Ardian Ferdy Firmansyah

In [54]:

```
#pip install speedtest-cli
```

In [2]:

```
import datetime
import csv
import subprocess
```

In [3]:

```
date_time = datetime.datetime.now()
print(date_time, type(date_time))
```

```
2021-08-28 21:39:52.276371 <class 'datetime.datetime'>
```

In [4]:

```
date_time.strftime('%a, %d %b %Y %H:%M:%S')
```

Out[4]:

```
'Sat, 28 Aug 2021 21:39:52'
```

In [5]:

```
date_time = datetime.datetime.now().strftime("%Y-%m-%d %H:%M:%S")
```

In [6]:

```
# Code cell 6
# This string contains the command line to interface with speedtest.net
speedtest_cmd = "speedtest-cli --simple"
# Execute the process
process = subprocess.Popen(speedtest_cmd.split(), stdout=subprocess.PIPE)
# Collect the command output
process_output = process.communicate()[0]
```

In [7]:

```
# Code cell 7
print(process_output, type(process_output))
```

```
b'Ping: 23.396 ms\r\nDownload: 23.33 Mbit/s\r\nUpload: 11.27 Mbit/s\r\n' <class 'bytes'>
```

In [8]:

```
# Code cell 8
# Store the time at which the speedtest was executed
date_time = datetime.datetime.now().strftime("%Y-%m-%d %H:%M:%S")
process_output = process_output.split()
process_output.append(date_time)
print(process_output, type(process_output))
```

```
[b'Ping:', b'23.396', b'ms', b'Download:', b'23.33', b'Mbit/s', b'Upload:', b'11.27', b'M
bit/s', '2021-08-28 21:40:15'] <class 'list'>
```

In [9]:

```
# Code cell 9
# function to excute the speed test
def speedtest():
    # We need to store the time at which the speedtest was executed
```

```
    date_time = datetime.datetime.now().strftime("%Y-%m-%d %H:%M:%S")
    # This is a string that contains what we would write on the command line
    #to interface with speedtest.net
    speedtest_cmd = "speedtest-cli --simple"
    # We now execute the process:
    process = subprocess.Popen(speedtest_cmd.split(), stdout=subprocess.PIPE)
    process_output = process.communicate()[0]
    process_output = process_output.split()
    # and we add the date and time
    process_output.append(date_time)
    return process_output
```

In [10]:

```
print(speedtest())
```

```
[b'Ping:', b'26.651', b'ms', b'Download:', b'34.83', b'Mbit/s', b'Upload:', b'11.16', b'M
bit/s', '2021-08-28 21:40:15']
```

In [11]:

```
# Code cell 11
with open("./tmp/test.txt",'w') as f:
    f.write('test_msg')
```

In [12]:

```
# Code cell 12
# !cat C:/Users/Ardian/Music/tmp/test.txt
```

In [13]:

```
with open("./tmp/test.txt",'r') as f:
   str = f.read()
print(str)
```

```
test_msg
```

In [14]:

```
# Code cell 14
# function to save data to csv
def save_to_csv(data, filename):
    try:
        # If the file exists, we want to append a new line to it, with the
        #results of the current experiment
        with open(filename + '.csv', 'a') as f:
            wr = csv.writer(f)
            wr.writerow(data)
    except:
        # If it does not exist, create the file first
        with open(filename + '.csv', 'w') as f:
            # Hint: This is similar to appending new lines to a file.
            # Create a csv writer object
            wr = csv.writer(f)
            wr.writerow(data)
            # Save (write) to file
            f.write(wr)
            # ADD CODE HERE
```

In [15]:

```
def print_from_csv(filename):
    with open(filename + '.csv', 'r') as f:
        re = csv.reader(f)
        for row in re:
            print(row)
```

In [16]:

```
for i in range(5):
```

```
    speedtest_output = speedtest()
    print('Test number {}'.format(i))
    print(speedtest_output)
    save_to_csv(speedtest_output, './tmp/rpi_data_test')
```

```
Test number 0
[b'Ping:', b'23.253', b'ms', b'Download:', b'25.51', b'Mbit/s', b'Upload:', b'10.95', b'M
bit/s', '2021-08-28 21:40:39']
Test number 1
[b'Ping:', b'24.416', b'ms', b'Download:', b'31.83', b'Mbit/s', b'Upload:', b'9.61', b'Mb
it/s', '2021-08-28 21:41:02']
Test number 2
[b'Ping:', b'26.77', b'ms', b'Download:', b'41.55', b'Mbit/s', b'Upload:', b'10.12', b'Mb
it/s', '2021-08-28 21:41:26']
Test number 3
[b'Ping:', b'24.36', b'ms', b'Download:', b'39.97', b'Mbit/s', b'Upload:', b'9.41', b'Mbi
t/s', '2021-08-28 21:41:49']
Test number 4
[b'Ping:', b'32.413', b'ms', b'Download:', b'32.56', b'Mbit/s', b'Upload:', b'9.03', b'Mb
it/s', '2021-08-28 21:42:14']
```

