# Chapter 1 Introduction…Solutions

1. Consider Google Earth application. You launch the application, move the mouse on the earth’s surface, click on Mount Everest to see an up-close view of the mountain range. Identify the interactions in layman’s terms between the operating system and the hardware during the above sequence of actions.

Launching the application causes the operation to initiate a process which requests from the operating system a connection to Google Earth. Each operation performed by the user either changes the state of the program and requests output be performed by the operating system or changes the state of the program and requests the operating system send information to Google Earth requesting more information.

2. How does a high-level language influence the processor architecture?

The processor architecture must allow efficient, cost-effective translation of the high-level language constructs into instructions that the machine can execute

3. Answer True or False with justification: “The compiler writer is intimately aware of the details of the processor implementation.”

False: The compiler writer must know some details known as the instruction set architecture but many details of the processor implementation are of no use or interest to the compiler writer

4. Explain the levels of abstractions found inside the computer from the silicon substrate to a complex multi-player video game.

The semiconductor materials have electrical properties which allow them to be used to make transistors which are switches.

The transistors may be grouped together and connected to implement logic gates. These are simple circuits which allow logic functions such as AND, OR, and NOT to be realized.

Logic gates may be connected together to form logic elements or functional units which perform operations such a decoding an n-bit binary number into selecting one of n outputs or adding two n-bit binary numbers together.

The logic elements and logic gates may be used to build devices with state such as memories or state machines which may be used to control logic circuits. These elements are brought together to form a datapath and control system which is the processor of the computer.

An instruction set is used to command the processor to perform each of the things it is capable of doing (e.g. add two numbers together; fetch something from memory, etc.)

A computer program known as a compiler is developed which can take a computer program written in some high-level language and translate it into instruction from the instruction set.

Computers executing programs that were written in a high-level language are connected together with communications and networking technologies to form networks allowing people in different places to interact to play a game.

5. Answer True or False with justification: “The internal hardware organization of a computer system varies dramatically depending on the specifics of the system.”

True and False: Depending on which level of abstraction you are dealing with this statement may be true or false! The same basic logic building blocks are used but the details of transistors might change depending on speed vs. power consumption issues, almost all computers will certainly know how to add and the essential circuitry for that will be quite similar the organization of logic elements and design of the datapath and control system might be quite different between a graphics processor and one used to control a hearing aid.

6. What is the role of a “bridge” between computer buses as shown in Figure 1.8?

Acts as a kind of translator/communications path between two devices (the two buses) which may have dissimilar operational protocols

7. What is the role of a “controller” in Figure 1.8?

Appear to the computer to be memory locations which are in reality control registers for the particular I/O devices to be controlled. The controller takes the information supplied by the processor and converts it into the appropriate control signals for the I/O device and/or takes information from the device and sets bits in control registers to allow the processor to receive the information.

8. Using the Internet, research and explain 5 major milestones in the evolution of computer hardware.

Examples:

Vacuum tunes to transistors

Integrated circuits

Disk drives

Display technology (from paper to glass)

Networking

9. Using the Internet, research and explain 5 major milestones in the evolution of the operating system.

Examples:

Multiprogramming

Scheduling

Time sharing

GUI Interface

Parallel operating systems

Error recovery

10. Compare and contrast grid computing and the power grid. Explain how the analogy makes sense. Also, explain how the analogy breaks down.

In both cases we have an interconnected network of devices serving some useful purpose. The generating systems may be thought of as powerful resources supplying power to the industrial and residential users of electricity. In grid computing the flow of information is more two-way (or even n-way). There are dramatic differences in the way things are paid for where in the electric grid the consumers pay the producers whereas in grid computing additional revenue streams may be provided by advertisers or others wishing to use information generated by the grid. In the case of the power grid there are a relatively small number of suppliers and a vast number of consumers. In grid computing there would perhaps be far more consumers than producers but far more producers that in the case of the power grid.

11. Match the left and right hand sides.

*Unix operating system* Ritchie

*Microchip* Kilby and Noyce

*FORTRAN programming language* Backus

*C programming language* Thompson and Ritchie

*Transistor* Bardeen, Brattain, and Shockley

*World’s first programmer* Lovelace

*World’s first computing machine* Babbage

*Vacuum Tube* De Forest

*ENIAC* Mauchley and Eckert

*Linux operating system* Torvalds