

Instructions: Answer exactly five of the following six questions. Do not answer all six. If you do answer all six, the first five answers in your blue book(s) will be graded, and the sixth will be ignored.

Please remember to put your name and e-mail address on the cover of your blue book(s).

Question 1: (20 points) Internet History and Design Principles

- (a) (3 points) The Internet grew out of a late-1960s and early-1970s:
- (i) Experiment in data networking.
  - (ii) Niche-market commercial data-networking service.
  - (iii) Mass-market commercial data-networking service.
  - (iv) All of the above.
- (b) (3 points) One line in the following chart is wrong; that is, the item in the left column should be in the right column and *vice versa*. Which line is wrong?

Telephone Network

- Connection-based
- Best Effort
- Intelligence is “in the network”
- Traffic is carried by relatively few, “well known” communications companies

Internet

- Packet-based
- Admission Control
- Intelligence is “at the endpoints”
- Traffic is carried by many routers, operated by a changing set of unknown parties.

- (c) (4 points) How do the network-architectural principal of *layering* and the existence of open protocol standards foster a dynamic and fertile environment for innovation in electronic commerce and other Internet-based interaction?
- (d) (4 points) Clark and Blumenthal discuss relatively recent claims of various stakeholders that they require certain capabilities that the Internet has not traditionally provided. For example, they discuss governments’ claims that they require the ability to wiretap, to collect sales taxes, and to prevent the transmission of illegal or classified material, parents’ claim that they require the ability to block children’s access to “adult” material, and copyright owners’ claim that they require the ability to prevent unauthorized copying or at least to monitor traffic in order to track unauthorized copying. With which Internet-design principle are these claimed requirements difficult to reconcile? Do Clark and Blumenthal think that this principle must be abandoned if these new requirements are to be met?
- (e) (4 points) As discussed in class, computers and networks have been getting faster,

cheaper, and more ubiquitous for quite some time. As this process has unfolded, the main reason for enabling computers to “talk to each” (*i.e.*, to form networks) has evolved. At first, the main reason was to enable efficient sharing of machine resources (*e.g.*, printers and back-up filesystems); later, it was to enable efficient sharing of data, and then it was to enable parallel computation. Currently, what is the main reason for enabling computers to talk to each other?

- (f) (2 points) True or False: At least one of the original ARPANET design goals has not been fully met as of this time.

Question 2: (20 points) Information Economics

- (a) (3 points) The cost of generating original information content is independent of the number of people who ultimately gain access to it. Economists state this important property of original information content by saying that it:
- (i) Exhibits strong network effects.
  - (ii) Is a pure public good.
  - (iii) Should be created for mass-market distribution.
  - (iv) None of the above.
- (b) (2 points) True or False: Electronic distribution of information products generally increases distribution costs (and, where relevant, storage costs) but reduces consumption costs.
- (c) (5 points) Information industries often involve *systems of interoperating components* and *durable complementary assets*. The Netscape browser, the HTTP protocol, and the HTML formatting language are interoperating components, but the market dominance of the Netscape browser did not endure. Why not?
- (d) (4 points) Recall that networked industries are those that rely on customers’ interaction. Networks can be real (as in the telecommunications industry) or virtual. For two points each, give two examples of virtual networks.
- (e) (6 points) For four points, define the term “network effects.” For two points, select the one of the following three companies that is least dependent on network effects for its success:
- (i) eBay
  - (ii) Microsoft
  - (iii) Amazon

Question 3: (20 points) Electronic Commerce I

- (a) (3 points) What is *multi-channel retailing*?

