CSPP54001 Networks
Questions For Finals
Total Questions: 73

Update History

1. **Latest update at 10:30AM, March 12, 2003**
   a. Question 62: added the first 5 segments for both A and B.

2. **Update at 2PM, March 11, 2003**
   a. Question 64: added the cost of <C, G> link.
   b. Question 57: updated the cost of <F, G> link.

3. **Update at 12AM, March 10, 2003**
   a. Question 73: added first time.

4. **Update at 11AM, March 10, 2003**
   a. Question 64: the cut-off part of the graph on the next page is merged with the other part in a same page.

5. **Creation at 10PM, March 9, 2003**
   a. This file is the combination of the txt file with first 54 questions and the pdf file with the rest 55-72 questions. Several typos have been corrected and the file is more readable.
   b. Question 62: the missing information has been added to both sub-question A and B.

QUESTION 1

You are a newly-minted CSPP grad. You have been hired by InnoTech, a hot software and consulting firm that is destined to set the tech economy ablaze once again. You affect your snottiest tech attitude and drive to your first day of work. On your new desk is a note from the equally snotty network administrator, asking you to configure the network settings on your new PC. The note tells you to set an IP of 128.1.1.96, and a subnet mask of 255.255.255.192. He neglects to give you a default router to use, and your PC has no other forwarding table entries. After checking around, you discover there is a router in the department with the following properties:

Subnet	Netmask	Next Hop	IP address Interface
128.1.1.0	255.255.255.192	Interface 0	128.1.1.1
128.1.1.64	255.255.255.192	Interface 1	128.1.1.65
128.1.1.128	255.255.255.192	Interface 2	128.1.1.129
128.1.1.192	255.255.255.192	Interface 3	128.1.1.193

Router's default route: 128.1.1.10 (InnoTech Internet border router)

As a typically lazy employee, you want to be able to surf the web when you get bored. To do that, you need a route to your company's Internet border router.

a) What, if anything, do you need to set your PC's default router to enable this?

b) Describe the forwarding required to get packets to   www.slackingatwork.com (130.1.1.100), which, conveniently enough, is directly reachable from InnoTech's border router.

QUESTION 2

How do the P2P and traditional client/server models differ?

QUESTION 3

The question deals with "Subnetting":

a) What are the major factors for which subnetting proved advantageous for the Internet?

b) Describe the datagram forwarding algorithm.

c) Implement the algorithm used in part (b) to describe what the   router does with packets addressed to the following IP addresses:

  i) 128.135.35.16
 ii) 128.135.35.208
iii) 128.135.40.162

iv) 128.135.35.66
v) 128.135.40.18

Given the following information:

SubnetNumber	SubnetMask	NextHop
128.135.35.0	255.255.255.128	Interface 1
128.135.35.128	255.255.255.128	Interface 2
128.135.35.127	255.255.255.128	R1
128.135.40.128	255.255.255.128	R2
128.135.35.4	255.255.255.63	Interface 3
<Default>		R3

QUESTION 4

Background:

A. HTML is a language that specifies text, links to other files such as images, form controls, and layout instructions. The linked to   files may be embedded within the text display or used as a navigational link to another page.

B. HTTP is a file transfer protocol most commonly used by web browsers to transfer HTML pages and their contents.

C. HTTP version 1.0 specifies each page or file embedded within a page is downloaded via a separate request or connection.

D. HTTP version 1.1 was changed from version 1.0 to allow a connection to remain open beyond the response to the initial request.

Question:

Explain the advantage of this modification. In what situations will the change most benefit an individual using a web browser? (i.e. distance, file size, number of links on a page, number of embedded objects, size of form, bandwidth, etc.) Provide an example to explain at least one of your points.

QUESTION 5

How should a firewall provide increased protection of a network? Name the three common types of firewall discussed in class.

QUESTION 6

What is P2P technology? Please give an example.

