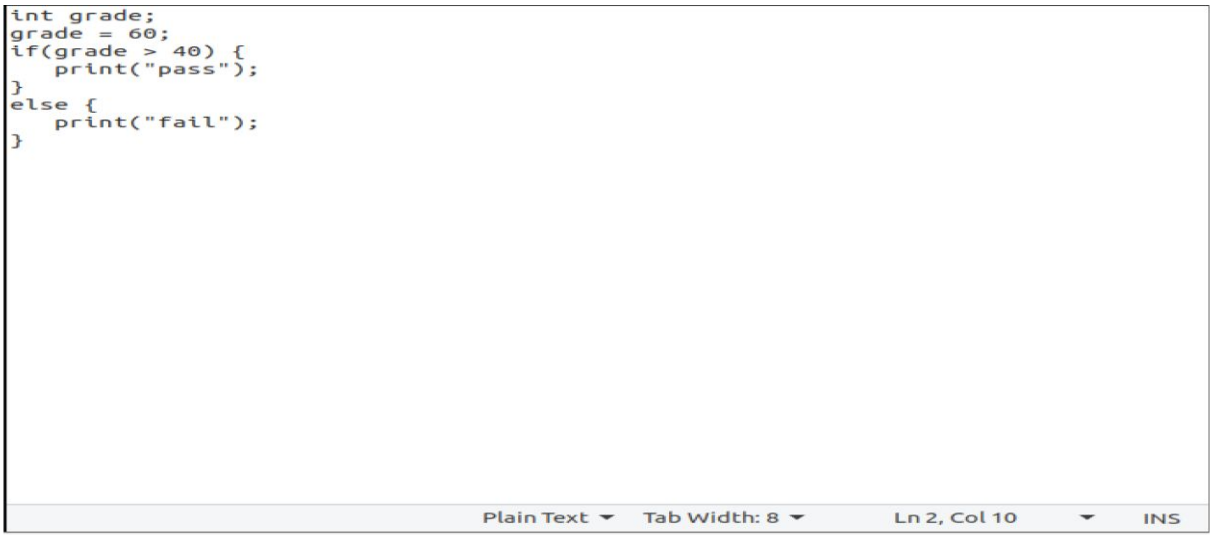
```
int goals;
int points;
goals = 2;
points = 10;
print(goals * 3 + points);
```

Execution of above program:


mullg@ubuntu: ~/2019-ca400-XXXX/src/hopeful
File Edit View Search Terminal Help

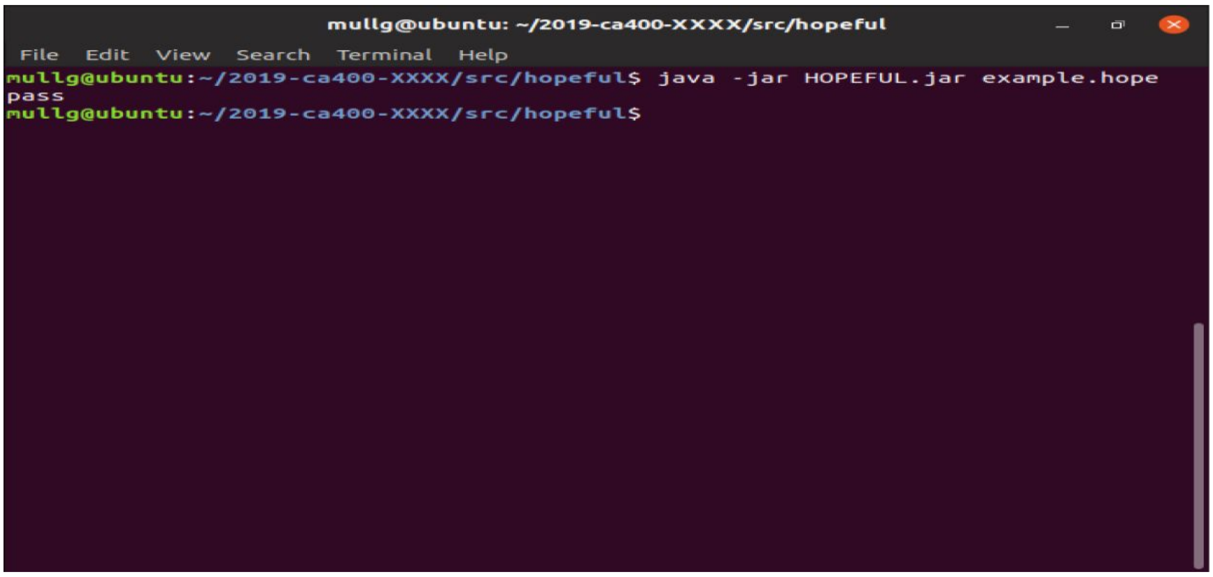
```
mullg@ubuntu:~/2019-ca400-XXXX/src/hopeful$ java -jar HOPEFUL.jar example.hope
16
mullg@ubuntu:~/2019-ca400-XXXX/src/hopeful$
```