In [17]:

```
print_from_csv('./tmp/rpi_data_test')
```

```
["b'Ping:'", "b'23.253'", "b'ms'", "b'Download:'", "b'25.51'", "b'Mbit/s'", "b'Upload:'",
"b'10.95'", "b'Mbit/s'", '2021-08-28 21:40:39']
[]
["b'Ping:'", "b'24.416'", "b'ms'", "b'Download:'", "b'31.83'", "b'Mbit/s'", "b'Upload:'",
"b'9.61'", "b'Mbit/s'", '2021-08-28 21:41:02']
[]
["b'Ping:'", "b'26.77'", "b'ms'", "b'Download:'", "b'41.55'", "b'Mbit/s'", "b'Upload:'",
"b'10.12'", "b'Mbit/s'", '2021-08-28 21:41:26']
[]
["b'Ping:'", "b'24.36'", "b'ms'", "b'Download:'", "b'39.97'", "b'Mbit/s'", "b'Upload:'",
"b'9.41'", "b'Mbit/s'", '2021-08-28 21:41:49']
[]
["b'Ping:'", "b'32.413'", "b'ms'", "b'Download:'", "b'32.56'", "b'Mbit/s'", "b'Upload:'",
"b'9.03'", "b'Mbit/s'", '2021-08-28 21:42:14']
[]
```