QUESTION 7

A state government wants to update their voice services to Voice Over IP (VOIP).
The major drivers for his initiative are:
  - Cost reduction (single large capital expense, substantial reduction in maintenance)
  - Simplified maintenance, single system to maintain for voice and data
  - Ability to provide next generation services that incorporate voice and data, for
example kiosks that offer support through voice, web sites that provide voice support.

a) From a technical perspective, what are major concerns with VOIP?

b) From an administrative perspective, what are the major concerns with VOIP?

c) What obstacles are there with providing voice services for next generation
services?

QUESTION 8

Topic - End to End argument:

Name the seven layers of the OSI model, state at which layer it makes the most sense
to implement an encryption protocol, and provide three reasons to support your
choice.

QUESTION 9

Anytime you connect your laptop to the school network, most likely you will be
assigned a session-specific IP address via DHCP before you can start using the
network and surf the Internet. What is DHCP? Briefly describe the underlying
mechanism on how a DHCP server assigns a dynamic IP address to individuals that
connect to the network.

QUESTION 10

What are the chief advantage and disadvantage of multimode fiber cable?

QUESTION 11

A student using the silver-star Linux box at the MacLab at Regenstein was working
on his final project for his web class. He meant to write a perl script that sent out three
emails and wrote a loop to do this. He sent this out to a guy who has been hacking his
site from LA and he wanted to play a joke on him.

When the student ran the script, he realized that an infinite loop was created and
attempted to kill the job. He checked with the MacLab personnel and they

(erroneously) confirmed that the job had been killed. In reality, the loop continued to run for 9 hours before Techstaff noticed the problem and was able to shut it down.

The message read:

```
To: someone@aol.com
From: God@universe.gov
Subject: I am watching you

I am watching you.
I am watching you
I am watching you.
```

The total message was 383 bits long.

a) Assume that the network from U Chicago to Los Angeles is 155 Mbits/second and that the distance is 3044km. If signals travel at 50% of the speed of light (299,792.5 km per sec), what is the time of flight?

b) How many bytes will be in transit if the network delivers 50% of its peak bandwidth?

c) While the generated message including the header was 383 bits long, the format was not accepted by the AOL server. This generated 3 different error messages on the AOL server, which were sent back to the U of C CS department. Each error message was 3485 bits long and the U of C mail system received the last error message 11 hours after the process the first error message was received. The AOL server transmitted at 200 Mbits per seconds.

How many bytes of error messages ended up on the U of C system (again assuming 50% of peak bandwidth)?

d) Although the student was not purposely spamming and even though this action was meant as a joke, since the recipient's mailbox filled up, this event resulted in a denial of service error for the recipient and nearly brought down the CS mail server.

What University policies were violated and what would you do as CIO or the policy maker at the U of C? What would you be required to do? Would you revoke the student's account (thereby kicking him out of the school)? Or would you try to find out the student's motivations and if the action was done maliciously?

QUESTION 12

List and briefly explain three of the four main types of security attacks.

QUESTION 13

Explain the differences in function between TCP and UDP.

QUESTION 14

What is optical grating? Give a general description and usage of Fiber Bragg Grating and Array Waveguide Grating.

QUESTION 15

Recipient-B receives an expected work related highly confidential electronic document from Sender-A. Recipient-B is concerned about any possible security attacks that might have occurred during the process of transmitting the file over an insecure network.

Recipient-B verifies with Sender-A by phone that the document was sent, but what further threat(s) should the recipient evaluate to confirm that a third party has not caused a breach in the privacy of the organization during the process of transmitting a proprietary document?

QUESTION 16

Give examples to compare and contrast Grid Computing and Computer Cluster.

QUESTION 17

Discuss the flow control (end-to-end) of TCP and how it manages to remain reliable over the Internet as opposed to a point-to-point link (named as least two differences).

QUESTION 18

Describe the features of Open Shortest Path First Protocol.

QUESTION 19

Hosts A and B are connected to a switch S via 10-Mbps links as shown below. The propagation delay on each link is 20 us. S is a store-and-forward device; it begins retransmitting a received packet 35 us after it has finished receiving it. Calculate the total time required to transmit 10,000 bits from A to B

a) As a single packet

b) As two 5,000-bit packets sent one right after the other host A-----------S-----------host B

QUESTION 20

Describe one protocol for implementing authentication?

QUESTION 21

With reference to the End-to-End Argument in System Design,

a. Give an example of a function that can be completely and correctly implemented at the application layer (at the end points of the communication system).

2. Give an example showing how the addition of a function to the communication subsystem may be beneficial to the overall system.

QUESTION 22

Which commands could you use to display the routing table on the local computer?

QUESTION 23

Explain the difference between bandwidth and latency.

QUESTION 24

Describe a peer in P2P. What are the fundamental characteristics of a P2P network? Give two P2P applications and describe how does the data transference work in these 2 applications? What could be the possible problems in P2P network, give one example?

QUESTION 25

Name the three dominant content delivery systems that exist today, and give characteristics of each.

QUESTION 26

How does a "route flap storm" start?

QUESTION 27

What is the difference between attenuation and dispersion and what are the factors that would cause each?

QUESTION 28

Why is packet switching used in the Internet? Discuss the primary source of its advantage (over circuit switching).

QUESTION 29

A student creates and sells t-shirts from his dorm room that say "The University of Chicago: Where Fun Comes to Die." The shirt becomes a big hit in Hyde Park, and alumni worldwide catch wind and want to purchase shirts from the student. The student sets up a website using his uchicago personal webspace. On his site, he posts some pictures of the shirts and instructions on how to send him money via PayPal. Despite the popularity of the site, the personal web site server handles the load with ease, so it does not disrupt other users.

Question: From the University IT department's standpoint, is there any problem here? Discuss.

QUESTION 30

What are some of the features that came about due to the emergence of Central Internet Servers and the use of a new distribution network? (List 3)

QUESTION 31

Describe what a Web Service is and identify Web Service pros and cons.

QUESTION 32

Explain the conflict between tolerating burstiness and controlling network congestion.

QUESTION 33

How does a filter-based firewall protect from unauthorized traffic?

QUESTION 34

Any network has a limited number of resources such as computing cycles, data storage, and connectivity to other nodes, bandwidth and information about the network. Many practical large--scale networks follow power--law or hierarchal

schemes. i.e. some nodes have a lot of resources, many have a moderate number of resources, and most have very few resources.

a. What are the advantages and disadvantages of highly centralized networks, (single server--many clients)?

b. What are the advantages and disadvantages of highly decentralized networks-- i.e. each node has roughly equal resources?

QUESTION 35

Identify a key point in a network where packet fragmentations would most likely occur and why. Be sure to relate your answer in terms of the MTU and provide a good rule of thumb for determining the size of a MTU.

QUESTION 36

Explain what total internal reflection is and why it is important for fiber optic fibers.

QUESTION 37

Question: TCP is often used to deliver packets but there are times when UDPs are preferable. Name some of the main characteristics of UDP that would make it attractive to use it as a packet format.

QUESTION 38

With Grid Services, one of the major concerns discussed in class deals with the problem of authentication in a virtual organization. Describe the authentication problem, and the current method for dealing with this concern.

QUESTION 39

Give two examples of how P2P technologies have impacted the Internet.

QUESTION 40

a) For an RSA Encryption Algorithm with a public key of (5,35), what would the corresponding ciphertext be for a value of 4?

b) Given a real network that can be described by a power law graph with an exponent or sigma = 3, what is the probability of a node on that network interacting directly with a number of nodes equal to the ciphertext value from part a above?

c) Why does a traditional random graph theory like that of Erdos & Renyi fail to explain the scaling of a real network like the one in part b above?

QUESTION 41

Why are line amplifiers needed in optical networks and how is amplification implemented without converting optical signal to electric state?

QUESTION 42

Discuss the special problems and challenges associated with optical fiber as compared to copper wire. Please mention both physical difficulties such as those encountered during the physical installation of the fiber as well as the technical difficulties such as the phenomenon of chromatic dispersion.

QUESTION 43

Name a real-world example of each of the following types of networks and briefly describe what they do. {For example, a real-world example of an Internet service provider is America Online}

- P2P Network
- Optical Network
- Grid Computing

QUESTION 44

Explain three of the following five rights-management and protection technologies that are being deployed to limit the introduction rate and policing of content into the Darknet.

a) Conditional Access Systems

b) Digital rights management systems

c) Software

d) Watermarking

e) Fingerprinting

QUESTION 45

(a) Name the four layers in the 4-layer Internet Model
(b) Briefly describe the bottom three layers of the model

(c) Give an example of each

QUESTION 46

Peer-to-Peer (P2P) technology is used for a variety of different purposes.
(A) Name and describe three major types of P2P applications.
(B) What are some of the common issues in designing and implementing the applications you chose in part A?

QUESTION 47

What are the 4 categories of security attacks? Can you describe the difference between Active and Passive Security Threats, and give examples of each?

QUESTION 48

What are four advantages of OSPF over RIP?

QUESTION 49

SubnetNumber	SubnetMask	NextHop
128.96.33.0	255.255.255.0	Interface 0
128.96.34.0	255.255.255.128	R1
128.96.34.64	255.255.255.192	R2
128.96.34.128	255.255.255.0	R3
Default		R4

Given the routing table, what are the next hops for the packets addressed to each of the following destinations?

a) 128.96.34.10
b) 128.96.33.12
c) 128.96.34.151
d) 128.96.33.192
e) 128.96.34.100

QUESTION 50

Suppose you want to send a 15-MB size file over a 1Gbps network with a latency (RTT) 100ms using a protocol similar to TCP that has sending packet size 1 KB, and the receiver advertised window size is 1 MB (2^{10}KB).

This TCP uses a very simple rule for the flow and congestion control:

First, it uses the Slow Start until it reaches the threshold MIN (CongestionWindow, AdvertisedWindow); Then, send the rest of data using this threshold in each RTT. We assume no other flow and congestion control mechanisms are used, such as multiplicative decrease, additive increase, fast retransmission and fast recovery, etc.

a) How many RTTs are needed to send this file?
b) What is the effective throughput for the transfer?

QUESTION 51

List three reasons why the Internet network is less stable than the telephone network:

QUESTION 52

Peer-to-Peer networks offer users the ability to share data with other users in a networked system that allows maximum access to information and other peers worldwide with a minimum cost (limited only by the users resources) to the individual user. Explain some of the problems and disadvantages of current peer-to-peer implementations.

QUESTION 53

Topic: Congestion Control and Flow Control

a) Consider a network in which for each link, the link capacity is greater than the sum of the input rates for all end systems in the network. Is congestion control needed in this scenario? Why or why not? Is flow control needed in this scenario? Why or why not?

b) Suppose a TCP sender receives many successive (i.e., in a row) duplicate acknowledgements for packet x. What should the TCP sender infer has happened? Why?

c) What is the purpose of slow start in TCP's congestion control algorithm? How might the length of a connection (in packets) impact the effectiveness of slow start?

QUESTION 54

Name two characteristics of good P2P system design.

QUESTION 55

A. The Internet is implemented as a packet switched network. Name the advantages of a packet switching infrastructure and the disadvantages which make implementing Internet protocols somewhat difficult.

B. Explain how the TCP and IP protocols work together to overcome these difficulties.

QUESTION 56

First, fill in the six open cells in the table below:

Key size (bits)	Number of alternative keys	Time required at 10^6 decryptions/µs
32		
56		
128		

Now, describe whether or not we should feel secure with 128-bit encryption for Internet transactions. If so, why? If not, explain why not? If there is more to the story than just our encryption key size, please explain.

