PRINCE OF SONGKLA UNIVERSITY

FACULTY OF ENGINEERING

Examination: Semester 2 **Academic Year:** 2011-2012

Date: December 19, 2011 (2554) **Time:** 09:00 – 12:00

Subject Number: 241-461 **Room:** Robot Lecture Theatre

Subject Title: Internet Engineering

Name: _____ Student Number: _____

Exam Duration: 3 hours

This paper has 10 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 60 marks total for this exam. This will contribute 30% of the course total.

Authorised Materials:

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

Instructions to Students:

- Attempt all 6 questions .
- Anything illegible is incorrect.
- 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	Total

Question 1. *(10 marks)*

The following list gives a set of statements, facts, or data, that can be made about, or apply to, the Domain Name System (DNS).

For each question on the next two pages, select the statement from this list that best answers that question.

Not all statements need be used as the answer to a question, but some may be used more than once.

The questions are on the next two pages.

The Statements

A) The answer to the question asked.
B) The **TC** (Truncated Reply) bit will be set in the header of the reply.
C) The name in the question section of the resource record does not exist.
D) Unlimited.
E) Indicate failure to the application.
F) Two hundred and fifty-five (255).
G) Retry the query using whatever server information exists that has not expired.
H) There is no data of the type requested at the DNS node given the question resource record.
I) Depends how many Resource Records (RRs) fit within the 512 byte packet size limit, which depends upon how big they are.
J) Return the resource records that exist in its cache (for which the Time-to-Live is greater than zero).
K) A zone is a domain with (perhaps) some sub-domains removed.
L) Five hundred and twelve (512).
M) The server does not know the answer requested, and so is providing the names of other servers to ask.
N) Omit the additional data resource records from the reply.
O) Retry the query by sending to a root nameserver (a server for the root domain or zone).
P) Sixty-five thousand, five hundred and thirty-five (65535).
Q) Set the **TC** (Truncated Reply) bit in the header of the reply.
R) Retry the query by sending to another (or the same) server for the zone whose server did not reply.

The Questions

Select the statement from the list on the previous page that is the best answer for each question, and write the letter (one of A .. R) that is next to that statement in the box next to the question.

i) The maximum number of answers (resource records) that can be returned in response to a DNS query is: ☐

ii) Despite waiting for several seconds, no reply has been received to a DNS query. The client (resolver) will: ☐

iii) A DNS reply contains no error (the **rcode** field is zero) and no answers (the count of resource records in the answer section is zero). The Authority section contains a single resource record which is a **Start of Authority** (SOA) record. This reply is: ☐

iv) A Name Server (NS) resource record appears in the answer section of a DNS reply. This is: ☐

v) After several attempts, a resolver has been unable to obtain a reply to its query from the servers for a zone, so it will: ☐

vi) A server is creating a reply to a question it received via UDP. It has added several resource records to the answer section of the reply, and has added NS records for the authoritative servers for the zone that owns the answers to the authority section. Then it wants to add to the additional data section address (type A and AAAA) records for those nameservers, and for some other names that were included in the answer section, but discovers that these records cause the packet to grow beyond the size limit for a UDP DNS packet. The server will: ☐

vii) A resolver receives a reply containing a *Server Error* error code. It will then: ☐

viii) A resolver receives a reply containing a *Format Error* error code. It will then: ☐

ix) At time 1000 a DNS cache receives an answer with three resource records in the resource record set, with Time-to_Live values of 300, 400, and 400 respectively. At time 1333 that same DNS cache receives a query requesting this same answer. The query has the Recursion Desired (**RD**) bit set (with value 1) and the cache will set the Recursion Available (**RA**) bit (to 1) in the reply. To answer the query the cache will: ☐

x) A Fully Qualified Domain Name (FQDN) is sent in a query to a cache with the Recursion Desired (RD) bit set (to 1). The cache has no information about the top level domain (TLD) (country domain or generic TLD). The cache will: ☐

(10 marks)

Question 2.

The following list gives the network configuration of a small number of networks. Each network has an IPv4 address and an IPv6 address. The prefix length of each network number is given following a slash ('/').

A) 128.16.0.0/16	2001:1234:0123:FACE::/64
B) 192.168.1.0/24	2001:4321:0:BBBB::/64
C) 192.168.2.0/24	2001:4321:0:CCCC::/64
D) 61.62.63.0/24	2002:3D3E:3F40:1::/64
E) 10.0.0.0/8	2002:0ABC:0101:2360::/60

The following are also available as answers to the questions below:

F) None of the networks listed (but possibly some other network).
G) This is an invalid address, which exists nowhere.
H) This is a valid address that cannot be assigned to a network node.

For each of the addresses below, select which from the list above includes the address given.

i) 10.11.12.13 ☐

ii) 128.250.15.109 ☐

iii) 2001:4321:0:CCCC:1021:1234:0:1C0E ☐

iv) 192.168.1.234 ☐

v) 192.168.2.345 ☐

vi) 2001:1234:123:FACE:192:168:2:345 ☐

vii) 2002:abc:101:2365::3 ☐

viii) 128.16.0.255 ☐

ix) 128.16.255.0 ☐

x) 2002:3D3E:3F40:1:2:3:4 ☐

(8 marks)

Question 3.

A User Datagram Protocol (UDP) packet (or datagram) contains a header containing 4 fields. Explain the use of each of the four fields:

A) **Source Port**

B) **Destination Port**

C) **Length**

D) **Checksum**

(12 marks)

Question 4.

E-mail (and its protocol, SMTP) and the World Wide Web (WWW) (and HTTP) are both systems that make use of the Transmission Control Protocol (TCP) to transport data between applications.

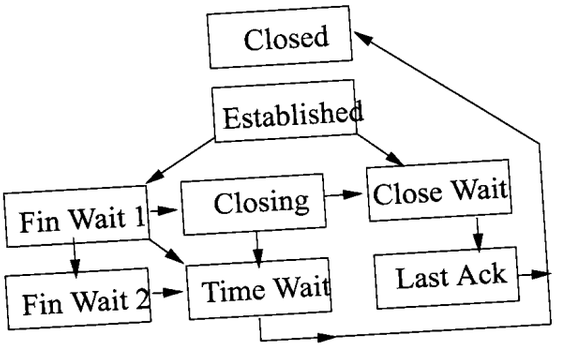
Describe the similarities and differences in requirements and the uses of those application protocols and the different requirements that they make upon TCP.

(10 marks)

Question 5.

The finite state machine (FSM) diagram below shows a part of the FSM for TCP connection establishment and shutdown. In particular, this shows the part used for ending communications.

Explain the purpose of each of the states shown, and what data transfer (if any) can occur while in this state. Also indicate what events cause the FSM to switch from one state to another (for the parts indicated in the diagram – there is no need to describe the transitions out of Closed state that get to Established state).



(10 marks)

Question 6.

The following table contains values from the TCP timestamp option, in particular, the **Your Time** (YT) values received in a series of acknowledgement packets that have been received from a connection to a particular peer.

The table also contains the value of the system's clock (which is used to fill in the **My Time** (T) values in packets that are transmitted) at the time each of those acknowledgement packets was received.

The units measured by the clock are not important for this question (you can imagine them to be micro-seconds, or milli-seconds, or anything else you desire.)

YT	Clock
1213	1222
1215	1223
1221	1232
1223	1232
1224	1235
1240	1250
1243	1252

Determine a reasonable value for the retransmit timer for this connection (using the same unit of time as is used by the clock shown in the table.) Explain your answer.