**Introduction to Computers and Python**

1.1   Introduction

**1.1 Q1:** Which of the following statements is false?

a. Software (that is, the Python instructions you write, which are also called code) controls hardware (that is, computers and related devices).

b. Programmers use the Python Standard Library and various other libraries to “reinvent the wheel.”

c. Programmers use libraries to create software objects that they interact with to perform significant tasks with modest numbers of instructions.

d. IPython executes Python instructions interactively and immediately shows their results.

Answer: b. Actually, programmers use the Python Standard Library and various other libraries to *avoid* “reinventing the wheel.”

**1.1 Q2:** Which of the following statements a), b) or c) is false?

a. Decades ago, most computer applications ran on networked computers.

b. Today’s applications can be written with the aim of communicating among the world’s computers via the Internet.

c. A key intersection between computer science and data science is artificial intelligence.

d. All of the above statements are *true*.

Answer: a. Actually, decades ago, most computer applications ran on “standalone” computers (that is, *not* networked together).

1.2   Hardware and Software

**1.2 Q1:** Which of the following statements is false?

a. Computers can perform calculations and make logical decisions phenomenally faster than human beings can.

b. Computers process data under the control of sequences of instructions called computer programs (or simply programs).

c. A computer consists of various physical devices referred to as hardware (such as the keyboard, screen, mouse, solid-state disks, hard disks, memory,

d. Computing costs are rising dramatically, due to the increasing complexity of hardware and software technologies.

Answer: d. Actually, computing costs are *dropping* dramatically, due to rapid developments in hardware and software technologies.

1.2.1  Moore’s Law

**1.2 Q2:** Every year or two, the capacities of computers have approximately doubled inexpensively. This remarkable trend often is called \_\_\_\_\_\_\_\_.

a. the law of large numbers

b. the principal of least privilege

c. Moore’s law

d. Wirth’s law

Answer: c.

1.2.2  Computer Organization

**1.2 Q3:** Which logical unit of the computer is the receiving section?

a. input unit

b. output unit

c. memory unit

d. central processing unit.

Answer: a.

**1.2 Q4:** Information in the memory unit is \_\_\_\_\_\_\_\_. It’s typically lost when the computer’s power is turned off.

a. persistent

b. constant

c. sticky

d. volatile

Answer: d.

**1.2 Q5:** A gigabyte is approximately one \_\_\_\_\_\_\_\_ bytes.

a. thousand

b. million

c. billion

d. trillion.

Answer: c.

**1.2 Q6:** Information on secondary storage devices is \_\_\_\_\_\_\_\_ — it’s preserved even when the computer’s power is turned off.

a. volatile

b. unstable

c. transient

d. persistent

Answer: d.

**1.2 Q7:** Secondary storage information takes much \_\_\_\_\_\_\_\_ to access than information in primary memory, but its cost per unit is much \_\_\_\_\_\_\_\_.

a. less time, less

b. more time, less

c. less time, more

d. more time, more

Answer: b.

1.3   Data Hierarchy

**1.3 Q1:** A(n) \_\_\_\_\_\_\_\_ is the smallest data item in a computer. It can have the value 0 or 1.

a. bit

b. byte

c. field

d. record

Answer: a.

**1.3 Q2:** The most popular database model is the \_\_\_\_\_\_\_\_ database, in which data is stored in simple tables.

a. network

b. graph

c. relational

d. hierarchical

Answer: c.

**1.3 Q3:** Which one of the following statements is true?

a. a terabyte is larger than a petabyte.

b. a kilobyte is exactly 1000 bytes.

c. a gigabyte is 1024 megabytes.

d. an exabyte is 1024 zettabytes.

Answer: c.

1.4   Machine Languages, Assembly Languages and High-Level Languages

**1.4 Q1:** Which of the following statements is false?

a. Any computer can directly understand only its own machine language, defined by its hardware design.

b. The most widely used Python implementation—CPython (which is written in the C programming language for performance)—uses a clever mixture of compilation and interpretation to run programs.

c. Translator programs called assemblers convert assembly-language programs to machine language at computer speeds.

d. Interpreter programs, developed to execute high-level language programs directly, avoid the delay of compilation, and run faster than compiled programs.

Answer: **d.** Actually, interpreter programs run slower than compiled programs.

**1.4 Q2:** Which of the following statements is false?

a. With the advent of assembly languages, computer usage increased rapidly, but programmers still had to use numerous instructions to accomplish even the simplest tasks.

b. To speed the programming process, high-level languages were developed in which single statements could be written to accomplish substantial tasks.

c. Translator programs called assemblers convert high-level-language source code into machine language.

d. High-level languages instructions look almost like every-day English and contain commonly used mathematical notations.