QUESTION 57

There is such a network routing system as below. Each node (A, B, …H) represents a host and the number on the each edge represents the cost to reach to the adjunct host.
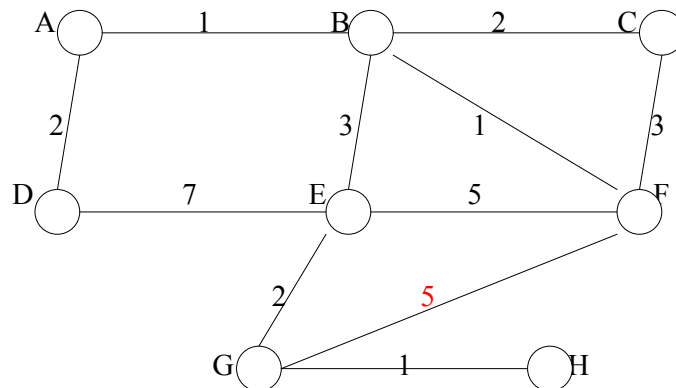
a) By using the technique of Bellman-Ford algorithm, determine the route from A, B, C, D, E, F and G to H.

b) Give global distance-vector table when each node knows only the distance to its immediate neighbors based on the network above.

c) Suppose that links A-D and F-G both are failed. Give the final routing table of D after A, D, F and G have reported the news. Explain briefly what implication does the final routing table of D give you comparing the answer for a)?

QUESTION 58
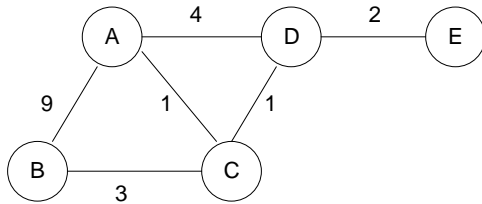
For the network above give vector distance variables when:
a. Each node only knows distance to immediate neighbors
b. Each node has reported the information it had in the preceding step to its immediate neighbors
c. Step b is repeated

QUESTION 59

Question1 (Based From The Article "Are File Swapping Networks Cacheable?"):
   If caching was available for P2P traffic what problem(s) would this solve? (Please articulate your answer in one to two sentences)

Question2 (Based From The Article "Measuring and Analyzing The Characteristics of Gnutella and Napster Hosts"):
   In a P2P network what determine(s) how fast a server can serve information to an application customer?

QUESTION 60

(a) List some of the tools enabling resource sharing within virtual organizations.
(b) Explain some of the problems with using web services as a grid technology.
(c) Give three examples where implementing Grid computing would be helpful.

QUESTION 61

a) Provide the names of each layer in the following 4-Layer Internet model.

b) Provide a protocol for each of the 4 layers in part a)

c) True or False

1. ( ) Network layer provides reliable, in-sequence delivery of data.
2. ( ) The Internet Protocol is connectionless and unreliable.
3. ( ) TTL field in IP header defines how long the data lives in milliseconds.
4. ( ) TCP and UDP both provide reliable, in-order delivery of data

QUESTION 62

Consider the following simple network: Three physical links (denoted as A, B, and C) are sending data over a switch that will multiplex the data onto one physical link, denoted by X.

The switch can buffer an infinite number of packets instantaneously.
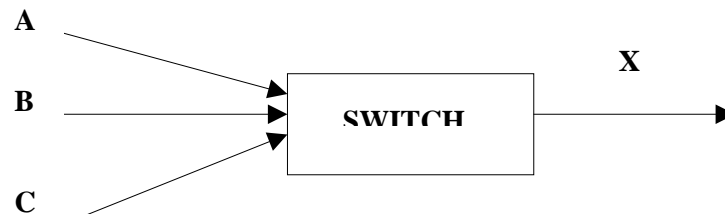
A. The switch uses synchronous time-division multiplexing (STDM) and the order of transmission is round-robin from A to B to C. Show the sequence of data flow across link X by using the letters A, B, and C to show data from links A, B, and C respectively. Use 0 (Zero) to show "No Transmission this time segment". The first five (5) segments are shown. Continue until all data from all links is exhausted.