In [18]:

```
for i in range(100):
    speedtest_output = speedtest()
    print ('Test number: {}'.format(i))
    print (speedtest_output)
    save_to_csv(speedtest_output, './tmp/rpi_data')
```

```
Test number: 0
[b'Ping:', b'24.849', b'ms', b'Download:', b'31.79', b'Mbit/s', b'Upload:', b'5.01', b'Mb
it/s', '2021-08-28 21:42:37']
Test number: 1
[b'Ping:', b'31.924', b'ms', b'Download:', b'27.73', b'Mbit/s', b'Upload:', b'8.72', b'Mb
it/s', '2021-08-28 21:43:03']
Test number: 2
[b'Ping:', b'21.94', b'ms', b'Download:', b'37.42', b'Mbit/s', b'Upload:', b'9.86', b'Mbi
t/s', '2021-08-28 21:43:27']
Test number: 3
[b'Ping:', b'30.006', b'ms', b'Download:', b'25.00', b'Mbit/s', b'Upload:', b'8.22', b'Mb
it/s', '2021-08-28 21:43:51']
Test number: 4
[b'Ping:', b'26.009', b'ms', b'Download:', b'40.79', b'Mbit/s', b'Upload:', b'10.45', b'M
bit/s', '2021-08-28 21:44:17']
Test number: 5
[b'Ping:', b'23.503', b'ms', b'Download:', b'39.39', b'Mbit/s', b'Upload:', b'9.90', b'Mb
it/s', '2021-08-28 21:44:40']
Test number: 6
[b'Ping:', b'23.912', b'ms', b'Download:', b'41.64', b'Mbit/s', b'Upload:', b'10.34', b'M
bit/s', '2021-08-28 21:45:03']
Test number: 7
[b'Ping:', b'26.458', b'ms', b'Download:', b'41.45', b'Mbit/s', b'Upload:', b'10.45', b'M
```

```
bit/s', '2021-08-28 21:45:27']
Test number: 8
[b'Ping:', b'32.969', b'ms', b'Download:', b'35.24', b'Mbit/s', b'Upload:', b'9.24', b'Mb
it/s', '2021-08-28 21:45:51']
Test number: 9
[b'Ping:', b'23.863', b'ms', b'Download:', b'38.61', b'Mbit/s', b'Upload:', b'9.60', b'Mb
it/s', '2021-08-28 21:46:14']
Test number: 10
[b'Ping:', b'24.196', b'ms', b'Download:', b'35.65', b'Mbit/s', b'Upload:', b'10.91', b'M
bit/s', '2021-08-28 21:46:37']
Test number: 11
[b'Ping:', b'24.246', b'ms', b'Download:', b'41.81', b'Mbit/s', b'Upload:', b'9.60', b'Mb
it/s', '2021-08-28 21:47:00']
Test number: 12
[b'Ping:', b'24.153', b'ms', b'Download:', b'35.08', b'Mbit/s', b'Upload:', b'10.64', b'M
bit/s', '2021-08-28 21:47:23']
Test number: 13
[b'Ping:', b'24.263', b'ms', b'Download:', b'38.93', b'Mbit/s', b'Upload:', b'9.92', b'Mb
it/s', '2021-08-28 21:47:46']
Test number: 14
[b'Ping:', b'26.071', b'ms', b'Download:', b'28.47', b'Mbit/s', b'Upload:', b'10.74', b'M
bit/s', '2021-08-28 21:48:10']
Test number: 15
[b'Ping:', b'21.047', b'ms', b'Download:', b'28.40', b'Mbit/s', b'Upload:', b'10.92', b'M
bit/s', '2021-08-28 21:48:35']
Test number: 16
[b'Ping:', b'26.14', b'ms', b'Download:', b'37.20', b'Mbit/s', b'Upload:', b'9.29', b'Mbi
t/s', '2021-08-28 21:48:58']
Test number: 17
[b'Ping:', b'31.434', b'ms', b'Download:', b'24.03', b'Mbit/s', b'Upload:', b'12.08', b'M
bit/s', '2021-08-28 21:49:22']
Test number: 18
[b'Ping:', b'26.288', b'ms', b'Download:', b'41.91', b'Mbit/s', b'Upload:', b'10.41', b'M
bit/s', '2021-08-28 21:49:45']
Test number: 19
[b'Ping:', b'21.51', b'ms', b'Download:', b'34.48', b'Mbit/s', b'Upload:', b'9.76', b'Mbi
t/s', '2021-08-28 21:50:08']
Test number: 20
[b'Ping:', b'18.64', b'ms', b'Download:', b'35.78', b'Mbit/s', b'Upload:', b'9.25', b'Mbi
t/s', '2021-08-28 21:50:32']
Test number: 21
[b'Ping:', b'24.262', b'ms', b'Download:', b'37.56', b'Mbit/s', b'Upload:', b'10.28', b'M
bit/s', '2021-08-28 21:50:55']
Test number: 22
[b'Ping:', b'22.312', b'ms', b'Download:', b'32.75', b'Mbit/s', b'Upload:', b'8.25', b'Mb
it/s', '2021-08-28 21:51:18']
Test number: 23
