

A Balanced Introduction to Computer Science, 3/E

David Reed

Chapter 3 Review Question Solutions

1. TRUE or FALSE? The ARPANet, the precursor to today's Internet, was funded primarily by the U.S. Department of Defense.

TRUE

2. TRUE or FALSE? Because the ARPANet utilized ordinary phone lines to connect computers over large distances, it was slow compared to existing technologies of the time.

FALSE

3. TRUE or FALSE? In a centralized computer network, the failure of a single machine or connection can isolate large portions of the network.

TRUE

4. TRUE or FALSE? A router is a special-purpose computer on the Internet that receives message packets, access routing information, and passes the packets on towards their destination.

TRUE

5. TRUE or FALSE? When a message is broken into packets as transmitted over the Internet, it is guaranteed that all packets will take the same route from source to destination.

FALSE

6. TRUE or FALSE? 147.134.2.84 is an example of an IP address.

TRUE

7. The Internet Society, an international non-profit organization, maintains and enforces standards for the hardware and software of the Internet.

TRUE

8. TRUE or FALSE? The World Wide Web was developed in the early 1970s, shortly after the development of the Internet.

FALSE

9. TRUE or FALSE? Microsoft marketed the first commercial Web browser.

FALSE

10. TRUE or FALSE? In the URL `http://balance3e.com/index.html`, the part `balance3e.com` identifies the Web server where the page is stored.

TRUE

11. The Internet of today evolved from the ARPANet of the 1960s and 70s. In what ways is the Internet similar to the old ARPANet? In what ways is it different?

Following the initial design of the ARPANet, the Internet is a distributed network that utilizes packet-switching. However, the number of users and variety of uses for the Internet has far exceeded any expectations of the ARPANet, which was designed for use by a small number of military researchers. To accommodate the large number of computers on the Internet, it has evolved into a hierarchical network, with high-speed backbones for transmission between central locations and slower communication lines for local connections.

12. The Internet is often described as the "Information Superhighway." Describe how the analogy of a highway system fits the structure of the Internet.

The backbone connections are analogous to interstate highways, providing fast communications between principal destinations. Connected to the backbone are transmission lines, which provided slower, more limited capabilities and linked secondary destinations; these transmission lines could be compared to state highways. Additional connections are required to reach individual computers, in the same way that city and neighborhood roads are used to link individual houses.

13. Paul Baran proposed two groundbreaking design ideas for the structure and behavior of the ARPANet. Describe these design ideas and the benefits they provide.

The first of Baran's ideas adopted for the ARPANet was that of a *distributed network*, where control is distributed across a large number of machines. This allows for messages to be rerouted along alternate connections when a particular computer or connection fails. Baran's other idea central to the ARPANet architecture was that of *packet-switching*, where messages to be sent over the network are first broken into small pieces and then sent independently to their final destination. Advantages of this approach

include a more efficient use of the connections, the ability to react to failures and congestion, and improved reliability.

14. Describe how packet-switching can increase the reliability of a network.

In a packet-switching network, messages to be sent over the network are first broken into small pieces known as *packets*, and these packets are sent independently to their final destination. If a message is broken into packets and the packets are transmitted independently, it is probable that at least part of the message will arrive at its destination, even if some failures occur within the network. If the recipient receives only part of the message, TCP software on his or her computer can acknowledge the partial message's receipt and request retransmission from the sender.

15. Internet communications are defined by a set of protocols called TCP/IP. What do TCP and IP stand for, and what is the role of each protocol in transmitting and receiving information?

Transmission Control Protocol (TCP) controls the method by which messages are broken down into packets and then reassembled when they reach their final destination. *Internet Protocol (IP)*, on the other hand, is concerned with labeling the packets for delivery and controlling the packets' paths from sender to recipient.

16. What is an IP address? What steps are involved in mapping a computer's domain name (e.g., `www.creighton.edu`) to its IP address?

An IP address is a number, usually written as a dotted sequence such as 147.134.2.84. Special-purpose computers called *domain name servers* are used to store mappings between domain names and their corresponding IP addresses. When a computer sends a message to a destination such as `www.creighton.edu`, the sending computer first transmits a request to a domain name server, which matches the recipient's domain name to an IP address and returns that address.

17. Which has grown at a faster rate, the Internet or the Web? Justify your answer.

The data in Figure 3.15 gives somewhat mixed results. If you look at the period from 2006 to 2010, the Web has grown at a faster rate, with the number of Web servers increasing by 133% compared with a 72% increase in Internet-connected computers. Most recently, from 2008 to 2010, the number of Web servers has increased at a smaller rate: 17% versus 33%. If you judge Web size by the number of pages, then the Web is growing much faster (from 8 billion pages in 2005 to 40 billion pages in 2009).

18. What is hypertext? How are the key ideas of hypertext incorporated into the Web?

The term hypertext refers to documents that interlink text and media, such as images, sounds, and alternate story lines. The Web utilizes hypertext in that Web pages can contain other media and links to other pages as well.

19. What specific features did the Mosaic browser include that were not available in earlier browsers? How did these features help make the Web accessible to a larger audience?

Mosaic employed buttons and clickable links as navigational aids, making the Web easier to traverse. The browser also supported the integration of images and media within pages, which enabled developers to create more visually appealing Web documents.

20. Describe two factors that contributed to Microsoft's dominance of the browser market.

Microsoft's financial position was much stronger than Netscape's — due to its success with other software products, Microsoft possessed vast resources with which to develop and market its browsers. Also, Microsoft was able to leverage its dominance in operating systems by packaging Internet Explorer as part of Windows.

21. What does HTTP stand for, and what is its role in facilitating Web communications?

HyperText Transfer Protocol (HTTP) is the protocol that determines how messages exchanged between browsers and servers are formatted.

22. The World Wide Web Consortium maintains and regulates Web-related standards and oversees the design of Web-based technologies. Visit their Web site (www.w3.org) to review the organization's goals and list of technologies under active development. Describe three technologies (other than HTML, HTTP, and XML) whose development is managed by the World Wide Web Consortium.

Student answers will vary.

23. How does caching improve the performance of a Web browser? Does caching reduce the number of interactions that take place between the browser and the Web server?

When a page or image is first downloaded, it is stored in a temporary directory on the user's computer. The next time that page or image is requested, the browser first checks to see if it has a copy stored locally in the cache, and, if so, whether the copy is up-to-date (this is accomplished by contacting the server and asking how recently the page was changed). If an up-to-date copy is stored locally, then the browser can display this copy, instead of downloading the original. Caching can make downloading a new copy unnecessary, but it still requires a check to see if the cached page is up-to-date.