UNIVERSITI SAINS MALAYSIA

Second Semester Examination
Academic Session 2004/2005

March 2005

CST311 – Distributed Computing & Network

Duration : 2 hours

INSTRUCTIONS TO CANDIDATE:

- Please ensure that this examination paper contains **EIGHT** questions in **FOUR** printed pages before you start the examination.
- Answer **ALL** questions.

ENGLISH VERSION OF THE QUESTION PAPER

1. Answer the following questions on the Data Link Layer.

   (a) Assume a generator polynomial $G(x) = x^5 + x^2 + x + 1$ and a frame 101101011010. Compute the CRC for this G(x) and frame.

   (b) Consider a point-to-point link between nodes A and B with the following measured values:

   - Link length = 2000 kilometers
   - Propagation = 5 meters/nanosecond
   - Link speed = 1 Mbps
   - ACK processing time at node A = 10 milliseconds
   - Packet processing time at node B = 20 milliseconds
   - Packet size = 1500 bytes
   - ACK size = 64 bytes

   Assume the node A is sending packets to node B. Compute link utilisation for the case of using protocol Stop-and-Wait. (Note: processing delays are NOT negligible, but t_{ACK} is negligible.)

   (12/100)

2. Answer the following questions on the MAC sub-layer.

   (a) What is the primary "job" of the MAC sub-layer?

   (b) After 16 successive collisions, what does an IEEE 802.3 Ethernet station do?

   Consider an IEEE 802.3 Ethernet 10Base2 LAN with 31 stations. The stations are all 5 meters apart for a total of 150 meters of cabling. Media propagation is 5 nanosec per meter.

   (c) What is the duration in time and length in bytes of a worst-case collision? Ignore any possible repeater delays (just focus on wire delays).

   (d) If, on average, a 1500 byte packet suffers 5 collisions worst-case before being successfully transmitted, what is the overhead (from collisions only)?

   (12/100)

3. Answer the following questions on the Network layer.

(a) A router has the following (CIDR) entries in its routing table:

Address/mask	Next hop
135.46.56.0/22	Interface 0
135.46.60.0/22	Interface 1
192.53.40.0/23	Router 1
Default	Router 2

For each of the following IP addresses, what does the router do if a packet with that address arrives?

(i) 135.46.65.104

(ii) 135.46.59.114

(iii) 135.46.54.3

(iv) 192.53.56.111

(b) Sketch the IPv6 segment structure.

(c) Explain how the Dual Stack technique works.

(d) List and briefly describe **three (3)** types of IPv6 addrresses.

(e) What is the shorthand notation of the following IPv6 address?

3ffe:0501:0008:0000:0260:97ff:fe40:efab

(16/100)

4. Answer the following questions on the Transport layer.

(a) Describe why an application developer might choose to run an application over UDP rather than TCP.

(b) Is it possible for an application to enjoy reliable data transfer even when the application runs over UDP? If so, how?

(10/100)

5. Name the **four (4)** communication models used in a distributed system. Explain each briefly, with importance given to the differences between them.

(16/100)

6. Answer the following questions on Processes.

   (a) Using a diagram, explain an implementation of multithread server.

   (b) List and explain the reasons for code migration in distributed system.

   (c) Explain how code migration is achieved in heterogeneous systems if we use procedural languages such as C and Java.

(15/100)

7. Answer the following questions on Synchronisation.

   (a) Consider the behavior of two machines in a distributed system. Both have clocks that are supposed to tick 1000 times per millisecond. One of them actually does, but the other ticks only 990 times per milliseconds. If UTC updates once in a minute, what is the maximum clock skew that will occur?

   (b) Many distributed algorithms require one process to act as coordinator, or otherwise perform some special roles. In general, it does not matter which process takes on this special responsibility, but one of them has to do it. If all processes are exactly the same, with no distinguishing characteristics, there is no way to select one of them to be special. Consequently, we will assume that each process has a unique number, for example its network address. In general, election algorithms attempt to locate the process with the highest process number and designate it as coordinator. The algorithms differ in the way they do the location. List and describe briefly **two (2)** algorithms for electing a coordinator.

(10/100)

8. Sketch a diagram of the general organisation of a CORBA system and explain briefly each component.

(9/100)