Use the following information, assuming that during each quanta, a single link can send one "packet" of data.

At time 0, the switch has buffered 4 packets for link A, 6 packets for link B, and 2 packets for link C. At time segment 16, 4 additional packets are buffered from link A and 4 packets are buffered for link C.

Time\Data From Link	
1	A
2	B
3	C
4	A
5	B

B. The switch utilizes statistical multiplexing with an initial order of transmission being round-robin from A to B to C. Use 0 (Zero) to show "No Transmission this time segment". Continue until all data from all links is exhausted.

Use the following information, assuming that during each quanta, a single link can send one "packet" of data.

At time 0, the switch has buffered 4 packets for link A, 6 packets for link B, and 2 packets for link C. At time segment 16, 4 additional packets are buffered from link A and 4 packets are buffered for link C.

C. What is the primary cause of inefficiency in part A?

D. What is the reason for inefficiency (unused segments, if any) in part B?
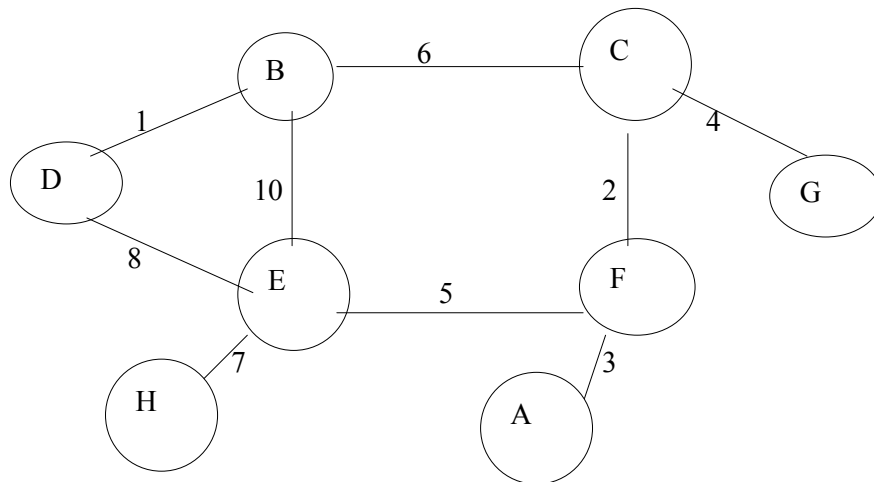
QUESTION 63
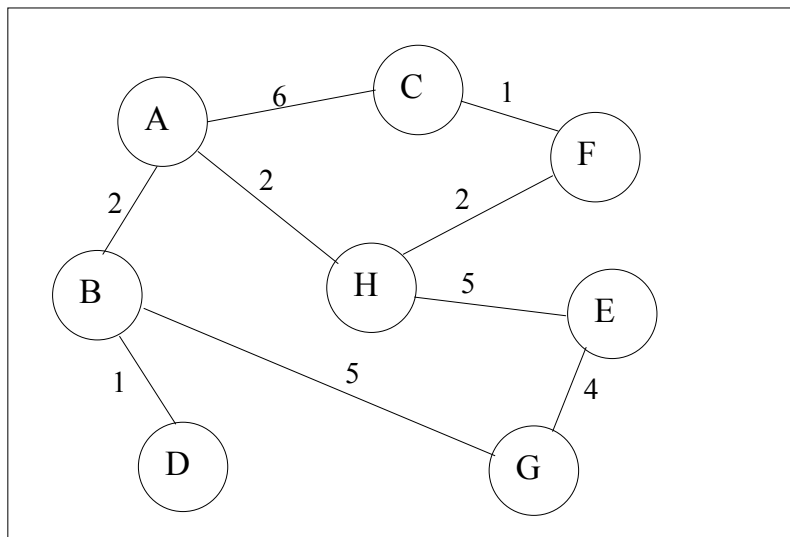
Figure 1: Network

Question: For the network in figure 1, show how the link-state algorithm builds the routing table for node G?

