FINAL EXAM
FIRST SEMESTER SESSION 2011/2012

COURSE CODE / NAME : STIJ3023 / COMPUTER NETWORK
DATE : 11/01/2012 (WEDNESDAY)
TIME : 8.30 PM – 11.00 PM (2½ HOURS)
VENUE : DSB K.T/WD, KYM, KIA

INSTRUCTION :

1. This exam paper contains FIFTEEN (15) questions in NINE (9) printed pages, excluding the cover page.
2. Answer ALL the questions in the space provided.
3. You are NOT ALLOWED to remove the exam paper from the examination hall.

MATRIC NO : ________________________________
( with word ) ( with number )

IDENTIFICATION CARD NO. :

LECTURER :

GROUP :  □  TABLE NO. :  □□□□

DO NOT OPEN THIS EXAMINATION PAPER UNTIL INSTRUCTED

CONFIDENTIAL
STIJ3023 COMPUTER NETWORK

STRUCTURED QUESTIONS (100 MARKS)
INSTRUCTION: Answer ALL the questions.

1. Suppose Host A wants to send a large file to Host B. The path from Host A to Host B has three links, of rates R1=500Kbps, R2=2Mbps, and R3=1Mbps.

   a) Assuming no other traffic in the network, what is the throughput for the file transfer.  
      (2 marks)

   b) Suppose the file is 4 million bytes. Roughly, how long will it take to transfer the file to Host B.  
      (2 mark)

   c) Repeat a) and b), but now with R2 reduced to 100Kbps.  
      (4 marks)

2. Give TWO (2) reasons why persistent connections and pipelining were added to HTTP/1.1.  
   (2 marks)

3. Give TWO (2) reasons for the deployment of web caching in the Internet.  
   (2 marks)
4. What is the difference between network architecture and application architecture? For each architecture, give an example. 

(4 marks)

5. Consider the following plot of TCP window size as a function of time for two TCP connections A and B as shown in figure 1. In this problem, we assume that both TCP senders are sending large files and the packet loss events are independent in connection A and B.

![Figure 1: Evolution of TCP's congestion window for connection A and B.](image_url)
a) Identify the type of TCP connections (Reno or Tahoe) that have been used by connection A and B. Justify your answers. (4 marks)

b) What are the values of the Threshold parameter between the 1\textsuperscript{st} and the 14\textsuperscript{th} transmission rounds for each connection? (4 marks)

c) At the 12\textsuperscript{th} transmission round for connection A, is segment loss detected by a triple duplicate ACK or by timeout? Justify your answer. (4 marks)

6. Distinguished between multiplexing and demultiplexing in transport layer. (4 marks)
7. Consider the network diagram in figure 2 below.

![Network Diagram](image)

**Figure 2: Network Diagram**

a) Show the operation of Dijkstra’s (Link State) algorithm for computing the least cost path from A to all destinations by filling in the table below:

(10 marks)

<table>
<thead>
<tr>
<th>N</th>
<th>D(B), p(B)</th>
<th>D(C), p(C)</th>
<th>D(D), p(D)</th>
<th>D(E), p(E)</th>
<th>D(F), p(F)</th>
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b) Illustrates a network diagram explicitly list the shortest path routes from A to all destinations that are the result of the algorithm’s computation.

(2 marks)

c) Show the forwarding table for node A

(2 marks)
8. A router maintains a queue of packets awaiting transmission on a link. Selecting the right buffer size is a challenging problem.

a) Give ONE (1) reason why a large buffer would be desirable. 

b) Give TWO (2) reasons why a larger buffer might be undesirable. 

9. Consider a host A that is connected to a local network through a network interface with an IP address 1.1.1.10 and a MAC address AA-AA-AA-AA-AA. At some point in time, a new host B is connected to the same local network, through a network interface with an IP address 1.1.1.11 and a MAC address BB-BB-BB-BB-BB-BB. Assume that host A knows the IP address of host B. List, in the table below, all the link layer frames that are exchanged between A and B, assuming that A sends two IP packets to B immediately after B connects to the local network. Preserve the frame order. 

<table>
<thead>
<tr>
<th>Frame No.</th>
<th>Type</th>
<th>MAC Address</th>
<th>IP Address</th>
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<td>Source</td>
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10. a) In mobile IP with indirect routing, will the end-to-end delays of datagrams increase? What if direct routing is used? (2 marks)

b) What are the advantages and disadvantages of direct routing over indirect routing? (4 marks)

11. Explain the differences between hidden and exposed terminal problem in wireless network. Note: Explain by using diagram and example. (6 marks)
12. Consider the figure 3 below. A sender begins sending packetized audio periodically at \( t=1 \). The first packet arrives at the receiver at \( t=8 \).

![Diagram showing packets generated and received over time]

a) What are the delays from sender to receiver of packet 2 through 8?  
(4 marks)

b) If audio playout begins as soon as the first packet arrives at the receiver at \( t=8 \), which of the first eight packets sent will not arrive in time for playout?  
(3 marks)

c) If audio playout begins at \( t=9 \), which of the first eight packets sent will not arrive in time for playout?  
(2 marks)