[b'Ping:', b'23.771', b'ms', b'Download:', b'28.85', b'Mbit/s', b'Upload:', b'8.95', b'Mb
it/s', '2021-08-28 21:51:43']
Test number: 24
[b'Ping:', b'22.585', b'ms', b'Download:', b'22.45', b'Mbit/s', b'Upload:', b'8.23', b'Mb
it/s', '2021-08-28 21:52:05']
Test number: 25
[b'Ping:', b'18.789', b'ms', b'Download:', b'14.30', b'Mbit/s', b'Upload:', b'2.46', b'Mb
it/s', '2021-08-28 21:52:29']
Test number: 26
['2021-08-28 21:53:02']
Test number: 27
[b'Ping:', b'22.044', b'ms', b'Download:', b'5.30', b'Mbit/s', b'Upload:', b'0.63', b'Mbi
t/s', '2021-08-28 21:53:12']
Test number: 28
['2021-08-28 21:53:52']
Test number: 29
[b'Ping:', b'29.628', b'ms', b'Download:', b'17.98', b'Mbit/s', b'Upload:', b'3.72', b'Mb
it/s', '2021-08-28 21:54:10']
Test number: 30
[b'Ping:', b'43.949', b'ms', b'Download:', b'30.79', b'Mbit/s', b'Upload:', b'9.56', b'Mb
it/s', '2021-08-28 21:54:34']
Test number: 31
[b'Ping:', b'19.19', b'ms', b'Download:', b'26.83', b'Mbit/s', b'Upload:', b'9.04', b'Mbi
t/s', '2021-08-28 21:54:59']
Test number: 32
```

```
[b'Ping:', b'23.237', b'ms', b'Download:', b'24.05', b'Mbit/s', b'Upload:', b'11.01', b'M
bit/s', '2021-08-28 21:55:23']
Test number: 33
[b'Ping:', b'23.81', b'ms', b'Download:', b'33.08', b'Mbit/s', b'Upload:', b'10.20', b'Mb
it/s', '2021-08-28 21:55:48']
Test number: 34
[b'Ping:', b'23.726', b'ms', b'Download:', b'42.60', b'Mbit/s', b'Upload:', b'9.95', b'Mb
it/s', '2021-08-28 21:56:11']
Test number: 35
[b'Ping:', b'21.627', b'ms', b'Download:', b'37.16', b'Mbit/s', b'Upload:', b'10.13', b'M
bit/s', '2021-08-28 21:56:36']
Test number: 36
[b'Ping:', b'25.547', b'ms', b'Download:', b'14.57', b'Mbit/s', b'Upload:', b'10.73', b'M
bit/s', '2021-08-28 21:57:02']
Test number: 37
[b'Ping:', b'22.198', b'ms', b'Download:', b'14.66', b'Mbit/s', b'Upload:', b'10.21', b'M
bit/s', '2021-08-28 21:57:25']
Test number: 38
[b'Ping:', b'23.755', b'ms', b'Download:', b'31.21', b'Mbit/s', b'Upload:', b'9.64', b'Mb
it/s', '2021-08-28 21:57:48']
Test number: 39
[b'Ping:', b'14.469', b'ms', b'Download:', b'35.67', b'Mbit/s', b'Upload:', b'9.71', b'Mb
it/s', '2021-08-28 21:58:12']
Test number: 40
[b'Ping:', b'23.079', b'ms', b'Download:', b'34.64', b'Mbit/s', b'Upload:', b'9.64', b'Mb
it/s', '2021-08-28 21:58:36']
Test number: 41
[b'Ping:', b'23.786', b'ms', b'Download:', b'29.83', b'Mbit/s', b'Upload:', b'10.54', b'M
bit/s', '2021-08-28 21:59:00']
Test number: 42
[b'Ping:', b'22.878', b'ms', b'Download:', b'41.29', b'Mbit/s', b'Upload:', b'9.16', b'Mb
it/s', '2021-08-28 21:59:23']
Test number: 43
[b'Ping:', b'24.16', b'ms', b'Download:', b'32.31', b'Mbit/s', b'Upload:', b'10.05', b'Mb
it/s', '2021-08-28 21:59:46']
Test number: 44
['2021-08-28 22:00:10']
Test number: 45
['2021-08-28 22:00:12']
Test number: 46
[b'Ping:', b'29.34', b'ms', b'Download:', b'27.87', b'Mbit/s', b'Upload:', b'9.69', b'Mbi
t/s', '2021-08-28 22:00:15']
Test number: 47
[b'Ping:', b'23.955', b'ms', b'Download:', b'32.86', b'Mbit/s', b'Upload:', b'10.14', b'M
bit/s', '2021-08-28 22:00:38']
Test number: 48
[b'Ping:', b'22.461', b'ms', b'Download:', b'26.35', b'Mbit/s', b'Upload:', b'11.56', b'M
bit/s', '2021-08-28 22:01:02']
Test number: 49
[b'Ping:', b'20.456', b'ms', b'Download:', b'38.36', b'Mbit/s', b'Upload:', b'10.30', b'M
bit/s', '2021-08-28 22:01:25']
Test number: 50
[b'Ping:', b'22.059', b'ms', b'Download:', b'29.05', b'Mbit/s', b'Upload:', b'9.86', b'Mb
