ITS323 – Quiz 5

Introduction to Data Communications, Semester 1, 2011

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Question 1 [1.5 each marks]

Fill in the blanks regarding the following statements. Select from the following: circuit switching | datagram packet switching | Dijkstra's algorithm | frequency division multiplexing | hop limit | selective flooding | sequence number | time division multiplexing | virtual circuit packet switching

(a) When using *datagram packet switching* data at the source is sub-divided into packets, and packets may take different paths to the destination.

(b) *Time Division Multiplexing* involves data from multiple users being transmitted over a single link at the same frequency, but at different times.

(c) *Circuit switching* was originally developed for telephone networks.

(d) A node has five neighbour nodes. Sending a copy of a packet to three of the five neigbhours is a method to reduce packet transmissions—this method is called *selective flooding*.

(e) A telephone call usually requires 4kHz bandwidth. A local telephone exchange (end-office) may use a single link to carry data all telephone calls in-progress to an intermediate exchange. The transmission of multiple calls across the link is an example of *Frequency Division Multiplexing*.

(f) An advantage of *circuit switching* is that resources are reserved for the duration of the connection, meaning the application performance is guaranteed.

(g) *Dijkstra's algorithm* can be used to calculate the least-cost routes in a switched network.

(h) *Datagram or VC packet switching* is well suited to applications that have varying sending rates over time.

(i) *Virtual circuit packet switching* involves establishing a connection from source to destination and then sending the data as packets.

(j) *Frequency Division Multiplexing* involves data from multiple users being transmitted over a single link at the same time, but at different frequencies.

(k) *Circuit switching* is the most common form of switching used in landline (fixed) telephone networks.

(l) A disadvantage of *circuit switching* is that all stations must use the same link technology/speed.

(m) Using a *hop limit* reduces the number of packets transmitted in a network, but also reduces the chance of delivery of data to the destination when flooding.

(n) With the same path characteristics and data size, *virtual circuit packet switching* will always incur a larger total delay to transfer data when compared to datagram packet switching.

Question 2 [1.5 marks]

Explain an [| | advantage | disadvantage] of using information from neighbour nodes (rather than local information only) when determining least-cost routes in a network.

Answer. *Collecting information from neighbour nodes means a node has more information about the status of the network. The node knows about its own (local) links as well as the links of its neighbours. With local information only, the node knows less information about the network. Knowing more information about the network increases the chances of selecting optimal routes (advantage), but there is an increased overhead in obtaining that information (disadvantage).*

Question 3 [4 marks]

The following is a subset of the least-cost paths in a network, where the numbers represent nodes and the costs of links are identical in both directions. If each node has its own routing table, draw the routing table for node [1 | 8 | 7 | 8].

1—7—6—3, 4—2—1, 1—5—8 8—7—1, 8—5—4—2, 6—3—8 6—2—3—7, 1—7—5—4, 3—8—7 3—4—8, 1—8—7—5—9, 6—2—8—4

Answer. *Firstly, since the costs of links are the same in both directions, the costs of paths are the same in both directions. Therefore 1—2—4 is a least-cost path. Also note that if 1—2—4 is a least cost path, then 1—2 is also a least cost path (why? if there was a path with lower cost from 1 to 2 than 1—2, then that path would also be part of the least-cost path from 1 to 4). Hence we can determine the following least-cost paths (in order of destinations):*

- *1—2*
- *1—7—6—3*
- *1—2—4*
- *1—5*
- *1—7—6*
- *1—7*
- *1—5—8*

Dest	Next
2	2
3	7
4	2
5	5
6	7
7	7
8	5

Dest	Next
1	7
2	5
3	3
4	5
5	5
6	3
7	7

Table 1: Routing Table for Node 8

Dest	Next
1	1
2	3
3	3
4	5
5	5
6	3
8	8

Table 2: Routing Table for Node 7

Dest	Next
1	1
2	2
3	4
4	3
5	7
6	2
7	7
9	7

Table 3: Routing Table for Node 8

The routing table should list the destination and the next node in the least-cost path:

The same approach can be applied for the other question variants. The answers (routing tables) are: