PRINCE OF SONGKLA UNIVERSITY

FACULTY OF ENGINEERING

Final Examination: Semester 2 **Academic Year:** 2009-2010

Date: February 26, 2010 (2553) **Time:** 13:30 – 16:30

Subject Number: 241-461 **Room:** A401

Subject Title: Internet Engineering

Name: _____ Student Number: _____

Exam Duration: 3 hours

This paper has 11 pages (including this page).

- Write the answers in the spaces provided in the examination paper.
- Clearly write your student number in the space provided at the top of each page. Write your name and student number in the spaces provided on this cover page.
- There are 80 marks total for this exam.

Authorised Materials:

- Anything the student can carry (except communication devices.)

Instructions to Students:

- Attempt all 7 questions .
- Anything illegible is incorrect.
- Show all calculations, not just the final result.
- Answer briefly where possible, essays are **not** required. There is no need to use all of the space provided for each answer!
- The marks allocated for each question are shown next to that question.
- *Answer questions in English.* Good English is **not** required.

For marker's use only.

1	2	3	4	5	6	7	Total

Question 1. *(8 marks)*

The following IP (IPv4) addresses are to be converted from the textual form you see written here, into the binary format used in network packet headers, and other places.

For each of the following addresses, write in the box provided, the number of bits (the total number of ones and zeroes together) that will be used to represent the address in its binary format.

(You can calculate the number of bytes and multiply by 8 to obtain the number of bits if you prefer, but the answer given must be the number of bits.)

A) 172.30.3.217 ☐

B) 127.0.0.1 ☐

C) 10.11.12.13 ☐

D) 192.168.1.1 ☐

E) 64.32.16.8 ☐

F) 8.16.32.64 ☐

G) 0.0.0.0 ☐

H) 31.255.255.255 ☐

Question 2. *(8 marks)*

(Write the answers in the boxes provided)

i) Which one of the following is **not** a valid IPv4 Internet Address?

A) 1.2.3.4
B) 101.101.101.101
C) 111.222.123.321
D) 200.002.200.002
E) 99.255.255.99

ii) How many hosts is it possible to connect to an IPv4 network (link) that has a 23 bit subnet mask?

A) 32
B) 1022
C) 9
D) 23
E) 510
F) More than any of those

iii) How many hosts (approximately) is it possible to connect to an IPv6 network (link) that has a 64 bit subnet mask?

A) 281,474,976,710,656 (2^{48})
B) 65534 ($2^{16} - 2$)
C) 2^{64}
D) 254
E) 2^{128}
F) More than any of those

iv) Which one of the following statements is **true**?

A) There is a defined address any host can use to talk to itself
B) Better assignment policy means less IPv6 addresses will be wasted than happens with IPv4
C) All available IPv4 addresses have been assigned already
D) IPv6 is not used by any of the world's major networks

Question 3. *(10 marks)*

The list following gives a number of explanations for various networking events, scenarios, decisions, etc. Each entry in the list is numbered. On the following page there are a number of statements. Every one of those statements is false.

For each statement, read the statement very carefully, and then choose the explanation from the list below that best, in your opinion, explains why that statement is false.

There are more possible explanations than statements, so obviously some of the explanations will not be used in answering this question. Further, it is possible that one, or more, of the explanations might be the correct answer to explain why more than one, or even all, of the statements are false.

(That is: you may use the same explanation more than once.)

The Explanations

1) ATM has a 48 octet cell size.
2) A lost fragment wastes bandwidth transmitting the remaining fragments.
3) Tunnelling cases a reduction in available MTU.
4) Two IP addresses that differ only in the local parts should be connected to the same network.
5) Link local IPv6 addresses are all that is needed for communications when there is no router.
6) Only IPv6 has Router Advertisements.
7) TCP Sequence and Acknowledgment numbers cycle and continue forever.
8) Key distribution for symmetric key algorithms can be a difficult problem.
9) It is impossible to manually configure everything.
10) Lost packets help TCP adapt to network conditions.
11) Packets smaller than the minimum required MTU never need fragmenting.
12) An IPv6 optional header can be several hundreds of bytes long.
13) Any node can be a network management agent.
14) A certificate signs the private key of the organisation described.
15) It is possible to manually configure everything.
16) Public Key security algorithms are complex and slow.
17) Routers never reply to an ICMP packet.
18) To access data from a MIB the Object Identifier of the leaf node, and an instance identifier, must be provided.
19) Anyone can act as a Certificate Authority.
20) The statement in the question is not false, it is true.