Answer: c. Actually, those translator programs are compilers. Assemblers convert assembly language programs into machine language.

1.5   Introduction to Object Technology

**1.5 Q1:** Which of the following statements a), b) or c) is *false*?

a. The classes that objects come from are essentially reusable software components.

b. Almost any verb can be reasonably represented as a software object in terms of attributes (e.g., name, color and size) and behaviors (e.g., calculating, moving and communicating).

c. A class that represents a bank account might contain one method to deposit money to an account, another to withdraw money from an account and a third to inquire what the account’s balance is.

d. All of the above statements are *true*.

Answer: b. Actually, almost any *noun* can be reasonably represented as a software object in terms of attributes (e.g., name, color and size) and behaviors (e.g., calculating, moving and communicating).

**1.5 Q2:** A program might call a bank-account object’s deposit \_\_\_\_\_\_\_\_ to increase the account’s balance.

a. attribute

b. method

c. class

d. function

Answer: b.

**1.5 Q3:** A new class of objects can be created conveniently by inheritance—the new class (called the \_\_\_\_\_\_\_\_) starts with the characteristics of an existing class (called the \_\_\_\_\_\_\_\_), possibly customizing them and adding unique characteristics of its own.

a. superclass, subclass

b. hyperclass, subclass

c. target, superclass

d. subclass, superclass

Answer: d.

1.6   Operating Systems

**1.6 Q1:** Windows is a(n) \_\_\_\_\_\_\_\_ operating system—it’s controlled by Microsoft exclusively.

a. proprietary

b. private

c. open source

d. None of the above.

Answer: a.

**1.6 Q2:** \_\_\_\_\_\_\_\_ is by far the world’s most widely used desktop operating system.

a. Linux

b. MacOS

c. Windows

d. none of the above

Answer: c.

**1.6 Q3:** With \_\_\_\_\_\_\_\_ software development, individuals and companies contribute their efforts in developing, maintaining and evolving software in exchange for the right to use that software for their own purposes, typically at no charge.

a. object-oriented

b. high-level

c. open-source

d. proprietary

Answer: c.

**1.6 Q4:** Which of the following organizations has millions of open-source projects under development?

a. Python Software Foundation

b. GitHub

c. The Apache Software Foundation

d. The Eclipse Foundation

Answer: b.

1.7   Python

**1.7 Q1:** Python recently surpassed the programming language \_\_\_\_\_\_\_\_ as the most popular data-science programming language.

a. DSPL

b. Java

c. C++

d. R

Answer: d.

**1.7 Q2:** Which of the following are reasons why Python is popular and everyone should consider learning it?

a. It’s open source, free and widely available with a massive open-source community.

b. It’s easier to learn than languages like C, C++, C# and Java, enabling novices and professional developers to get up to speed quickly.

c. It’s easier to read than many other popular programming languages.

d. All of the above.

Answer: d.

1.8   It’s the Libraries!

**1.8 Q1:** Which of the following statements about libraries is false?

a. Using existing libraries helps you avoid “reinventing the wheel,” thus leveraging your program-development efforts.

b. Rather than developing lots of original code—a costly and time-consuming process—you can simply create an object of a pre-existing library class, which takes only three Python statements.

c. Libraries help you perform significant tasks with modest amounts of code.

d. All of the above statements are *false*.

Answer: b. Actually, it takes only one statement.

**1.8.1  Python Standard Library**

**1.8 Q2:** Which of the following Python Standard Library modules offers additional data structures beyond lists, tuples, dictionaries and sets?

a. sys and statistics

b. collections

c. queue

d. (b) and (c)

Answer: d.

**1.8 Q3:** Which Python Standard Library module do we use for performance analysis?

a. datetime

b. time

c. timeit

d. sys

Answer: c.

**1.8.2  Data-Science Libraries**

**1.8 Q4:** Which of the following popular Python data science libraries are central to machine learning, deep learning and/or reinforcement learning:

a. scikit-learn

b. keras and tensorflow

c. OpenAIGym

d. All of the above

Answer: d.

1.9   Other Popular Programming Languages

**1.9 Q1:** The popular programming languages Python and \_\_\_\_\_\_\_\_ are the two most widely used data-science languages.

a. C

b. Java

c. JavaScript

d. R

Answer: d.

1.10   Test-Drive: Using IPython and Jupyter Notebooks

**1.10 Q1:** In which IPython interpreter mode do you enter small bits of Python code called snippets and immediately see their results?

a. interactive mode

b. script mode

c. program mode

d. None of the above

Answer: a.