it/s', '2021-08-28 22:01:50']
Test number: 51
[b'Ping:', b'24.376', b'ms', b'Download:', b'38.21', b'Mbit/s', b'Upload:', b'10.44', b'M
bit/s', '2021-08-28 22:02:13']
Test number: 52
[b'Ping:', b'23.933', b'ms', b'Download:', b'32.42', b'Mbit/s', b'Upload:', b'10.66', b'M
bit/s', '2021-08-28 22:02:36']
Test number: 53
[b'Ping:', b'23.865', b'ms', b'Download:', b'27.23', b'Mbit/s', b'Upload:', b'9.36', b'Mb
it/s', '2021-08-28 22:02:59']
Test number: 54
[b'Ping:', b'26.797', b'ms', b'Download:', b'34.14', b'Mbit/s', b'Upload:', b'9.85', b'Mb
it/s', '2021-08-28 22:03:23']
Test number: 55
[b'Ping:', b'23.987', b'ms', b'Download:', b'40.70', b'Mbit/s', b'Upload:', b'9.72', b'Mb
it/s', '2021-08-28 22:03:46']
Test number: 56
[b'Ping:', b'21.695', b'ms', b'Download:', b'31.89', b'Mbit/s', b'Upload:', b'9.71', b'Mb
it/s', '2021-08-28 22:04:09']
```

```
Test number: 57
[b'Ping:', b'25.761', b'ms', b'Download:', b'39.67', b'Mbit/s', b'Upload:', b'9.45', b'Mb
it/s', '2021-08-28 22:04:32']
Test number: 58
[b'Ping:', b'24.728', b'ms', b'Download:', b'39.92', b'Mbit/s', b'Upload:', b'10.66', b'M
bit/s', '2021-08-28 22:04:55']
Test number: 59
[b'Ping:', b'24.035', b'ms', b'Download:', b'38.14', b'Mbit/s', b'Upload:', b'9.66', b'Mb
it/s', '2021-08-28 22:05:18']
Test number: 60
[b'Ping:', b'23.893', b'ms', b'Download:', b'40.42', b'Mbit/s', b'Upload:', b'8.34', b'Mb
it/s', '2021-08-28 22:05:41']
Test number: 61
[b'Ping:', b'29.217', b'ms', b'Download:', b'21.73', b'Mbit/s', b'Upload:', b'9.83', b'Mb
it/s', '2021-08-28 22:06:05']
Test number: 62
[b'Ping:', b'28.032', b'ms', b'Download:', b'28.32', b'Mbit/s', b'Upload:', b'11.03', b'M
bit/s', '2021-08-28 22:06:28']
Test number: 63
[b'Ping:', b'23.853', b'ms', b'Download:', b'20.22', b'Mbit/s', b'Upload:', b'8.92', b'Mb
it/s', '2021-08-28 22:06:52']
Test number: 64
[b'Ping:', b'25.668', b'ms', b'Download:', b'31.62', b'Mbit/s', b'Upload:', b'9.74', b'Mb
it/s', '2021-08-28 22:07:15']
Test number: 65
[b'Ping:', b'17.368', b'ms', b'Download:', b'27.04', b'Mbit/s', b'Upload:', b'7.77', b'Mb
it/s', '2021-08-28 22:07:38']
Test number: 66
[b'Ping:', b'23.698', b'ms', b'Download:', b'27.80', b'Mbit/s', b'Upload:', b'9.20', b'Mb
it/s', '2021-08-28 22:08:01']
Test number: 67
[b'Ping:', b'26.878', b'ms', b'Download:', b'42.95', b'Mbit/s', b'Upload:', b'10.00', b'M
bit/s', '2021-08-28 22:08:24']
Test number: 68
[b'Ping:', b'18.455', b'ms', b'Download:', b'44.84', b'Mbit/s', b'Upload:', b'9.58', b'Mb
it/s', '2021-08-28 22:08:47']
Test number: 69
[b'Ping:', b'23.042', b'ms', b'Download:', b'39.46', b'Mbit/s', b'Upload:', b'9.76', b'Mb
it/s', '2021-08-28 22:09:10']
Test number: 70
[b'Ping:', b'36.792', b'ms', b'Download:', b'34.25', b'Mbit/s', b'Upload:', b'10.87', b'M
bit/s', '2021-08-28 22:09:34']
Test number: 71
[b'Ping:', b'23.946', b'ms', b'Download:', b'39.54', b'Mbit/s', b'Upload:', b'10.69', b'M
bit/s', '2021-08-28 22:09:58']
Test number: 72
[b'Ping:', b'30.988', b'ms', b'Download:', b'33.20', b'Mbit/s', b'Upload:', b'9.54', b'Mb
it/s', '2021-08-28 22:10:21']
Test number: 73
[b'Ping:', b'28.596', b'ms', b'Download:', b'42.84', b'Mbit/s', b'Upload:', b'10.07', b'M
bit/s', '2021-08-28 22:10:45']
Test number: 74
[b'Ping:', b'23.817', b'ms', b'Download:', b'36.52', b'Mbit/s', b'Upload:', b'10.41', b'M
bit/s', '2021-08-28 22:11:08']
Test number: 75