QUESTION 64

For the following network, show how the link-state algorithm builds the routing table for node D.

QUESTION 65

Name the layers of both the OSI Model and the Internet Architecture Model. Discuss the uses of the layers and how they relate to both TCP and IP.
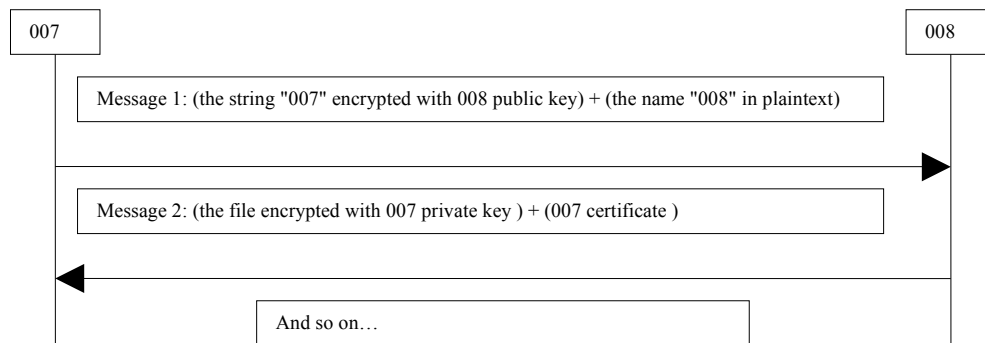

QUESTION 66

007 and 008 are two spies in the service of Her Majesty the Queen. 007 is stationed in Iraq, while 008 is undercover in Afghanistan. Since the president of the USA insists that there is a link between the government of Iraq and terrorists hiding in Afghanistan, the two spies need a secure way to communicate with each other in order to exchange information. They will use a dedicated protocol over IP, over the Internet. Your task is to define the protocol: what messages are sent and what do they contain.

Assumptions:
1. Messages should be sent in a private (against enemy interception) and authenticated (sender should be sure it sending to a known destination, receiver should be sure that the data came from the expected sender). You should <u>not</u> be worried about integrity of data sent.
2. Only Public key mechanisms will be used for authentication and encryption.
3. The two spies don't know anything about each other, except that 007 knows the IP address of 008.
4. Each of the spies has a static (never changes) public-private key pair of its own.
5. Each file transfer (or request for transfer) over this protocol should use a fresh public-private key pair generated especially for that session. The static keys (mentioned in 4) will not be used for transferring the data, but only for exchanging the fresh keys.
6. Each spy has a certificate from a CA called "Q" (which they both trust), that specifies: entity name (007 or 008), the static public key of entity, CA name ("Q"), and a digital signature.

7. The general sequence should be: authentication phase (including the exchange of fresh keys), client encrypted request for a file, server encrypted transfer of the file in one chunk. No acknowledgements are used.
8. Latency consideration is more important than Bandwidth (since the packets are small and the propagation delay is high). So put as much data as you can in a single message.
9. Use the minimal number of messages (regardless of their size).

So what is required from you? Show the sequence of messages passed between 007 and 008, when 007 requests a specific file from 008 and gets it. Describe the contents of each message in detail. Example:

```
┌─────┐                                                              ┌─────┐
│ 007 │                                                              │ 008 │
└─────┘                                                              └─────┘
   │                                                                    │
   │  ┌──────────────────────────────────────────────────────────┐     │
   │  │ Message 1: (the string "007" encrypted with 008 public key)│    │
   │  │ + (the name "008" in plaintext)                            │    │
   │  └──────────────────────────────────────────────────────────┘     │
   │ ─────────────────────────────────────────────────────────────────►│
   │                                                                    │
   │  ┌──────────────────────────────────────────────────────────┐     │
   │  │ Message 2: (the file encrypted with 007 private key )      │    │
   │  │ + (007 certificate )                                       │    │
   │  └──────────────────────────────────────────────────────────┘     │
   │ ◄─────────────────────────────────────────────────────────────────│
   │                                                                    │
   │        ┌──────────────────────┐                                    │
   │        │   And so on…          │                                    │
   │        └──────────────────────┘                                    │
```

QUESTION 67

Suppose a router has built up the routing table. The router can deliver packets directly over interface 0 and 1, or it can forward packets to router R2, R3, R4…R7.

