Test 15 April 2016, questions and answers

Internet Technologies (University of Melbourne)

***Student Number*_____**

THE UNIVERSITY OF MELBOURNE
DEPARTMENT OF COMPUTING AND INFORMATION SYSTEMS

Mid Semester test – Semester 1, 2016

COMP90007 Internet Technologies

Test Duration: 40 minutes **Total marks in this Test: 25**
Reading Time: 5 minutes **(Worth 5% of the final mark for the subject)**

This exam has 8 pages.

Authorized materials:
The following items are authorized: writing materials (e.g. pens, pencils). Calculators and all other books are *not* allowed.

Instructions to Invigilators:
Supply students with standard script book.

The test paper must remain in the exam room and be returned to the subject coordinator.

Instructions to Students:

- This paper contains 4 questions. Attempt all questions.
- Write your answers directly on this question paper as instructed by each question.
- Bullet points are acceptable in answering descriptive questions.
- *Any unreadable answers will be considered wrong*.

Q1 [10 marks] Multiple Choice Questions.

Indicate your answer by circling the appropriate choice for each question.

1. The layer responsible for servicing the Presentation layer functions in the OSI reference model is —

(a) Syntax layer.

(b) Transport layer.

(c) Presentation layer.

(d) Session layer.

(e) None of the above.

2. How many layers are in the OSI reference model?

(a) Five.

(b) Eight.

(c) Seven.

(d) Three.

(e) None of the above.

3. The transport layer in OSI model provides —

(a) Only connection-less services.

(b) Only connection oriented services.

(c) Both connection-less and connection oriented services.

(d) Connection-less or connection oriented services depending on the country.

(e) None of the above.

4. According to Nyquist's result, the maximum data rate obtainable using a signalling scheme with V discrete levels on a channel with bandwidth H Hz is given by —

(a) $2H \log_2 (1 + V)$.

(b) H l $\log_{10} (1 + V)$.

(c) $2H \log_2 (V)$.

(d) $H \log_2 (1 + V)$.

(e) More information is needed.

5. According to Shannon's result, the maximum data rate of a noisy physical channel with bandwidth H Hz and signal to noise ratio S/N is given by —

(a) $2H \log_2 (1 + S/N)$.

(b) $H \log_{10} (1 + S/N)$.

(c) $H \log_{10} (1 + 2\ S/N)$.

(d) $H \log_2 (1 + S/N)$.

(e) More information is needed.

6. The essential difference between flat addressing and hierarchical addressing is that —

(a) flat addressing uses a sequence of bytes as the address while hierarchical addressing uses a dotted notation.

(b) flat addressing refers to software while hierarchical addressing refers to hardware.

(c) hierarchical addresses are related to one another, while flat addresses are not.

(d) hierarchical addressing is not unique over the network devices.

(e) none of the above are essential.

7. As Data Units (DU) move from the lower to the upper layers, headers are —

(a) removed.

(b) added.

(c) rearranged.

(d) modified.

(e) both (a) and (b).

8. The term fragmentation refers to —

(a) breaking a long packet or message into smaller packets.

(b) breaking a long virtual circuit or circuit into smaller pieces.

(c) sending packets through a network using different paths.

(d) establishing a path through a network using different protocols.

(e) none of the above.

9. Which of the following is not a guided medium?

(a) Coaxial cable.

(b) Twisted pair cable.

(c) Fibre optic cable.

(d) Atmosphere.

(e) All of the above.

10. The network layer in TCP/IP model provides–

(a) only connection less services.

(b) only connection oriented services.

(c) both connection less and connection Oriented services.

(d) the same services specified in OSI Model.

(e) None of the above.

Q2 [5 marks] A source is generating uncompressed 800 × 600 pixel colour frames with 8 bits/pixel at 40 frames/sec.

a. Determine the source bit rate.

Ans: 800*600*8*40 = 153.6 Mbps

b. The generated data is transmitted over a 100 kilometres long cable. If the propagation speed in the cable is 2/3 the speed of light in a vacuum, determine the latency of the communication medium. Speed of light in a vacuum is 3×10^8 metres per second.

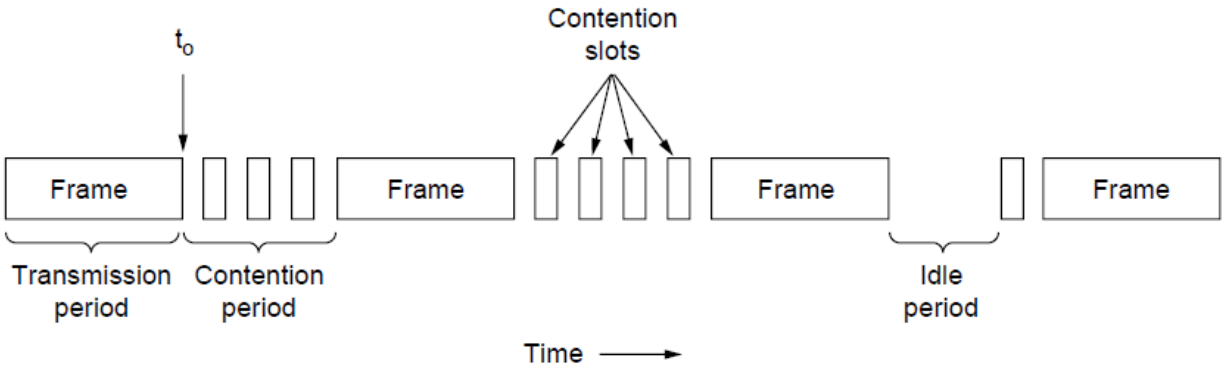
Length of the medium : 100 kms = 100 000 metres.

