

CS4231
Parallel and Distributed Algorithms

Solution for Homework 5

Instructor: Haifeng YU

Homework Assignment

- Page 161
 - Problem 9.5 – Remember to prove that the global snapshot you get is a consistent one
- Prove the following
 - If G and H are both consistent global snapshots, then $G \cap H$ and $G \cup H$ are also consistent global snapshots

Problem 9.5

- For any event e , define:

$$\text{cut}(e) = \{ f \mid f \text{ has smaller logical clock value than } e \}$$

- Claim: For any event e , $\text{cut}(e)$ is a consistent global snapshot
 - $\text{cut}(e)$ is a **global snapshot**: if f_2 is in the set and f_1 is before f_2 in process order, then f_1 must be in the set
 - $\text{cut}(e)$ is a **consistent global snapshot**: if f_2 is in the set and f_1 is before f_2 in send-receive order, then f_1 must be in the set

Aim to prove:

If G and H are both consistent global snapshots, then $G \cap H$ is also a consistent global snapshot

- $G \cap H$ is a **global snapshot**:
 - Need to prove that if e_2 is in $G \cap H$ and e_1 is before e_2 in process order, then e_1 must be in $G \cap H$
 - $e_2 \text{ in } G \cap H \Rightarrow e_2 \text{ in } G \text{ and } e_2 \text{ in } H \Rightarrow e_1 \text{ in } G \text{ and } e_1 \text{ in } H \Rightarrow e_1 \text{ in } G \cap H$
- $G \cap H$ is a **consistent global snapshot**:
 - Need to prove that if e_2 is in $G \cap H$ and e_1 is before e_2 in send-receive order, then e_1 must be in $G \cap H$

Aim to prove:

If G and H are both consistent global snapshots, then $G \cup H$ is also a consistent global snapshot.

- $G \cup H$ is a **global snapshot**:
 - Need to prove that if e_2 is in $G \cup H$ and e_1 is before e_2 in process order, then e_1 must be in $G \cup H$
 - e_2 in $G \cup H \Rightarrow$ W.l.o.g., e_2 in $G \Rightarrow e_1$ in $G \Rightarrow e_1$ in $G \cup H$
- $G \cup H$ is a **consistent global snapshot**:
 - Need to prove that if e_2 is in $G \cup H$ and e_1 is before e_2 in send-receive order, then e_1 must be in $G \cup H$