1.10.1  Using IPython Interactive Mode as a Calculator

1.**10 Q2:** What value is produced when Python evaluates the following expression?

 5 \* (12.7 - 4) / 2

a. 21

b. 21.75

c. 29.5

d. None of the above.

**Answer: b.**

1.10.2  Executing a Python Program Using the IPython Interpreter

No questions.

1.10.3  Writing and Executing Code in a Jupyter Notebook

**1.10 Q4:** Which of the following statements a), b) or c) is *false*?

a. The Anaconda Python Distribution comes with the Jupyter Notebook—an interactive, browser-based environment in which you can write and execute code and intermix the code with text, images and video.

b. The JupyterLab interface enables you to manage your notebook files and other files that your notebooks use (like images and videos).

c. Jupyter Notebooks use IPython by default.

d. All of the above statements are true.

Answer: d.

**1.10 Q5:** Which of the following statements a), b) or c) about the Jupyter Notebook is false?

a. The unit of work in a notebook is a cell in which you can enter code snippets.

b. By default, a new notebook contains one cell, but you can add more.

c. To execute the current cell’s code, type Ctrl + Enter (or control + Enter).
JupyterLab executes the code in IPython, then displays the results below the cell.

d. All of the above statements are *true*.

Answer: d.

1.11   Internet and World Wide Web

**1.11 Q1:** Which of the following statements about the ARPANET and the Internet is false?

a. The ARPANET was the precursor to today’s Internet.

b. Today’s fastest Internet speeds are on the order of millions of bits per second with billion-bits-per-second (gigabit) speeds already being tested.

c. Although the ARPANET enabled researchers to network their computers, its main benefit proved to be the capability for quick and easy communication via what came to be known as electronic mail (e-mail).

d. The protocol (set of rules) for communicating over the ARPANET became known as the Transmission Control Protocol (TCP). TCP ensured that messages, consisting of sequentially numbered pieces called packets, were properly delivered from sender to receiver, arrived intact and were assembled in the correct order.

Answer: b. Actually, today’s fastest Internet speeds are on the order of *billions* of bits per second with *trillion*-bits-per-second (terabit) speeds already being tested.

1.11.1  Internet: A Network of Networks

**1.11 Q2:** Which of the following statements about the Internet is false?

a. One challenge was to enable different networks to communicate with each other. ARPA accomplished this by developing the Internet Protocol (IP), which created a true “network of networks,” the current architecture of the Internet.

b. The combined set of Internet protocols is now called TCP/IP.

c. Each Internet-connected device has a TCP address—a unique numerical identifier used by devices communicating via TCP/IP to locate one another on the Internet.

d. Bandwidth—the information-carrying capacity of communications lines—on the Internet has increased tremendously, while hardware costs have plummeted.

Answer: c. Actually, each Internet-connected device has an *IP address*—a unique numerical identifier used by devices communicating via TCP/IP to locate one another on the Internet.

1.11.2  World Wide Web: Making the Internet User-Friendly

**1.11 Q3:** Which of the following statements is false?

a. The World Wide Web is a collection of hardware and software associated with the Internet that allows computer users to locate and view documents (with various combinations of text, graphics, animations, audios and videos) on almost any subject.

b. In 1989, Tim Berners-Lee of CERN (the European Organization for Nuclear Research) began developing HyperText Markup Language (HTML)—the technology for sharing information via “hyperlinked” text documents.

c. Berners-Lee also wrote communication protocols such as JavaScript Object Notation (JSON) to form the backbone of his new hypertext information system, which he referred to as the World Wide Web.

d. In 1994, Berners-Lee founded the World Wide Web Consortium (W3C), devoted to developing web technologies.

Answer: c. Actually, in 1989, Tim Berners-Lee of CERN (the European Organization for Nuclear Research) began developing *HyperText Markup Language (HTML)*—the technology for sharing information via “hyperlinked” text documents.

1.11.3  The Cloud

**1.11 Q4:** Which of the following statements about the cloud is false?

a. A service that provides access to itself over the Internet is known as a web service.

b. Using cloud-based services in Python often is as simple as creating a software object and interacting with it. That object then uses web services that connect to the cloud on your behalf.

c. We’ll use Twitter’s web services via the Python library Tweepy to get information about specific Twitter users, search for recent tweets and receive streams of tweets as they occur—that is, in real time.

d. Azure is Google’s set of cloud-based services.

Answer: d. Actually, Azure is *Microsoft’s* set of cloud-based services.

**1.11 Q5:** The applications-development methodology of \_\_\_\_\_\_\_\_ enables you to rapidly develop powerful software applications by combining (often free) complementary web services and other forms of information feeds.

a. cloud computing

b. design patterns

c. proprietary computing

d. mashups

Answer: d.

