

COMPUTER SCIENCE E-1

Understanding Computers & the Internet

EXAM I

Name:

You will have two hours to complete the exam. This exam is closed-book, so no notes, calculators, phone-a-friend lifelines, or additional aids will be allowed. Answer all questions directly on the exam. Scratch paper can be found at the end of the exam. Please complete the following.

“I understand that some students may not be taking this exam at the same time as I am. I affirm that I will neither reveal the contents or difficulty of this exam to any such student nor discuss it with any such student.”

Signature: _____

Final Score

(for staff use only)

Multiple Choice

(1 point each) Circle the choice that best answers the question.

1. Does Morgan Freeman actually know what binary is?
 - a. Of course he does, Morgan Freeman knows everything.
 - b. He didn't mention it in *Bruce Almighty*, so definitely not.
 - c. It doesn't matter, he's still Morgan Freeman.
 - d. No, Tommy, movies and real life are two different things.

2. What is the largest unsigned, positive number we can represent using 4 bits? Only consider representing positive numbers in binary.
 - a. 4
 - b. 16
 - c. 8
 - d. 15

3. Which of these is the largest?
 - a. Kilobyte
 - b. Megabyte
 - c. Gigabyte
 - d. Megabit

4. When I visit `http://www.google.com`, which of the following protocols is **not** used in any way?
 - a. SMTP
 - b. HTTP
 - c. TCP
 - d. IP

5. Which is not a type of DNS record?
 - a. AAAA
 - b. TLD
 - c. MX
 - d. CNAME

6. Which of the following does **not** affect a CPU's performance?

- a. Heat sink
- b. Instruction set
- c. Pipeline size
- d. Clock speed

7. Which of the following protocols is used to send emails?

- a. IMAP
- b. MX
- c. SMTP
- d. POP3

8. Which of the following typically has the fastest access time?

- a. L1 cache
- b. RAM
- c. Register
- d. HDD

9. Which of the following typically has the largest storage capacity?

- a. L1 cache
- b. RAM
- c. Register
- d. HDD

10. What does a VPN allow you to do?

- a. Protect your email account from phishing attacks
- b. Override DHCP settings
- c. Forge HTTP requests
- d. Access a LAN securely from a public network

11. Which of the following is true of IPv6?

- a. It creates an infinite number of IP addresses
- b. It eliminates the need for NAT
- c. It uses 128 bits for IP addresses
- d. HTTP over IPv6 will be faster

12. Which of the following is not a component of an HDD?

- a. Read-write head
- b. CMOS
- c. Spindle
- d. Platters

13. Which of the following slots is generally not accessible without opening your computer's case?

- a. USB port
- b. Ethernet port
- c. SATA connector
- d. VGA port

14. Which of the following is not a component of a URL?

- a. Verb
- b. Path
- c. Fragment
- d. Query string

15. Which of the following is **not** a web browser?

- a. Internet Explorer
- b. Mozilla Firefox
- c. Google Chrome
- d. Yahoo Shine

Buzzwords

(3 points each) Much like HP's claims regarding "that cloud thing everyone is talking about," each of the following statements tries to use some technological buzzword. For each statement, state whether the author seems to know what he or she is talking about, and if not, explain why.

16. My new Monster HDMI cable has an HTTP API.

17. The iPad 4 will feature dual-core RAM.

18. Installing a firewall at the office will increase the speed of everyone's Internet connection.

19. Soon, you'll be able to access the course's lectures at `http://lectures.cse1`.

20. Sending email with the next version of Outlook will be faster because emails will go directly from your computer to the recipient's computer.

21. I can double a binary number by simply adding a 0 as the rightmost digit (i.e., the 0 will be an additional bit at the end of the number).

Binary

22. (2 points each) Convert the following decimal numbers to binary, showing your work.

i. 9

ii. 21

23. (2 points each) Convert the following binary numbers to decimal, showing your work.

i. 0101

ii. 11001

24. (4 points) Perform the following binary addition. Once you have an answer in binary, convert it to decimal.

$$\begin{array}{r} 1\ 0\ 1\ 0\ 1 \\ +\ 0\ 1\ 1\ 0\ 1 \\ \hline \end{array}$$

Short Answer

(2 points each) Answer each of the following questions using 1–2 sentences.

25. What is an Ethernet port used for?

26. What is an operating system, and at what point during the boot process does the operating system come into play?

27. What do we mean when we say a processor has multiple cores? Why does this make a CPU faster?

28. What is Moore's Law?

29. How is information encoded on an HDD? Put another way, when I write a byte to disk, how is that information actually represented on the hard drive?

30. Upon receipt of a packet, how does a router know where to send that packet next?

31. I have a 50 Mbps Internet connection, and I'm using an 802.11g wireless router to create a home network. But, it seems like my Internet connection is still pretty slow... why?