Hopeful program that prints pass or fail depending on whether a grade is above of below 40:



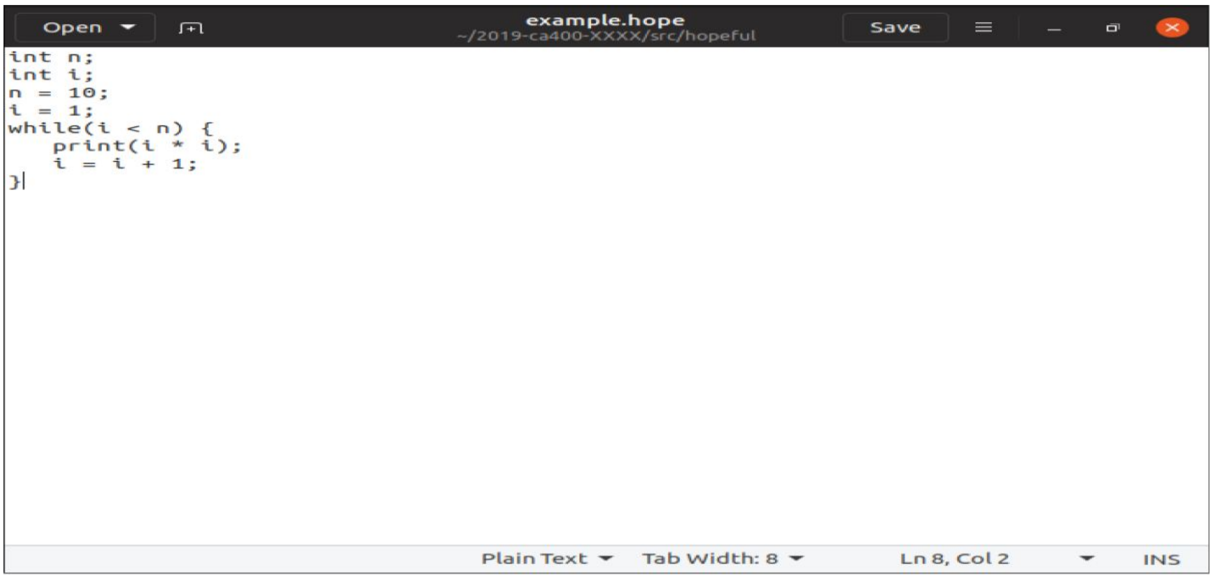
```
int grade;
grade = 60;
if(grade > 40) {
    print("pass");
}
else {
    print("fail");
}
```