[b'Ping:', b'26.171', b'ms', b'Download:', b'27.22', b'Mbit/s', b'Upload:', b'10.23', b'M
bit/s', '2021-08-28 22:11:32']
Test number: 76
[b'Ping:', b'27.331', b'ms', b'Download:', b'25.81', b'Mbit/s', b'Upload:', b'10.23', b'M
bit/s', '2021-08-28 22:11:55']
Test number: 77
[b'Ping:', b'33.99', b'ms', b'Download:', b'25.84', b'Mbit/s', b'Upload:', b'9.03', b'Mbi
t/s', '2021-08-28 22:12:19']
Test number: 78
[b'Ping:', b'23.907', b'ms', b'Download:', b'26.41', b'Mbit/s', b'Upload:', b'11.12', b'M
bit/s', '2021-08-28 22:12:43']
Test number: 79
[b'Ping:', b'38.093', b'ms', b'Download:', b'29.96', b'Mbit/s', b'Upload:', b'11.54', b'M
bit/s', '2021-08-28 22:13:05']
Test number: 80
[b'Ping:', b'19.215', b'ms', b'Download:', b'42.65', b'Mbit/s', b'Upload:', b'10.61', b'M
bit/s', '2021-08-28 22:13:30']
```

```
Test number: 81
[b'Ping:', b'26.521', b'ms', b'Download:', b'35.33', b'Mbit/s', b'Upload:', b'8.80', b'Mb
it/s', '2021-08-28 22:13:53']
Test number: 82
[b'Ping:', b'20.844', b'ms', b'Download:', b'33.33', b'Mbit/s', b'Upload:', b'10.31', b'M
bit/s', '2021-08-28 22:14:17']
Test number: 83
[b'Ping:', b'19.448', b'ms', b'Download:', b'28.52', b'Mbit/s', b'Upload:', b'10.29', b'M
bit/s', '2021-08-28 22:14:39']
Test number: 84
[b'Ping:', b'24.026', b'ms', b'Download:', b'44.82', b'Mbit/s', b'Upload:', b'9.85', b'Mb
it/s', '2021-08-28 22:15:04']
Test number: 85
[b'Ping:', b'27.267', b'ms', b'Download:', b'32.72', b'Mbit/s', b'Upload:', b'10.55', b'M
bit/s', '2021-08-28 22:15:27']
Test number: 86
[b'Ping:', b'26.368', b'ms', b'Download:', b'41.29', b'Mbit/s', b'Upload:', b'11.48', b'M
bit/s', '2021-08-28 22:15:50']
Test number: 87
[b'Ping:', b'24.614', b'ms', b'Download:', b'29.70', b'Mbit/s', b'Upload:', b'10.98', b'M
bit/s', '2021-08-28 22:16:13']
Test number: 88
[b'Ping:', b'24.338', b'ms', b'Download:', b'39.99', b'Mbit/s', b'Upload:', b'10.04', b'M
bit/s', '2021-08-28 22:16:37']
Test number: 89
[b'Ping:', b'25.079', b'ms', b'Download:', b'38.72', b'Mbit/s', b'Upload:', b'9.58', b'Mb
it/s', '2021-08-28 22:17:00']
Test number: 90
[b'Ping:', b'21.981', b'ms', b'Download:', b'36.25', b'Mbit/s', b'Upload:', b'9.59', b'Mb
it/s', '2021-08-28 22:17:24']
Test number: 91
[b'Ping:', b'23.681', b'ms', b'Download:', b'43.97', b'Mbit/s', b'Upload:', b'9.84', b'Mb
it/s', '2021-08-28 22:17:47']
Test number: 92
[b'Ping:', b'21.25', b'ms', b'Download:', b'34.57', b'Mbit/s', b'Upload:', b'9.90', b'Mbi
t/s', '2021-08-28 22:18:09']
Test number: 93
[b'Ping:', b'24.116', b'ms', b'Download:', b'39.84', b'Mbit/s', b'Upload:', b'10.78', b'M
bit/s', '2021-08-28 22:18:33']
Test number: 94
[b'Ping:', b'23.259', b'ms', b'Download:', b'27.24', b'Mbit/s', b'Upload:', b'9.39', b'Mb
it/s', '2021-08-28 22:18:56']
Test number: 95
[b'Ping:', b'32.478', b'ms', b'Download:', b'30.56', b'Mbit/s', b'Upload:', b'12.02', b'M
bit/s', '2021-08-28 22:19:19']
Test number: 96
[b'Ping:', b'30.824', b'ms', b'Download:', b'34.93', b'Mbit/s', b'Upload:', b'10.78', b'M
bit/s', '2021-08-28 22:19:43']
Test number: 97
[b'Ping:', b'23.87', b'ms', b'Download:', b'36.36', b'Mbit/s', b'Upload:', b'11.10', b'Mb
it/s', '2021-08-28 22:20:06']
Test number: 98
[b'Ping:', b'18.891', b'ms', b'Download:', b'39.78', b'Mbit/s', b'Upload:', b'10.51', b'M
bit/s', '2021-08-28 22:20:29']
Test number: 99
[b'Ping:', b'23.792', b'ms', b'Download:', b'38.98', b'Mbit/s', b'Upload:', b'9.05', b'Mb
it/s', '2021-08-28 22:20:53']
```

