Prof. T. Roscoe, Prof. R. Wattenhofer

Computer Systems

Quiz 5

Question 1

What are leap seconds are used to compensate for?

a) The difference between common clock systems and caesium atom oscillations.

b) The difference between the 365 rotations of the Earth and one of its revolutions around the Sun.

c) The instabilities in the Earth's rotation.

d) The differences between atomic and commonly used clocks.

Question 2

As the parameter X increases, so does the clock skew of any clock system of a network. For which parameter X (of a graph G) is this not true in general?

a) T (message delay)

b) D (diameter)

c) d (average degree)

d) ε (clock drift).

Question 3

There are three identical electronic digital timers on a table. Somebody walks into the room, unplugs the first clock, tapes a black tape over the seconds digits of the second one, and then starts all three timers. What sort of clock error do the first two clocks (mainly) demonstrate when compared to the third?

a) drift/drift

b) drift/jitter

c) jitter/drift

d) jitter/jitter

Question 4

Assume that Algorithm 23.9 ("Clock synchronization algorithm") is used to synchronize a communication network with disconnected components. Under what condition is the global skew of the whole network bounded?

a) Never.

b) Always.

c) When the largest clock rates in each connected component are all equal.

d) When the smallest clock rates in each connected component are all equal.

Question 5

In Algorithm 23.9 ("Clock synchronization algorithm"), replace line 6 with "if $C_w < C_v$ then". Which of the following statements is true?

a) The modification leads to an unbounded global clock skew.

b) The modification is ill-defined.

c) If message delays are positive, the maximum time any clock can reach is $O(T)$.

d) The modification leads to a larger local skew.

Question 6

Given a class of network topologies and bounds on clock rates and message delays, somebody proves a local skew of $\Theta(T)$. Under which of the following assumptions is this possible?

a) The clock rates are in the range $[1, 1 + \varepsilon]$.

b) The message delays are in the range $(0, T)$.

c) The diameter of the considered networks is constant.

d) All of the previous answers are wrong.

Question 7

Consider two vertices u and v with clock rates 2 and 1, respectively. These nodes run Algorithm 23.9 ("Clock synchronization algorithm") and all message delays are exactly 1. What is the maximum clock skew?

a) 1

b) 1.5

c) 2

d) 2.5

Question 8

Why should nodes in distributed storage networks be of low degree?

a) A high node degree leads to irreparable message collisions.

b) Nodes have to maintain a connection to each neighbor, which can be costly.

c) Nodes of high degree are single points of failure.

d) Networks with high average degree have a large diameter.

Question 9

Which topology property of Definition 24.4 does a $\sqrt(n) \times \sqrt(n)$ grid graph not possess?

a) Homogeneity.

b) Easily computed IDs in $[0, 1)$.

c) Small maximum degree.

d) Small diameter.

Question 10

How many node deletions can the distributed hash table defined in Algorithm 24.19 cope with in constant time intervals?

a) $O(1)$

b) $O(\log n)$

c) $O(\sqrt{n})$

d) $O(n)$

Question 11

Why should distributed storage networks have a small diameter?

a) Networks with small diameters have fewer points of failure.

b) Routing in networks with small diameters is always easier.

c) Message passing is difficult in high-diameter networks.

d) Requests should not take too long to reach their destination.

Question 12

What is the biggest advantage of butterflies and cube-connected-cycles networks compared to hypercubes?

a) Smaller maximum degree.

b) Fewer points of failure.

c) Easier routing.

d) Smaller diameter.

Question 13

Consider the mesh $M(n, k)$ for some n, k. What is its diameter?

a) $(n-1) \cdot k$

b) $n + k - 1$

c) $n \cdot 2^k$

d) $n \cdot (k-1)$

Question 14

We run Algorithm 24.1 ("Consistent Hashing") on a node network with 200 nodes, storing 12000 movies and using 15 different hashing functions. If movies are 10 GB on average, how much space will be used on each node on average?

a) 8000 GB

b) 9000 GB

c) 16000 GB

d) 18000 GB

Question 15

Consider the shuffle-exchange graph $SE(10)$. What is its diameter?