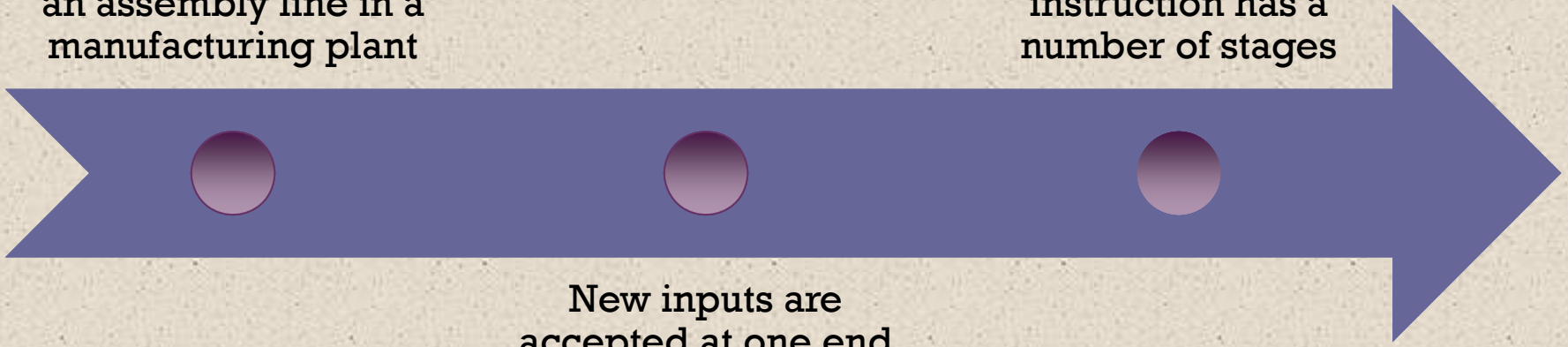
Pipelining Strategy

Similar to the use of an assembly line in a manufacturing plant

To apply this concept to instruction execution we must recognize that an instruction has a number of stages



New inputs are accepted at one end before previously accepted inputs appear as outputs at the other end

