The client will perform the following:

1) The client will read in 3 or 4 arguments:
    a) IP address of server
    b) Port of server
    c) Mode(0: turn on and set color, 1: change color, 2: Check status, 3: turn off)
    d) Color(If it applies. Eg: red, blue, green, yellow etc….)
2) Check if arguments are valid (e.g: mode is 1 or 0 but no color was provided)
3) Wait for a response using a 1 second timeout period
    a) If a response arrives, print out the response given
    b) If no response is given print a message saying the bulb is not working and exit the program.

The server will perform the following:

1) The server will read in 2 arguments:
    a) IP address of server
    b) Port of server
2) Light bulb is off with color none when the server starts.
3) Wait for a request to be made.
4) Perform given action.(turn on or off and set color, change color or check status)
5) If a color was provided check if it is a valid color from a given set of colors(Return an error if it color is not valid).
6) If bulb is already on and mode 0 is picked, change the color and leave bulb on.
7) If bulb is already off and mode 3 is picked, leave the bulb off.
8) If mode 1 is selected and bulb is off, return an error saying the bulb is off.
9) Return a message saying the action performed if it was successful.

Valid colors are: red, blue, green, white, yellow, orange, purple, pink

Test cases:

1) Turn light on and set color
2) Change color
3) Check status
4) Turn light off
5) Turn light on and set color with light on
6) Change color to non valid color
7) Missing color argument for mode 0 and 1
8) Change color on off lightbulb

Message Format:

Request:

```
0                1                2                  3                    4 (bytes)
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| Message Type (1)               |        Mode(0-3)                  |
-----------------------------------------------------------------------------------------------
|Color length(e.g: blue = 4)     |        Error code(0)              |
-----------------------------------------------------------------------------------------------
//               Color(none, red, blue, green, etc…)                //
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Response:

```
0                1                2                  3                    4 (bytes)
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| Message Type (2)               |        Mode(0-3)                  |
-----------------------------------------------------------------------------------------------
|Message length(e.g 18)          |        Error code(0 or 1)         |
-----------------------------------------------------------------------------------------------
//               Return message(e.g “Color is not valid”)           //
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Message type(16 bits): 1 on request, 2 on response
Mode(16 bits): 0 turn light on and set color, 1 change color, 2 check status, 3 turn off
Color length(16 bits): Length of the color string being sent ex: 4 for “blue”, 3 for “red”.
Message length(16 bits): Length of the message string returned e.g: 72 for “Color could not be changed to magenta since magenta is not a valid color”.
Error code(16 bits): Always 0 in request. 0 in response if there was no error, 1 if there was an error.
Color(variable length): “none” if the mode selected is either 2 or 3. Otherwise, a valid color from the list of colors.
Return message(variable length): Message saying what action was performed or if there was an error performing an action.

Test Output

Server example:

$ python3 server-bulb.py 127.0.0.1 9000

Test case 1(turn lightbulb on and set color):

Client example:

*Light is off

$ python3 client-bulb.py 127.0.0.1 9000 0 red

```
Sending request to 127.0.0.1, 9000:
Mode: 0
Color length: 3
Color: red

Received response from 127.0.0.1, 9000:
Error code: 0 (No errors)
Message length: 44
Message: Light was turned on and color was set to red
```

Test case 2(change color):

Client example:

*Light is on

```
$ python3 client-bulb.py 127.0.0.1 9000 1 orange
Sending request to 127.0.0.1, 9000:
Mode: 1
Color length: 6
Color: orange

Received response from 127.0.0.1, 9000:
Error code: 0 (No errors)
Message length: 29
Message: Light color changed to orange
```

Test case 3(check status):

Client example:

*Light is on and red

```
$ python3 client-bulb.py 127.0.0.1 9000 2
Sending request to 127.0.0.1, 9000:
Mode: 2
Color length: 4
Color: none

Received response from 127.0.0.1, 9000:
Error code: 0 (No errors)
Message length: 35
Message: Light is on and color is set to red
```

Test case 4(turn off):

Client example:

*Light is on

```
$ python3 client-bulb.py 127.0.0.1 9000 3
Sending request to 127.0.0.1, 9000:
Mode: 3
```

```
Color length: 4
Color: none

Received response from 127.0.0.1, 9000:
Error code: 0 (No errors)
Message length: 25
Message: Light has been turned off
```

Test case 5(turn on and set color with light on):

Client example:

*Light is on

```
$ python3 client-bulb.py 127.0.0.1 9000 0 pink
Sending request to 127.0.0.1, 9000:
Mode: 0
Color length: 4
Color: pink

Received response from 127.0.0.1, 9000:
Error code: 0 (No errors)
Message length: 27
Message: Light color changed to pink
```

Test case 6(change color to non valid color):

Client example:

*Light is on

```
$ python3 client-bulb.py 127.0.0.1 9000 1 magenta
Sending request to 127.0.0.1, 9000:
Mode: 1
Color length: 7
Color: magenta

Received response from 127.0.0.1, 9000:
Error code: 1 (error)
Message length: 28
Message: Magenta is not a valid color
```

Test case 7(missing color argument):

Client example:

*Light is on

```
$ python3 client-bulb.py 127.0.0.1 9000 0
Missing color argument
```

Test case 8(change color on off lightbulb):

Client example:

```
$ python3 client-bulb.py 127.0.0.1 9000 1 green
Sending request to 127.0.0.1, 9000:
Mode: 1
Color length: 5
Color: green

Received response from 127.0.0.1, 9000:
Error code: 1 (error)
Message length: 35
Message: Can’t change color on off lightbulb
```