CS 425 Distributed Systems, Fall 2007, University of Illinois at Urbana-Champaign

Midterm Solutions and Comments

Solutions

1. (Multiple Choice) 1(d), 2(c), 3(b), 4(c), 5(d), 6(a), 7(c).

2. (Timestamps and Ordering)
   (a) Lamport timestamps (NOT vector timestamps) are required on all message sends and message receipts. For events at process $P1$, timestamps are : 1, 2, 3, 5, 6, 7, 8. For $P2$: 4, 5, 6, 7, 11, 12. For $P3$: 2, 3, 4, 5, 8, 9, 10. No points for marking vector timestamps.
   (b) $P1.3$ is concurrent with each of $P3.3$ and $P3.4$. Other answers accepted.

3. (Global Snapshots)
   (a) $p_1 : e_1^3$, $p_2 : e_2^4$. $C_{12} = \{b\}, C_{23} = \{c, d\}$, remaining channels empty.
   (b) Draw a cut through the points e_1^3, e_2^4, e_3^1 and passing through messages b, c, d only (ok if cut crosses marker messages).

4. (Overlays)
   (a) $m = 9$ means there are $2^9 = 512$ points (0 through 511) on the Chord ring. The successor pointers on the ring are: $12 \rightarrow 33 \rightarrow 70 \rightarrow 201 \rightarrow 352 \rightarrow 466 \rightarrow 467 \rightarrow 470$.
   (b) Each node maintains $m = 9$ finger table entries. At peerID 466, the finger table entries for indices 0 through 8 are respectively: $467, 470, 470, 12, 12, 12, 33, 201, 352$.
   (c) $466 \rightarrow 33 \rightarrow 70 \rightarrow 201$ (holding file).

5. (Miscellaneous)
   (a) `Safety:` At most 4 processes can access the critical section simultaneously. `Liveness:` Every request for access to the critical section is eventially granted. Stronger statements that covered the above were also accepted (e.g., Liveness: If fewer than 4 processes crash when inside the critical section, every request to access the critical section is eventually granted).
   (b) This technique was discussed in class. Place the 9 processes in a 3×3 matrix, one process per entry in the matrix. Each process' voting set is composed of all the processes in its matrix row along with all processes in its matrix column. Each voting set is thus of size 5, each process participates in 5 voting sets, and any two voting sets have at least two elements in common (one row-column intersection and one column-row intersection). Processes in the same row (or same column) may have 3 common voting set members.