University of Pretoria

SEMESTER TEST: 12 APRIL 2016

COURSE: Computer Science
MEMORANDUM: COS332

TIME: 60 minutes
MARKS: 50

EXAMINER: Prof MS Olivier

THIS PAPER CONSISTS OF 13 PAGES.

ANSWER ALL QUESTIONS.
NO CALCULATORS PERMITTED

Question 1

In each case select the alternative that fits the question best and write only the corresponding letter on your answer sheet.

a) Layer 6 of ISO/OSI is the ... layer.

A: Application

B: Datalink

C: Session

D: Presentation

E: Physical

b) The ISO OSI session layer is positioned (exactly) between the ... and ... layers.

A: Network, Application

B: Transport, Application

C: Network, Presentation

D: Transport, Presentation

E: Presentation, Application

2./...

c) What is the name of ISO layer 2?

A: Data link layer

B: Presentation layer

C: Network layer

D: Data layer

E: More than one of the above

d) Layers 1 to 4 of the ISO OSI model are known as the

A: Network-oriented layers

B: Application-oriented layers

C: TCP/IP-oriented layers

D: More than one of the above

E: None of the above

e) Suppose a distributed database is used by a number of application protocols. On which OSI ISO layer should the two-phase commit protocol ideally be implemented?

A: 1

B: 2

C: 3

D: 4

E: 5

F: 6

G: 7

3./. . .

f) By whom are technical aspects of the Internet standardised?

A: IETF

B: ISO

C: EIA

D: ITU

E: CCITT

g) Ideally, an ISO layer provides services to ... and uses services from ....

A: the layer below it; the layer above it

B: the layer above it; the layer below it

C: its peer layer elsewhere in the network; the layer below it

D: the layer below it; its peer layer elsewhere in the network

E: a peer layer somewhere in the network; a peer layer somewhere in the network

h) When a new DNS TLD is in *landrush* it means

A: Only trademark holders are allowed to register domains in that TLD.

B: Exactly the same as when the TLD is in a general available state.

C: Normal users are allowed to register trademarked names in that TLD that would not have been possible under normal conditions.

D: The domain recently started accepting registrations from the general public — possibly at a higher cost than the eventual annual fees will be.

E: Its use has not been approved yet.

i) A DNS SOA RETRY entry indicates the time ... (in seconds).

A: A machine is allowed to use a resolved name before the name has to be resolved again.

B: A secondary nameserver is allowed to use names before synchronising with the primary server.

C: The time a secondary nameserver is allowed to exceed the time limit imposed on it by the primary server if it cannot establish contact with the primary server.

D: The time a secondary nameserver should wait to obtain a current copy of DNS entries after a previous synchronisation attempt failed.

E: The time a client who wants to resolve a name should wait before sending another resolution request.

j) Which of the following is not a valid MIME type?

A: application

B: audio

C: data

D: text

E: vnd

k) Suppose the first octet of a UTF-8 character is 193. How long (in octets) will the entire character be?

A: 1

B: 2

C: 3

D: 4

E: 5

F: 6

l) Which of the following is a valid MIME type?

A: `html`

B: `xml`

C: `jpg`

D: `model`

E: `msword`

m) Which of the following is *not* a valid MIME type?

A: multipart/mixed

B: image/jpeg

C: text/text

D: example/cos332

E: multipart/alternative

n) EBNF is

A: An abbreviation for Extended Backus-Naur Form

B: Often used by CFPs to specify the content of data messages

C: Standardised by a CFP

D: More than one of the above

E: All of the above

o) The ideal layer to implement encryption for most situations is

A: 7

B: 6

C: 4

D: 3

E: Dependent on the details of the specific case.

p) HTTP is used, amongst others, by Web browsers, WAP browsers, and applications that download maps and music, as well as many other applications. HTTP is on the

A: Application layer

B: Bottom half of the application layer

C: Top half of the application layer

D: Presentation layer

E: None of the above

q) How may information be encoded that is supplied with an HTTP `POST` request?

A: Key-value pairs, with spaces replaced by a + and URL-encoding applied afterwards.

B: Plain text

C: The native encoding of whatever data is communicated is used unmodified.

D: HTML

E: No data accompanies the HTTP POST message.

r) Flow control in TCP uses

A: Stop-and-wait

B: The unrestricted approach

C: Window advertisements

D: RTS and CTS

s) Which transport layer protocol(s) is/are used by DNS?

A: TCP

B: UDP

C: TCP and UDP

D: TCP/IP

E: IP

7./...

t) TFTP

A: Has strong access control.

B: Uses UDP.

C: Cannot be used with DNS.

D: More than one of the above

E: All of the above

u) What is the name of the server that is commonly used on Unix systems to share files with Windows clients?

A: Tango

B: Foxtrot

C: Samba

D: Waltz

E: Jive

v) The ccTLD of `who.is` is that of

A: Israel

B: Isle of Man

C: Iceland

D: International Software

E: Ipso Facto

w) Which of the following second-level domains does not exist?

A: `school.za`

B: `edu.za`

C: `ac.za`

D: `tech.za`

E: `law.za`

x) The primary reason for including the `host:` header in the HTTP protocol is to

A: Ensure that the `hosts` file cannot be misused.

B: Make a clear distinction between client and host requests.

C: Enable virtual hosting.

D: Enhance security by ensuring that the destination server is indeed the one the user wanted to visit because the name of the server can now be compared with the name provided in the `host:` header.

E: Specify alternative hosts that may contain the content the requester wants.

y) Which of the following is *not* an SNMP request?