SubnetNumber	SubnetMask	NextHop
203.74.205.0	255.255.255.224	Interface 0
203.74.205.32	255.255.255.224	Interface 1
203.74.205.64	255.255.255.224	R2
203.74.205.96	255.255.255.224	R3
203.74.205.128	255.255.255.224	R4
203.74.205.160	255.255.255.224	R5
203.74.205.192	255.255.255.224	R6
Default		R7

What router does with a packet addressed to the following destination?
203.74.205.33

QUESTION 68
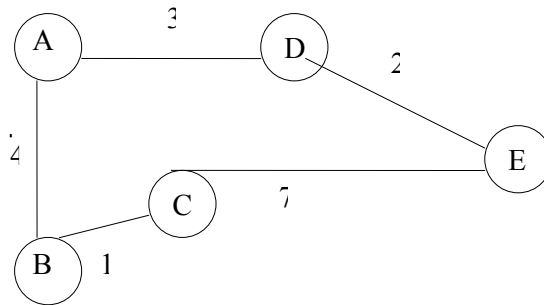
For the network given, show how the link-state algorithm builds the routing table for node D.

QUESTION 69

Part 1:
List the layers of the grid architecture and describe their function.

Part 2:
Contrast the layers of the Grid architecture with those of the Internet Protocol (IP) architecture. Describe what each layer of the IP architecture does and how this relates to the equivalent component(s) in the Grid architecture.

QUESTION 70

You are a cspp student connected to the Internet via an Ethernet Local Area Network (LAN). You are uploading a PDF (binary) version of your resume to your website with an FTP client over TCP/IP. Shows where each of the packet switching protocols (Ethernet, FTP, TCP and IP) and the file transfer mode (binary) belong in the 7-layer OSI and 4-layer Internet network models below.

QUESTION 71

Subnetting

Table 1: Routing table for R1

| Subnet Number	SubnetMask	NextHop
128:96:34:0	255:255:255:192	Interface0
128:96:34:64	255:255:255:192	Interface1
128:96:34:128	255:255:255:192	Interface2
128:96:34:192	255:255:255:192	Interface3
128:96:33:0	255:255:255:128	R2
< default >		R3

Suppose a host H1 is connected to a router R1 on a subnet and there is no other router on the subnet. The IP address and Subnet Mask for H1 are

	IP address	Subnet Mask
H1	128:96:34:100	255:255:255:192

If H1 wants to send a packet to the following IP addresses, Does the packet need to be sent R1 at first? If so, describe what R1 does when R1 received each packet. R1has built up the routing table shown in Table1.

(a) 128.96.34.12
(b) 128.96.34.67
(c) 128.96.33.130

QUESTION 72
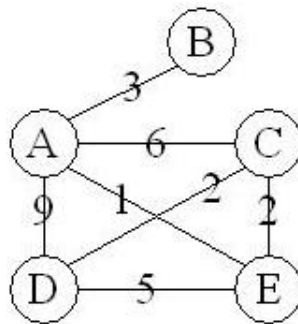
For clarification: Cost between A and E is 1 and cost between C and D is 2.
Build the routing table for node D.

QUESTION 73

I am sending a packet to Ian.
Draw final routing table(Sample is given below) of each router that is in the path of my packet based on the following example network.
Assume that my packet is routed in the most efficient way using distance-vector algorithm.

Sample Table (F router)

Destination	Cost	NextHop
A		
B		
C		
C		
E		

[Example network]