Everything You Always Wanted to Know About Synchronization but Were Afraid to Ask

This paper presents a systematic method for solving synchronization problems. The method is based on viewing processes as invariant maintainers. First, a problem is defined and the desired synchronization property is specified by an invariant predicate over program variables. Second, the variables are initialized to make the invariant true and processes are annotated with atomic assignments so the variables satisfy their definition. Then, atomic assignments are guarded as needed so they are not executed until the resulting state will satisfy the invariant. Finally, the resulting atomic actions are implemented using basic synchronization mechanisms. The method is illustrated by solving three problems using semaphores. The solutions also illustrate three general programming paradigms: changing variables, split binary semaphores, and passing the baton. Additional synchronization problems and synchronization mechanisms are also discussed.

Reference:

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