Timing Diagram for Instruction Pipeline Operation

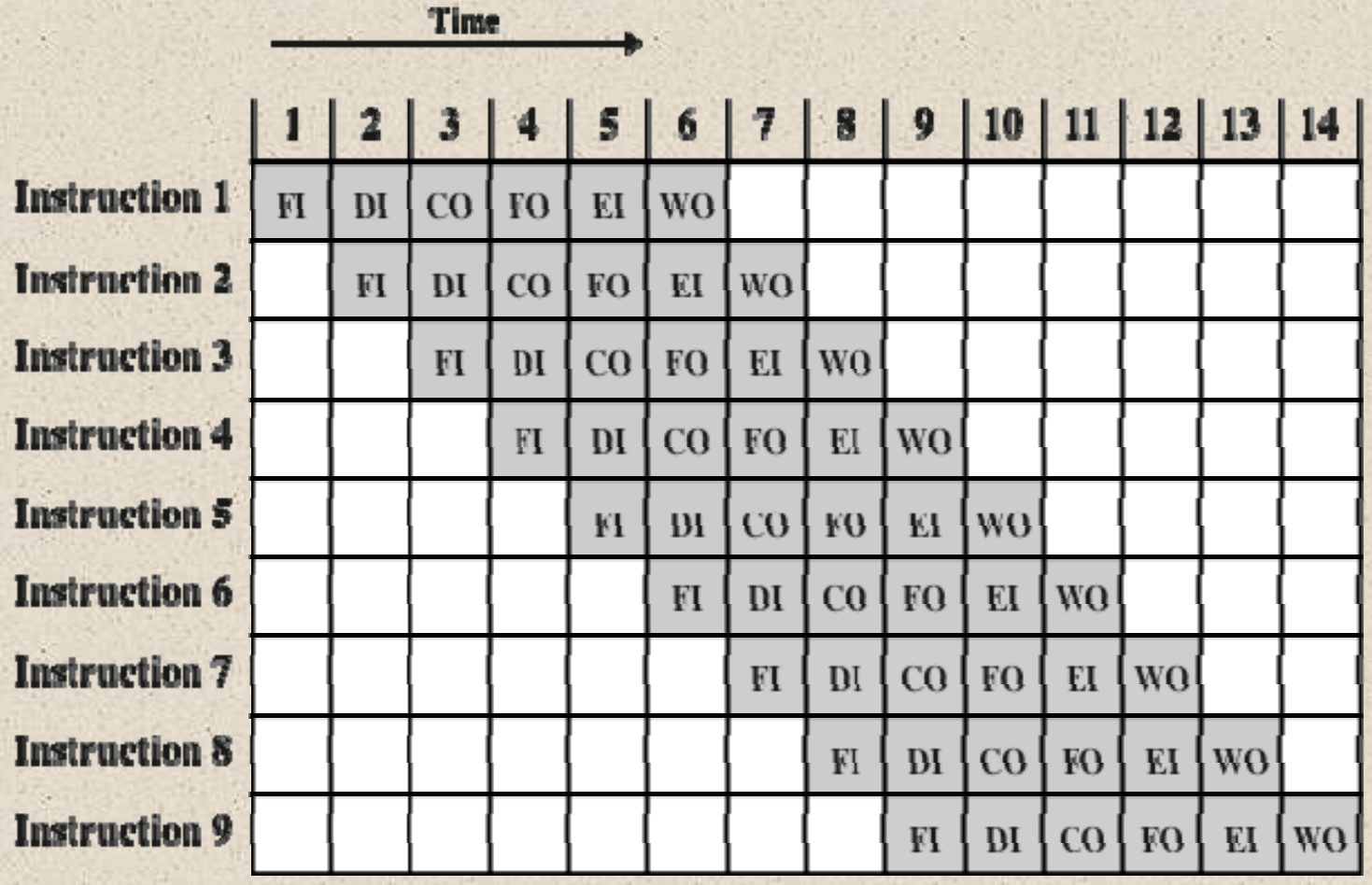


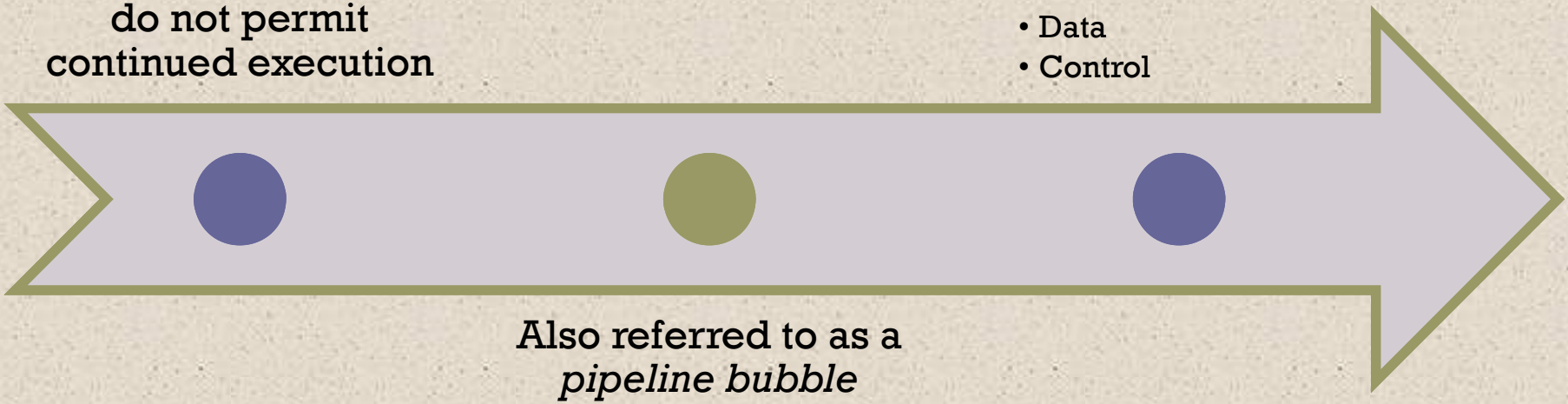
Figure 14.10 Timing Diagram for Instruction Pipeline Operation

Pipeline Hazards

Occur when the pipeline, or some portion of the pipeline, must stall because conditions do not permit continued execution

There are three types of hazards:

- Resource
- Data
- Control



Also referred to as a *pipeline bubble*

Resource Hazards

A resource hazard occurs when two or more instructions that are already in the pipeline need the same resource

The result is that the instructions must be executed in serial rather than parallel for a portion of the pipeline

A resource hazard is sometimes referred to as a *structural hazard*

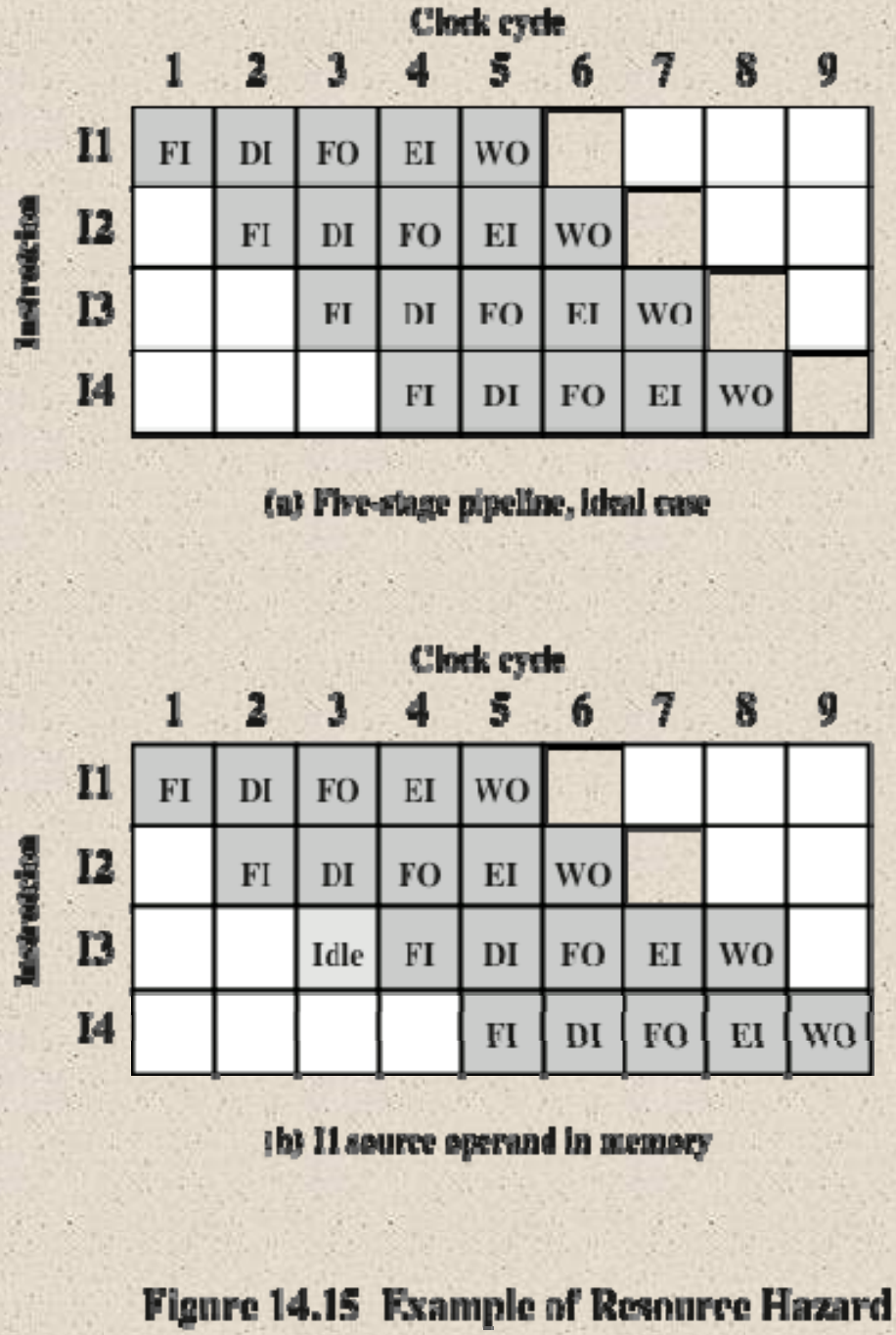


Figure 14.15 Example of Resource Hazard