32. What is a hosts file?

33. What role does a domain name registrar play?

34. Apache and nginx are examples of what?

35. Consider the HTTP request below (which R.J. observed is made pretty frequently between 5:30pm and 7:30pm on Mondays). What URL do these headers suggest was visited?

```
GET /home.php HTTP/1.1  
Host: www.facebook.com
```

36. Consider the HTTP response below. What effect will these headers likely have on a web browser?

```
HTTP/1.1 301 Moved Permanently  
Location: http://www.facebook.com/  
Content-Type: text/html; charset=utf-8  
Date: Mon, 11 Mar 2013 17:30:00 EST  
Content-Length: 0
```

37. Why might a server respond with the below HTTP status code?

400 Bad Request

Face Off

(3 points each) For each of the following pairs x vs. y , describe why you might want to use x instead of y (or, if you'd prefer, y instead of x).

38. HDD vs. SSD

39. IMAP vs. POP3

40. IPv6 vs. IPv4

41. VGA vs. HDMI

42. ASCII vs. UTF-8

Long Answer

(5 points each) Answer each of the following questions using 3–5 sentences.

43. What is a CPU pipeline? How can we introduce parallelism into the CPU pipeline, and why does this make a CPU faster?

44. My computer only has 1GB of RAM, but the total amount of RAM being consumed by all of my processes is 2GB. How is this possible? Explain what happens when a computer “runs out” of available space in RAM.

45. I'm buying a new computer, and I have the choice between spending \$100 on additional RAM or on a faster CPU. Why might I want a computer with more RAM? Why might I want a computer with a faster CPU? Which would you prefer to spend \$100 on, and why?

46. How does caching improve a computer's performance? That is, why would using a cache speed up my computer?

47. My computer has a private IP address of 192.168.56.50 on my home wireless network. My trusty wireless router has an IP address of 74.125.225.98. Describe what happens when I make a request to some server on the Internet. From what IP address does my request appear to be coming from? How does the server's response reach my computer if it has a private IP address?

48. Label the 5 different parts of the following URL:

`http://cse1.net/video?v=lectures/1/lecture1#t=12`

49. Describe the process of sending an email using SMTP.

50. Describe the process of resolving a domain name (in which a human-readable domain is translated into an IP address). Your answer should include references to at least three different types of DNS servers!

51. Describe the steps through which a device acquires an IP address on a network using DHCP.

52. Describe the differences between reliable data transfer and best-effort delivery.

Fill in the Blank

(2 points each) For each of the items below, tell us what a typical capacity or speed is for that item.

53. HDD _____

54. L1 Cache _____

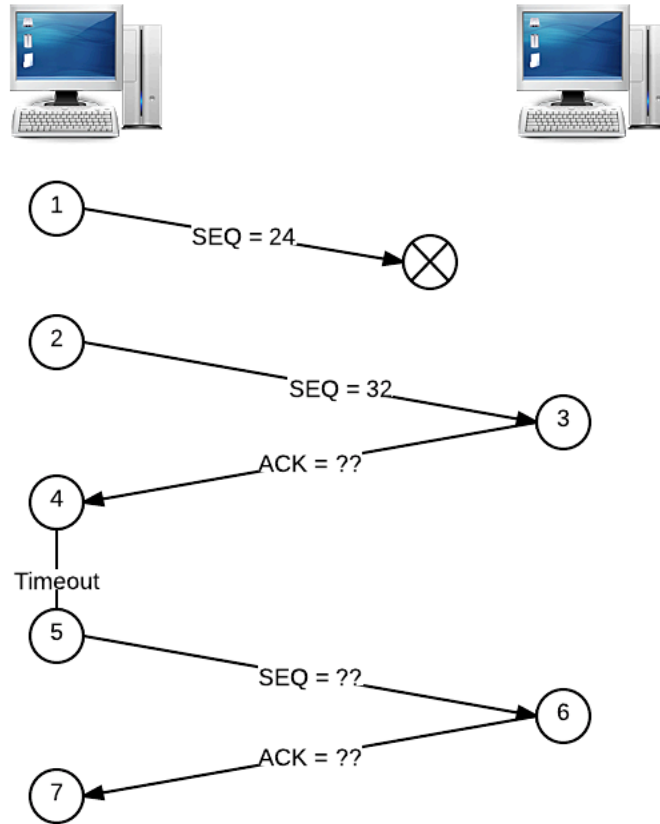
55. 802.11n _____

56. RAM _____

57. L2 Cache _____

58. SSD _____

59. The below shows two computers communicating using TCP. Each segment is 8 bytes in size. Fill in the three blanks marked with ?? with the correct SEQ and ACK numbers!



Finally, an Important Question

60. (0 points) Why is Grumpy Cat so grumpy?

Scratch Paper