- (b) (4 points) For two points each, give two examples of distribution models in which companies give customers free use of an information product or service.
- (c) (2 points) Personalized e-commerce profiles may facilitate price discrimination. True or False: Most users of B2C e-commerce sites appreciate the economic efficiency that price discrimination enables.
- (d) (5 points) What does it mean for an information product or service to be *technically commoditizable*?
- (e) (3 points) The main reason that Amazon, whose business is technically commoditizable, continues to be a successful Internet retailer by many measures is:
  - (i) Successful branding.
  - (ii) Good service.
  - (iii) Effective balance between specialization and experimentation with new partnerships, products, and business models.
  - (iv) All of the above.
- (f) (3 points) The main reason that eBay, whose business is technically commoditizable, continues to be the dominant Internet auction site is:
  - (i) eBay's cleverly worded user agreement.
  - (ii) eBay's acquisition of PayPal.
  - (iii) eBay's successful suit against Bidder's Edge.
  - (iv) Strong network effects.

Question 4: (20 points) Internet Technology

- (a) (3 points) Which of the following is not the responsibility of TCP?
  - (i) Flow control
  - (ii) Sequencing of packets
  - (iii) IP-address lookup caching
  - (iv) Error detection
- (b) (3 points) The DNS system is:
  - (i) A distributed database.
  - (ii) A central database.
  - (iii) A routing protocol.
  - (iv) A programming language.
- (c) (5 points) For one point each, match the item in the left-hand column with the item in the right-hand column that is most closely associated with it.

Physical Layer	Domain Hierarchy
IP Layer	Web Pages
Transport Layer	Ethernet
Application Layer	UDP Packets
DNS System	Routing

- (d) (3 points) A server machine such as www.cs.yale.edu may run several different server programs (thus providing several different “services” to client machines), including a web server, an email server, and a name server. To ensure that each client request is handled by the correct server program, different services are associated with different:
- (i) IP addresses.
  - (ii) Port numbers.
  - (iii) Routers.
  - (iv) Switches.
- (e) (6 points) In order to send data to destination machine B, source machine A needs the IP addresses of itself, of at least one DNS server, and of at least one router (*e.g.*, a gateway router). For two points each, give a very brief explanation of the way in which A uses each of these three IP addresses.

Question 5: (20 points) Electronic Commerce II

- (a) (2 points) Which of the companies that we have discussed in class had an IPO in 1997 but has not yet had a profitable year?
- (b) (2 points) Which of the companies that we have discussed in class has been strongly profitable for some time but has not yet had an IPO?
- (c) (4 points) Some early revenue models for online advertising (*e.g.*, “number of impressions,” “click through,” and “pay per sale”) proved ineffective. However, new models have developed, and advertising remains an important aspect of Internet-based business. For two points each, name two companies we have discussed in class whose business models depend heavily on advertisers’ paying for sponsored links and keywords.
- (d) (2 points) True or False: Auctions are important in C2C electronic commerce, because it is infeasible for a typical C2C seller to use market research to determine an appropriate fixed price for an item.

- (e) (4 points) In the context of B2C electronic commerce, what is *reintermediation*?
- (f) (6 points) As we have discussed in class, “portal” business models have changed and evolved since the notion was first introduced. At this point in the evolution, what is a portal? Specifically, for two points each, briefly describe three essential features that all major portals have in common.

Question 6: (20 points) Miscellaneous

- (a) (6 points) Google’s success as a search engine is based on many things, including the number of pages it indexes, its content-analysis technology, and its PageRank algorithm. Briefly explain how PageRank works.
- (b) (2 points) True or False: By paying for a “sponsored link,” an advertiser can raise the Google PageRank of its website.
- (c) (4 points) Google *caches* snapshots of the pages it encounters as it *crawls* the WWW. Give one example of how these cached snapshots are used.
- (d) (2 points) True or False: Information industries always succeed in forcing consumers to adopt new technologies for information distribution or consumption, even if adoption involves high switching costs.
- (e) (4 points) Write an HTML fragment that creates two buttons, labeled “vegetarian” and “carnivore,” from which the user may choose exactly one.
- (f) (2 points) For one point each, give two of the HTTP request methods that clients use to send requests to web servers.