SY201 – Cyber Operations Fundamentals; Programming Assignment `02`

Port Lookup

Name: _____ Alpha: _____

Begin this assignment by making sure your repo is up to date. Change to **`~/repo201`** and type:

`git pull`

All the files required for this assignment, including an electronic version of this handout, are available in:

`~/repo201/programming/pa02`

Read this entire handout at least once before you begin your research or start coding

1. **Background**:

In this assignment you'll write a program that accepts a port number from the user and then displays some detailed information about the protocol used with that port number.

What is a port number?

"A port number is the logical address of each application or process that uses a network or the Internet to communicate. A port number uniquely identifies a network-based application on a computer. Each application / program is allocated a 16-bit integer port number. This number is assigned automatically by the Operating System (OS), manually by the user, or is set as a default for some popular applications."[1]

Start by researching some basic information about port numbers and their associated protocols. For this research, you'll visit the site maintained by the Internet Assigned Numbers Authority (IANA), as well as Wikipedia. IANA is the authoritative source for port numbers and protocol assignments, but the Wikipedia article displays the IANA data in an easy-to-read and search format.

Gather information on various ports by completing these steps:

[1] Techopedia: https://www.techopedia.com/definition/15702/port-number

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a. Port numbers range from `0` to `65535`. IANA breaks that range into the following three categories: *System*, *User*, or *Dynamic*. Visit the IANA site at the link shown below and complete Table 1 on page 3 of this handout.

   https://www.iana.org/assignments/service-names-port-numbers/service-names-port-numbers.xhtml

b. Next, visit this Wikipedia page:

   https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers

   Here you'll find information about port numbers and protocols. You will likely need to follow the links and read the descriptions of the protocols to determine if the protocol is secure or not. Secure protocols can sometimes be identified by the use of the word *secure* in the protocol name, or indications that the protocol uses encryption. Protocols that are not secure can sometimes be identified by: no indications that encryption is used, protocols used for games (generally), and a separate port number is listed for secure version of the protocol.

   Using the Wikipedia page, complete Table 2 on page 3 of this handout.

   Note: The categories shown in Table 2 are specific to SY201 and group the protocols according to their intended use.

   - *comms*: Communication between end users.
   - *data*: Data transfers between systems.
   - *game*: Online game service.
   - *ops*: System configuration, coordination, or event logging.
   - *remote*: Services that provide remote access to a system.

Port Lookup

Range Name	Low Port Number	High Port Number
System		
User		
Dynamic		

Table 1. IANA Port Categories

Port	Acronym / Short Name	Protocol (Full Name)	Category	Secure? (Yes / No)
20			data	
22			remote	
23			remote	
25			comms	
53			ops	
445	SMB		data	Yes
514	Syslog		ops	
666			game	
3074			game	
6665-6669			comms	

Table 2. A Sampling of Port Numbers

2. **Design Requirements:**

Think carefully about how you want to approach this assignment before you start coding. It's rarely effective when you open up your editor and just start typing. Think first about the kinds of variables you will use, their names, and how the different sections of your code will interact. Take out a piece of paper and pencil and sketch out the major components of your design (collect input, validate input, perform calculations, present results, etc.). Draw simple flow diagrams or write code-like snippets (called *pseudocode*) that capture the major steps in your program. Your design sketch and / or pseudocode is a required deliverable for this assignment.

3. **Error Handling**

a. Starting with this assignment we're going to begin trapping and handling errors that may occur during program execution. If the user fails to enter a valid port number, then output an appropriate message (e.g. "`Invalid port number entered.`") and exit the program without further processing.

b. Your error handling should cover the case where the user enters integers that are invalid port numbers (like `65539`). It should also handle the case where the user enters something that isn't an integer at all (like entering "`GONAVY!`" when prompted for a port number).

c. If a valid port number is entered, but it's not one that you researched in Table 2, then print a message like: "`Port not found in database`", and exit the program without further processing.

4. **Program Flow**

Here's a sample of what a single run of your program should look like:

```
Enter Port number: 20

Port: 20
Range: system
Category: data
Protocol: File Transfer Protocol (FTP)
Secure: No
```

5. **Testing:**

Thoroughly testing your program can be a difficult task. For complex programs, there may be hundreds or thousands of possible cases to test. The universe of possibilities for this program is largely confined to the entries you researched when compiling Table 2, so you should be able to cover all the possibilities.

An area of keen interest to software developers is something called *edge cases*. These are possible inputs to your program that may not occur frequently, but are handled improperly by your code. Since they're encountered infrequently, you don't often think to test for them, so errors in your code can go unresolved. For this assignment, think of the following port number inputs as *edge cases*: `0`, `65535`, `6665`, and `6669`.

6. **Hints:**

a. Give your variables meaningful, descriptive names. While it's true that you could represent the port number using a variable named `p`, it will be much easier to read and debug your code if you use a variable name like `portNumber` instead.

b. The directory for this project also includes an executable version that you can run to get a sense for how your program should operate. The program is called `portLookup`.

Let's assume you're working in your `~/shares/sy201` directory. You can run `portLookup` by first copying it to your working directory and then adjusting its permissions with the following commands:

i. `cp ~/repo201/programming/pa02/portLookup .`
(*the trailing space and period in the command above are important*)
ii. `chmod 755 portLookup`

You only have to perform steps (i) and (ii) once. After that, you can run the program any time you want by typing: `./portLookup`

7. **Deliverables And Due Dates:**

   a. Using paper, and pen or pencil, complete your pseudocode / flow diagram *before* you start coding. Be sure to indicate your name and alpha on this page.

   b. Your completed source code (the one ending in `.py`).

   c. Submit parts (a) and (b) by 2359 on Tuesday, 11 September, in accordance with your instructor's directions. *You do not need to submit the tables on page 3 as part of this assignment.*