The Statements

(Write the number associated with the explanation you select from the list on the previous page in each box provided)

A) If there is no router, and no DHCPv6 server, an IPv6 node cannot operate, because it cannot obtain a prefix to configure its address. ☐

B) Using Path MTU Discovery (PMTUD) is mandatory for all IPv6 communications because IPv6 routers are not permitted to fragment packets. ☐

C) A **MIB** (Management Information Base) is a general purpose database implemented in network routers for network management and monitoring data. ☐

D) To digitally sign a document, file, or network packet, the node's private key is used to encrypt all of the data in the document, file, or packet. ☐

E) The minimum required MTU for IPv6 links should have been made 1500 bytes (octets), rather than 1280 as it was set, as these days no-one installs links with a smaller MTU than that provided by an Ethernet. ☐

F) DHCP is mandatory in all IPv4 networks as there is no other way to make sure every host gets a different IP address. ☐

G) The only way to obtain, or create, a digital certificate is to prove identity and pay much money to one of a few well known Certificate Authorities. ☐

H) Any OID (object identifier) can correctly appear in an SNMP **GET** request. ☐

I) Since every octet transferred over a TCP connection is given its own sequence number, and the sequence number is a 32 bit value, the maximum possible TCP transfer size is approximately 4 gigabytes (4 gigabytes is approximately 2^{32} bytes.) ☐

J) When an IPv6 node auto-configures its IPv6 address using an EUI-64 derived from its MAC address, and a prefix obtained from its local router, it is guaranteed that no other node can possibly have the same address. ☐

Question 4. *(9 marks)*

Which of the following three (3) statements about Internet routing are **TRUE** and which are **FALSE**?

(Write **T** *or* **F** *in each box provided)*

A) Routers running a Bellman-Ford (or Distance Vector) routing protocol know to which router(s) every network in the system is connected. ☐

Explain **why** that statement is true, or false.

B) In Link-State routing (Dijkstra's Shortest Path First algorithm, or similar) every router must obtain a LSA (Link State Advertisement) from every other router. ☐

Explain **why** that statement is true, or false.

C) For Path Vector routing (such as BGP), all Autonomous Systems (AS) must implement a common **internal gateway protocol** *(local routing protocol)* so that consistent forwarding can be achieved. ☐

Explain **why** that statement is true, or false.

Question 5. *(10 marks)*

What does the UDP protocol add to the protocol stack that is not already provided by the IP protocol, over which UDP runs?

Question 6. *(15 marks)*

A web (www) server has a certificate signed by a certificate authority (**CA**) that is known and trusted by all web browsers (assume this is true).

A) A web web browser connects to that server attempting to make a secure connection.
The server will send its certificate to the browser.
Upon receiving the certificate the web browser will check it.
How will it do that check?

_____

_____

B) After verifying the certificate (and succeeding) the browser will now have two pieces of knowledge. They are:

1) _____

2) _____

C) The server will also have sent a list of symmetric key algorithms to the browser.
Why is this list needed?

_____

_____

D) With this list the browser can select one algorithm and generate a secret key for the selected algorithm.
It then sends that key to the server.
How is that done securely?

_____

_____

Question 7. *(20 marks)*

A router implementing a Distance Vector routing protocol (perhaps RIP), contains the following information in its routing protocol database – learned from its own interface information, and earlier data received from other routers on the network.

Destination	Next Hop	Cost
0.0.0.0/0	172.30.1.14	5
10.1.0.0/16	172.30.1.14	4
10.2.0.0/16	172.30.1.14	5
128.1.0.0/16	172.30.1.14	3
172.30.1.0/24	(direct - interface 1)	0
172.30.2.0/24	172.30.1.14	1
172.30.3.0/24	172.30.1.14	2
172.30.7.0/24	(direct - interface 2)	0
172.30.8.0/24	172.30.7.1	1
172.30.16.0/24	172.30.1.14	1
172.30.101.0/24	(direct - interface 3)	0
192.168.15.0/24	172.30.7.1	2
192.168.16.0/24	172.30.7.1	3
192.168.17.0/24	172.30.7.1	4

This router then receives a routing update from 172.30.101.3 over its interface number 3, which contains:

(This table is shown in two columns to save space in this examination paper, you should not draw any other conclusions from this representation.)

Destination	Cost		Destination	Cost
0.0.0.0/0	1		10.1.0.0/16	1
10.2.0.0/16	0		10.3.0.0/16	0
128.1.0.0/16	2		172.30.1.0/24	4
172.30.2.0/24	3		172.30.3.0/24	3
172.30.4.0/24	3		172.30.16.0/24	4
172.30.101.0/24	0		192.168.1.0/24	1

The metric (cost) in all cases is simply the hop count (the number of routers that need to be passed to reach the destination given.)

A) After processing this incoming routing update, show in the boxes below the routing database that will now exist at this router.

[10 marks]

Destination	Next Hop	Cost
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(Enough space has been allowed for all entries that should be required, plus some extra – not all rows need be completed.)

B) After the routing update just described has been processed, this router needs to send an update out its interface number 2. (That is, on the link with network address 172.30.7.0 – you can assume, though it is irrelevant for this question, that this router is 172.30.7.2).

Show in the boxes below, the contents of the routing data in the routing packet transmitted on interface 2 at this time.

Assume that split horizon **IS** implemented in this router.

[10 marks]

Destination	Cost
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(Again, more rows are provided than should be needed for your answer, leave excess rows blank.)