A: `Get`

B: `GetNext`

C: `GetBulk`

D: `Reboot`

E: `Set`

[25]

Question 2

Name five (5) fields that occur in a TCP header but not in a UDP header. Briefly explain why each field is necessary in a TCP header but not in a UDP header. (For the purposes of this question FIN is not an acceptable answer.) **[5]**

Question 3

Assume that computers on an internet are addressed using addresses (A records) consisting of numbers from 1 to 100. Assume node 1 is a root name server and you use node 100 to perform *recursive* name resolution. The following are (partial) zone files at some nodes running *iterative* DNS servers. The files are incomplete since some rows and columns have been omitted; these omissions do not affect the answers to the questions. No caching occurs.

Node 1		
com.	NS	10
org.	NS	11
mil.	NS	12
za.	NS	13

Node 13		
ac	NS	20
co	NS	21
org	NS	22
net	NS	23

Node 21		
xx	NS	66
yy	NS	55
zz	NS	44

Node 22		
xx	NS	77
yy	NS	88
zz	NS	99

Node 55		
@	NS	55
www	A	50
ftp	A	51
mail	A	52
arthur	A	53

Node 66		
@	NS	66
@	MX,1	98
www	A	70
ftp	A	71
mail	A	72
arthur	A	73

Node 77		
@	NS	77
@	MX,1	99
www	A	80
ftp	A	81
mail	A	82
arthur	A	83
john	NS	55

The following series of `nslookup` queries is executed in sequence from top to bottom. Provide the address (that is, number) returned by each of the queries. The queries are indicated by a Roman number in square brackets (such as "[iii]"). The commands that do not return responses are not numbered. Write `N/A` if the query will not return an address.

```
nslookup > www.xx.org.za          [i]    [80]
> arthur.xx.co.za                 [ii]   [73]
> set type=NS
> com.                            [iii]  [10]
> co.za                           [iv]   [N/A]
> set type=A
> ftp.xx.co.za                    [v]    [N/A]
> server 100
> set type=MX
> ftp.xx.co.za                    [vi]   [98]
> john.xx.org.za                  [vii]  [98]
> set type=A
> john.xx.org.za                  [viii] [55]
> server 1
> com.                            [ix]   [N/A]
> server 77
> www.xx.org.za                   [x]    [80]
>
```

[10]

10./. . .

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Question 4

[555 bytes are consumed from A's buffer.
1500 bytes are consumed from B's buffer.

A

Source port	55
Destination port	66
Next byte to send	2223
Next byte expected	3334
My window size	555
Peer's window size	1500
Data to send	10000

B

Source port	66
Destination port	55
Next byte to send	3334
Next byte expected	2223
My window size	1500
Peer's window size	555
Data to send	10000

Payload size: 555 bytes

SRC:66,DEST:55,SEQ:3334, ACK:2223, WinAdv:1500

A

Source port	55
Destination port	66
Next byte to send	2223
Next byte expected	3889
My window size	0
Peer's window size	1500
Data to send	10000

A sends data to B.

Payload size: 1000 bytes

SRC:55, DEST:66, SEQ:2223, ACK:3889, WinAdv:0

B

Source port	66
Destination port	55
Next byte to send	3889
Next byte expected	3223
My window size	500
Peer's window size	0
Data to send	9445

Payload size: 0 bytes

SRC:66,DEST:55,SEQ:3889, ACK:3223, WinAdv:500

60 bytes are consumed from A's buffer.

A

Source port	55
Destination port	66
Next byte to send	3223
Next byte expected	3889
My window size	60
Peer's window size	500
Data to send	9000

A

Source port	55
Destination port	66
Next byte to send	3223
Next byte expected	3889
My window size	60
Peer's window size	500
Data to send	9000

A sends data to B.

Payload size: 500 bytes

SRC:55, DEST:66, SEQ:3223, ACK:3889, WinAdv:60

B

Source port	66
Destination port	55
Next byte to send	3889
Next byte expected	3723
My window size	0
Peer's window size	60
Data to send	9445

Payload size: 60 bytes

SRC:66,DEST:55,SEQ:3889, ACK:3723, WinAdv:0

A

Source port	55
Destination port	66
Next byte to send	3723
Next byte expected	3949
My window size	0
Peer's window size	0
Data to send	8500

a) Source port of segment (i) = [66]

b) Source port of segment (ii) = [55]

c) Source port of segment (iii) = [66]

d) Sequence number of segment (i) [3334]

e) Sequence number of segment (iii) [3889]

f) Acknowledgement number of segment (iv) [3889]

g) Window advertisement of segment (i) [1500]

h) Window advertisement of segment (iii) [500]

i) Data length of segment (iv) [500]

j) Data length of segment (v) [60]

]

Process A is given TCP socket 55 to connect to TCP socket 66 on server B (where these ports are used for some non-standard purposes). After a while both A and B has thousands of bytes of data ready to send to the other computer. A last successfully sent byte 2222, while B last successfully sent byte 3333. Both windows are currently full, so neither computer can transmit. Node A consumes 555 bytes from its buffer, while node B consumes 1500 bytes from its buffer. Both computers will send as much data as possible during any given transmission, but neither computer will transmit more than a 1000 bytes in a single segment.

Normally A and B will communicate in full duplex. However, for the purposes of this question assume that messages are sent one at a time. The events that happen are as follows:
(i) B sends data to A; (ii) A sends data to B; (iii) B sends an acknowledgement to A; A consumes 60 bytes from its buffer; (iv) A sends data to B; and (v) B sends a message to A.

Your task is to provide the values of the following header fields of the five segments listed above.

a) Source port of segment (i)

b) Source port of segment (ii)

c) Source port of segment (iii)

d) Sequence number of segment (i)

e) Sequence number of segment (iii)

f) Acknowledgement number of segment (iv)

g) Window advertisement of segment (i)

h) Window advertisement of segment (iii)

i) Data length of segment (iv)

j) Data length of segment (v)

[10]

TOTAL **[50]**

END OF PAPER