1.11.4  Internet of Things

**1.11 Q6:** The Internet is no longer just a network of computers—it’s an Internet of Things. A thing is any object with which of the following?

a. an IP address

b. the ability to send data over the Internet

c. in some cases, the ability to receive data over the Internet

d. Things can have all of the above.

Answer: **d.**

1.12   Software Technologies

1.12 Q1: Reworking programs to make them clearer and easier to maintain while preserving their correctness and functionality is called \_\_\_\_\_\_\_\_.

a. refactoring

b. design patterns

c. editing

d. None of the above.

Answer: a.

**1.12** Q2: Proven architectures for constructing flexible and maintainable object-oriented software are called \_\_\_\_\_\_\_\_.

a. refactored architectures

b. software blueprints

c. engineered architectures

d. design patterns

Answer: d.

1.13   How Big Is Big Data?

**1.13 Q1:** Which of the following statements about big data is false?

a. For computer scientists and data scientists, data is now as important as writing programs.

b. One megabyte is exactly one million (1,000,000) bytes.

c. According to a March 2016 AnalyticsWeek article, within five years there will be over 50 billion devices connected to the Internet (most of them through the Internet of Things, ) and by 2020 we’ll be producing 1.7 megabytes of new data every second for every person on the planet.

d. The speed at which quantum computers now under development could operate at is so extraordinary that in one second, a quantum computer theoretically could do staggeringly more calculations than the total that have been done by all computers since the world’s first computer appeared.

Answer: b. Actually, one megabyte is exactly 220 = 1024 x 1024 = 1,048,576 bytes.

**1.13 Q2:** Which of the following statements about energy consumption is false?

a. According to a recent article, energy use for processing data in 2015 was growing at 20% per year and consuming approximately three to five percent of the world’s power.

b. Another enormous electricity consumer is the blockchain-based cryptocurrency Bitcoin—processing just one Bitcoin transaction uses approximately the same amount of energy as powering the average American home for a year.

c. The energy use comes from the process Bitcoin “miners” use to prove that transaction data is valid.

d. Together, Bitcoin and Ethereum (another popular blockchain-based platform and cryptocurrency) consume more energy per year than Israel and almost as much as Greece.

Answer: b. Actually, processing just one Bitcoin transaction uses approximately the same amount of energy as powering the average American home for a *week*.

1.13.1  Big Data Analytics

**1.13 Q3:** Which of the following “V’s of big data” is described by “the validity of the data—is it complete and accurate? Can we trust that data when making crucial decisions? Is it real?”

a. Volume

b. Velocity

c. Variety

d. Veracity

Answer: d. Veracity

1.13.2  Data Science and Big Data Are Making a Difference: Use Cases

No questions.

1.14   Case Study—A Big-Data Mobile Application

**1.14 Q1:** Once Waze converts a spoken command to text, it must determine the correct action to perform, which requires:

a. JSON

b. speech recognition

c. natural language processing

d. speech synthesis

Answer: c.

**1.14 Q2:** Each of the following statements about a typical mobile social navigation app is *true*. Which most captures the essence of the application?

a. The app processes massive amounts of crowdsourced data—that is, the data that’s continuously supplied by users through their mobile GPS-based devices worldwide.

b. The app uses speech synthesis to speak driving directions and alerts to you, and speech recognition to understand your spoken commands.

c. The app uses your phone as a streaming Internet of Things (IoT) device. Each phone is a GPS sensor that continuously streams data over the Internet to the app.

d. The app probably stores its routing information in a graph database. Such databases can efficiently calculate shortest routes.

Answer: a.

1.15   Intro to Data Science: Artificial Intelligence—at the Intersection of CS and Data Science

**1.15 Q1:** What is the "ultimate goal" of the field of artificial intelligence?

a. Computers learning from massive amounts of data.

b. Computer vision.

c. Self-driving cars.

d. Artificial general intelligence—computers that perform intelligence tasks as well as humans.

Answer: d.

**1.15 Q2:** Which of the following statements about AI is false:

a. For many decades, AI has been a field with solutions and no problems.

b. Google’s AlphaZero is a game-playing AI that teaches itself to play games.

c. In a 1997 match between IBM’s DeepBlue computer system and chess Grandmaster Gary Kasparov, DeepBlue became the first computer to beat a reigning world chess champion under tournament conditions.

d. After training itself in Go for just eight hours, AlphaZero was able to play Go vs. its AlphaGo predecessor, winning 60 of 100 games.

Answer: a. Actually, for many decades, AI has been a field with *problems and no solutions*.