In [19]:

```
# Code cell 19
import datetime
import csv
import pandas as pd
# NumPy is a library that adds support for large, multi-dimensional arrays and matrices
# along with high-level mathematical functions to operate on these arrays
import numpy as np
```

In [38]:

```
data_file = './Data/rpi_data_long.csv'
```

In [39]:

```
#!head -n 5 ./Data/rpi_data_long.csv
```

In [40]:

```
# Code cell 22
column_names = [ 'Type A', 'Measure A', 'Units A',
                 'Type B', 'Measure B', 'Units B',
                 'Type C', 'Measure C', 'Units C',
                 'Datetime']
```

In [41]:

```
# Code cell 23
with open(data_file, 'r') as f:
    df_redundant = pd.read_csv(f, names = column_names)
```

In [42]:

```
# Code cell 24
# You can specify the number of rows you want to print to screen:
# you do so passing the number as an argument to the function
# (e.g., head(10))
df_redundant.head()
```

Out[42]:

	Type A	Measure A	Units A	Type B	Measure B	Units B	Type C	Measure C	Units C	Datetime
0	b'Ping:'	b'24.849'	b'ms'	b'Download:'	b'31.79'	b'Mbit/s'	b'Upload:'	b'5.01'	b'Mbit/s'	2021-08-28 21:42:37
1	b'Ping:'	b'31.924'	b'ms'	b'Download:'	b'27.73'	b'Mbit/s'	b'Upload:'	b'8.72'	b'Mbit/s'	2021-08-28 21:43:03
2	b'Ping:'	b'21.94'	b'ms'	b'Download:'	b'37.42'	b'Mbit/s'	b'Upload:'	b'9.86'	b'Mbit/s'	2021-08-28 21:43:27
3	b'Ping:'	b'30.006'	b'ms'	b'Download:'	b'25.00'	b'Mbit/s'	b'Upload:'	b'8.22'	b'Mbit/s'	2021-08-28 21:43:51
4	b'Ping:'	b'26.009'	b'ms'	b'Download:'	b'40.79'	b'Mbit/s'	b'Upload:'	b'10.45'	b'Mbit/s'	2021-08-28 21:44:17

In [43]:

```
# Code cell 25
df_compact = df_redundant.copy()
```

In [44]:

```
# Code cell 26
df_compact.rename(columns={'Measure A':'Ping (ms)',
                           'Measure B': 'Download (Mbit/s)',
                           'Measure C': 'Upload (Mbit/s)'}, inplace=True)
df_compact.head(3)
```

Out[44]:

	Type A	Ping (ms)	Units A	Type B	Download (Mbit/s)	Units B	Type C	Upload (Mbit/s)	Units C	Datetime
0	b'Ping:'	b'24.849'	b'ms'	b'Download:'	b'31.79'	b'Mbit/s'	b'Upload:'	b'5.01'	b'Mbit/s'	2021-08-28 21:42:37
1	b'Ping:'	b'31.924'	b'ms'	b'Download:'	b'27.73'	b'Mbit/s'	b'Upload:'	b'8.72'	b'Mbit/s'	2021-08-28 21:43:03
2	b'Ping:'	b'21.94'	b'ms'	b'Download:'	b'37.42'	b'Mbit/s'	b'Upload:'	b'9.86'	b'Mbit/s'	2021-08-28 21:43:27

In [45]:

```
# Code cell 27
df_compact.drop(['Type A', 'Type B', 'Type C',
         'Units A', 'Units B', 'Units C'], axis=1, inplace=True)
```

```
df_compact.head()
```

Out[45]:

	Ping (ms)	Download (Mbit/s)	Upload (Mbit/s)	Datetime
0	b'24.849'	b'31.79'	b'5.01'	2021-08-28 21:42:37
1	b'31.924'	b'27.73'	b'8.72'	2021-08-28 21:43:03
2	b'21.94'	b'37.42'	b'9.86'	2021-08-28 21:43:27
3	b'30.006'	b'25.00'	b'8.22'	2021-08-28 21:43:51
4	b'26.009'	b'40.79'	b'10.45'	2021-08-28 21:44:17

In [46]:

```
# Code cell 28
df_compact['Date'] = df_compact['Datetime'].apply(lambda dt_str: pd.to_datetime(dt_str).
date())
```

In [47]:

```
# Code cell 29
# Please note, this requires an intermediate step, because of how NaT are treated by the
time() function.
# Reference: https://github.com/pandas-dev/pandas/issues/11453
temp = df_compact['Datetime'].apply(lambda dt_str: pd.to_datetime(dt_str))
df_compact['Time'] = temp.dt.time
```

In [48]:

```
df_compact
```

Out[48]:

	Ping (ms)	Download (Mbit/s)	Upload (Mbit/s)	Datetime	Date	Time
0	b'24.849'	b'31.79'	b'5.01'	2021-08-28 21:42:37	2021-08-28	21:42:37
1	b'31.924'	b'27.73'	b'8.72'	2021-08-28 21:43:03	2021-08-28	21:43:03
2	b'21.94'	b'37.42'	b'9.86'	2021-08-28 21:43:27	2021-08-28	21:43:27
3	b'30.006'	b'25.00'	b'8.22'	2021-08-28 21:43:51	2021-08-28	21:43:51
4	b'26.009'	b'40.79'	b'10.45'	2021-08-28 21:44:17	2021-08-28	21:44:17
...	...	...	...	...	...	...
95	b'32.478'	b'30.56'	b'12.02'	2021-08-28 22:19:19	2021-08-28	22:19:19
96	b'30.824'	b'34.93'	b'10.78'	2021-08-28 22:19:43	2021-08-28	22:19:43
97	b'23.87'	b'36.36'	b'11.10'	2021-08-28 22:20:06	2021-08-28	22:20:06
98	b'18.891'	b'39.78'	b'10.51'	2021-08-28 22:20:29	2021-08-28	22:20:29
99	b'23.792'	b'38.98'	b'9.05'	2021-08-28 22:20:53	2021-08-28	22:20:53

100 rows × 6 columns

In [49]:

```
# Code cell 27
df_compact.drop(['Datetime'], axis=1, inplace=True)
```

In [50]:

```
df_compact.head(3)
```

Out[50]:

	Ping (ms)	Download (Mbit/s)	Upload (Mbit/s)	Date	Time

	Ping (ms)	Download (Mbit/s)	Upload (Mbit/s)	Date	Time
0	b'24.849'	b'31.79'	b'5.01'	2021-08-28	21:42:37
1	b'31.924'	b'27.73'	b'8.72'	2021-08-28	21:43:03
2	b'21.94'	b'37.42'	b'9.86'	2021-08-28	21:43:27

In [51]:

```
# Code cell 32
print(df_compact['Date'][0], type(df_compact['Date'][0]) )
print(df_compact['Time'][0], type(df_compact['Time'][0]) )
```

```
2021-08-28 <class 'datetime.date'>
21:42:37 <class 'datetime.time'>
```

In [52]:

```
df_compact
```

Out[52]:

	Ping (ms)	Download (Mbit/s)	Upload (Mbit/s)	Date	Time
0	b'24.849'	b'31.79'	b'5.01'	2021-08-28	21:42:37
1	b'31.924'	b'27.73'	b'8.72'	2021-08-28	21:43:03
2	b'21.94'	b'37.42'	b'9.86'	2021-08-28	21:43:27
3	b'30.006'	b'25.00'	b'8.22'	2021-08-28	21:43:51
4	b'26.009'	b'40.79'	b'10.45'	2021-08-28	21:44:17
...	...	...	...	...	...
95	b'32.478'	b'30.56'	b'12.02'	2021-08-28	22:19:19
96	b'30.824'	b'34.93'	b'10.78'	2021-08-28	22:19:43
97	b'23.87'	b'36.36'	b'11.10'	2021-08-28	22:20:06
98	b'18.891'	b'39.78'	b'10.51'	2021-08-28	22:20:29
99	b'23.792'	b'38.98'	b'9.05'	2021-08-28	22:20:53

100 rows × 5 columns

In [53]:

```
# Code cell 33
df_compact.to_csv('./Data/rpi_data_compact.csv')
```

In [ ]:

```

```