Execution of above program:


mullg@ubuntu: ~/2019-ca400-XXXX/src/hopeful
File Edit View Search Terminal Help

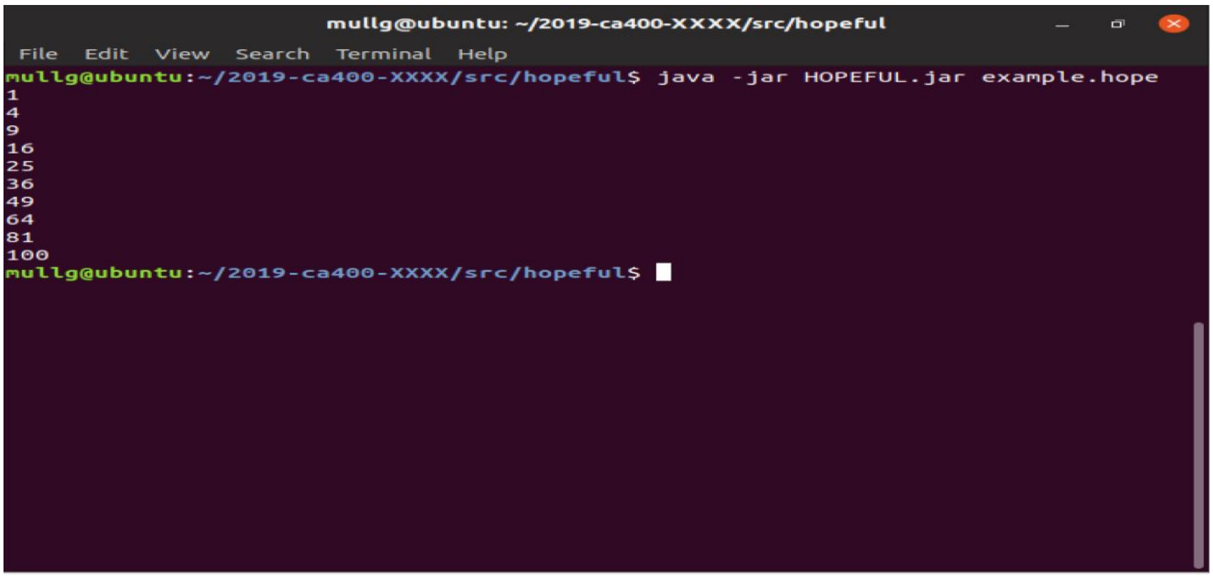
```
mullg@ubuntu:~/2019-ca400-XXXX/src/hopeful$ java -jar HOPEFUL.jar example.hope
pass
mullg@ubuntu:~/2019-ca400-XXXX/src/hopeful$
```

Hopeful program that prints the square of a number from 1 up to some integer n:



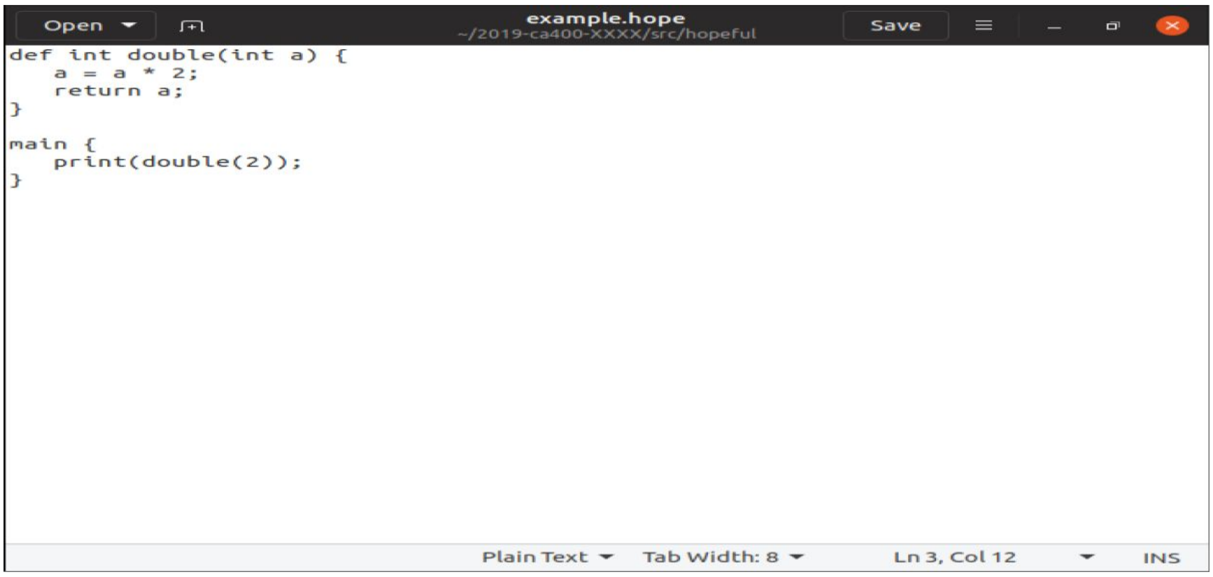
```
int n;
int i;
n = 10;
i = 1;
while(i < n) {
    print(i * i);
    i = i + 1;
}
```