Speed of the light in the medium C*2/3 = (2/3)* 3×10^8 metres per second = 2×10^8 metres per second

Delay = length/ speed

Ans: 100000/(2*10^8) = 0.5 ms

Q3[5 marks] Consider the CSMA/CD model shown below for collision free protocols.



Now consider the Binary Countdown protocol involving stations 0 to N-1 with each station represented by equal length binary digits. Stations with data ready to send broadcast their addresses during a contention period simultaneously. An arbitration rule is applied so that only one station wins the right to send the frame after the contention period.

a. Now consider the situation when N is 16. What is the length of the contention period in bits?

log16 to the base2=4

b. Briefly explain the arbitration rule used in the Binary Countdown protocol.

In the contention period stations transmit their addresses bit by bit starting from the most significant bit. The bits from all stations are ORed in the channel.
At any point of time, if a station with "0" bit in its address detects "1" in the channel, it backs out. Others continue to transmit. Only the channel that does not see any conflict with its address will win the right to send its frame at the end of the contention period.

c. Suppose at time t_0, stations 3, 5, 11 and 12 became ready to transmit. Which station will win the right to transmit after the contention period?

12

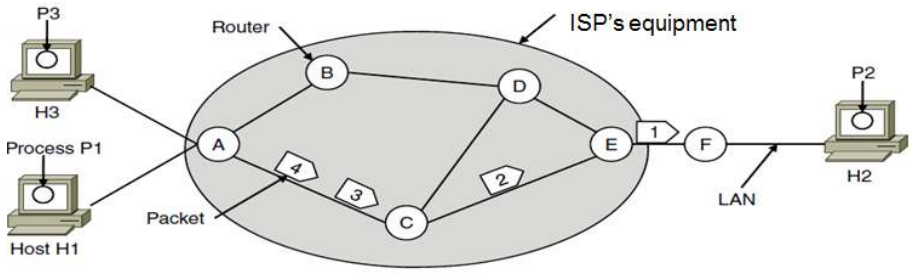
d. If d is size of the frame and there are N stations, what is the channel efficiency of the method?

d/(d+log n)

e. What is the main advantage of Binary Countdown protocol over Bit-Map protocol?

Lesser overhead

Q4 [5 marks] We discussed the implementation of virtual circuit network in the class. Consider the virtual circuit network example shown in the figure below connecting hosts H1 and H3 to H2. The routing tables in the example correspond to circuits established between processes in H1 and H3 to H2. The routing table at different routers is given below:



A's Table

In		Out	
H1	1	C	1
H3	1	C	5
H1	2	B	8
H3	2	B	9

B's table

In		Out	
A	8	D	12
A	9	D	17

C's Table

In		Out	
A	1	E	21
A	5	E	22

D's table

In		Out	
B	12	E	8
B	17	E	9

E's Table

In		Out	
C	21	F	1
C	22	F	2
D	8	F	3
D	9	F	4

The following figure shows the paths taken by the packets from H1 and H3 via different routers to H2 on two different virtual circuits, where some information about the routers and the VC numbers of the packets is missing.

a. Now complete the missing routers and VC numbers for the Circuit #1 and Circuit #2 given in the figure.

H1: 2 -> A-> 8 -> B -> 12 -> D -> 8 -> E -> 3 -> F

H2: 1 -> A -> 5 -> C -> 22-> E -> 2 -> F

b. How many circuits are present in this example?

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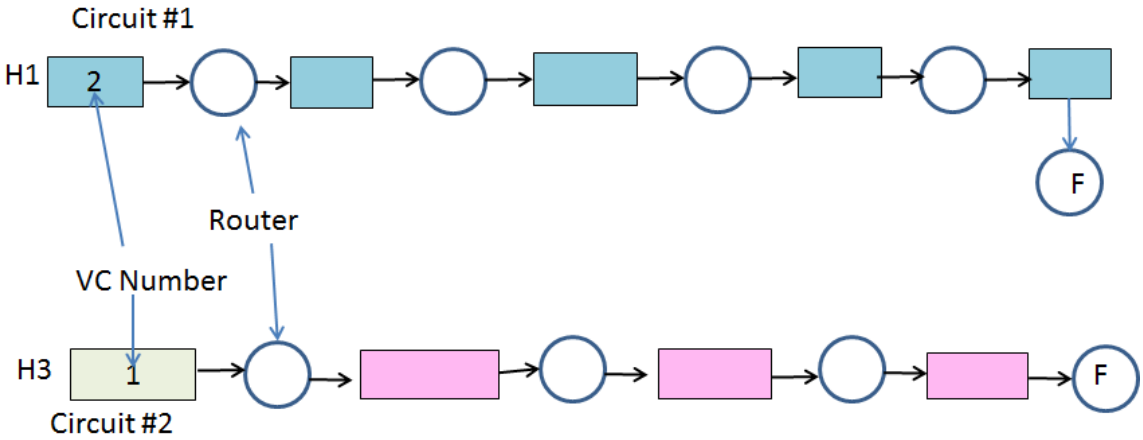
c. What is the main difference between virtual circuit and datagram networks?

In virtual circuits, a connection needs to be established prior to the actual communication (connection-oriented). All of the packets hence take the same path to the destination.

In datagram circuits, there exists no such prior connection. The packets can take whichever path they wish to take, to reach the destination. It is connection-less.



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End of test