

HW 4

Assigned 02/19, Due 02/28

Q1. Show that the protocol for SBA discussed in class satisfies validity, agreement and simultaneity properties.

Q2. Recall that we had defined the context γ_{ck}^{bt} to capture the fact that in the bit transmission problem, value of the bit is common knowledge. Explain how this context captures that.

Q3. Let σ be a run-based specification. let P be a joint protocol, and let (γ, π) be an interpreted context. Prove that P satisfies σ in (γ, π) iff P strongly satisfies σ in (γ, π) .

Q4. Show that both a.m.p. and a.r.m.p. systems display umd.

Q5.

1. Let \mathcal{S} be a nonrigid set in an interpreted system \mathcal{I} with G as the set of processes. Show that

$$i \in \mathcal{S} \Rightarrow (B_i^{\mathcal{S}} \phi \Rightarrow \phi).$$

2. Suppose $\mathcal{S}(r, m) = G$ for all (r, m) in \mathcal{I} , then show that

$$\mathcal{I} \models B_i^{\mathcal{S}} \phi \Leftrightarrow K_i \phi \text{ for } i \in G.$$

3. Prove that $\models i \in \mathcal{S} \Rightarrow (B_i^{\mathcal{S}} C_{\mathcal{S}} \phi \Leftrightarrow C_{\mathcal{S}} \phi)$.

Q6

Suppose that P is a protocol for SBA in the general-omission failure mode such that $\mathcal{I} = \mathbb{I}^{rep}(P, \gamma^{gom}, \pi^{sba})$ satisfies σ^{sba} .

- (a) Show that there are two runs r_1 and r_2 in \mathcal{I} such that

- (i) in both runs, process i decides on 0 and has the same local state when it decides.
- (ii) in r_1 process i is nonfaulty, while in r_2 it is faulty, and in r_2 the nonfaulty processes decide on 1.

- (b) Use part (a) to prove that $\mathcal{I} \not\models (i \in \mathcal{N} \wedge deciding_{\mathcal{N}}(0)) \Rightarrow K_i deciding_{\mathcal{N}}(0)$, but $\mathcal{I} \models (i \in \mathcal{N} \wedge deciding_{\mathcal{N}}(0)) \Rightarrow B_i^{\mathcal{N}} deciding_{\mathcal{N}}(0)$