Execution of above program:


mullg@ubuntu: ~/2019-ca400-XXXX/src/hopeful
File Edit View Search Terminal Help

```
mullg@ubuntu:~/2019-ca400-XXXX/src/hopeful$ java -jar HOPEFUL.jar example.hope
1
4
9
16
25
36
49
64
81
100
mullg@ubuntu:~/2019-ca400-XXXX/src/hopeful$ 
```

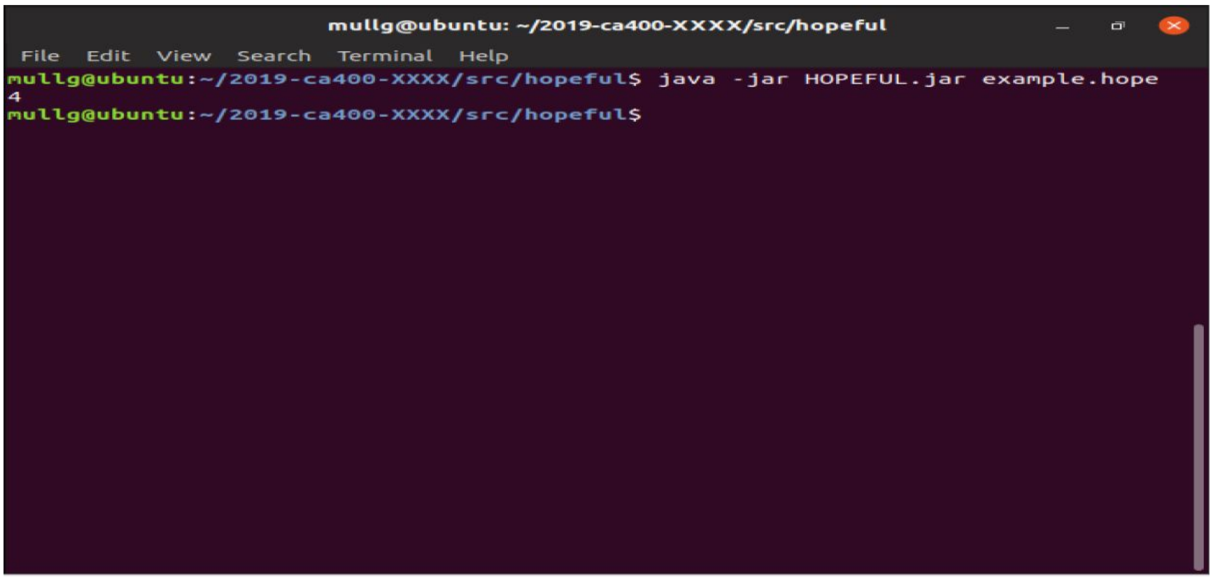
Hopeful program that contains a function that takes an integer and doubles it:



```
def int double(int a) {
    a = a * 2;
    return a;
}

main {
    print(double(2));
}
```

Execution of the above program:


mullg@ubuntu: ~/2019-ca400-XXXX/src/hopeful
File Edit View Search Terminal Help

```
mullg@ubuntu:~/2019-ca400-XXXX/src/hopeful$ java -jar HOPEFUL.jar example.hope
4
mullg@ubuntu:~/2019-ca400-XXXX/src/hopeful$
```