



Interrupting a State Machine

At the ISIS Neutron and Muon Source we interact with a variety of types of beamline systems for controlling the environment of samples under investigation. A state machine is an excellent way of controlling a system which has a finite number of states, a predetermined set of transitions, and known events for initiating a transition. But what happens when you want to interrupt that flow?

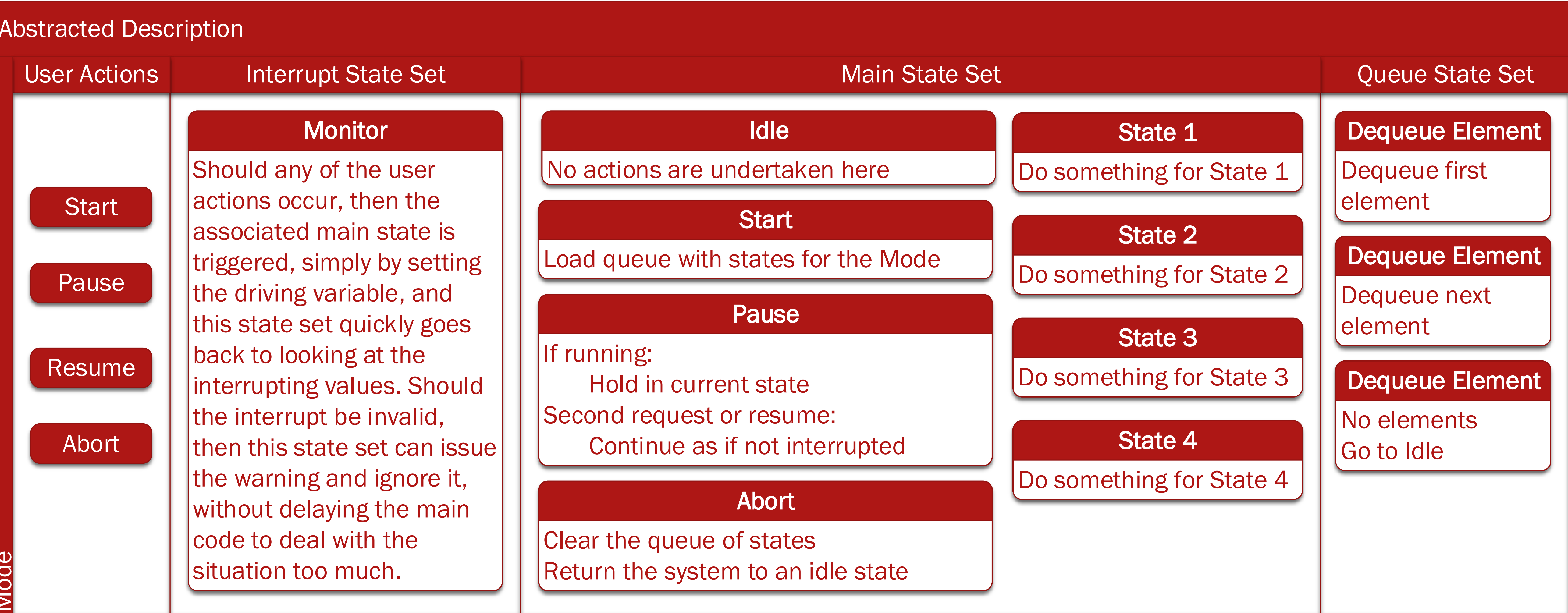


Figure 1: The state sets

The main state set above consists of states for being idle, start, pause, abort, state 1, state 2, state 3, and state 4. We can assume that the states handle themselves, in reality there may be more interaction between them and could need to respond to certain interrupts as well.

The interrupt state set monitors the start, pause/resume and abort statuses.

The queue state set will receive a list of states to go through from the start state, and as each state ends, will action the next state in the queue by setting the driving variable for the main state set, pausing and resuming as appropriate.

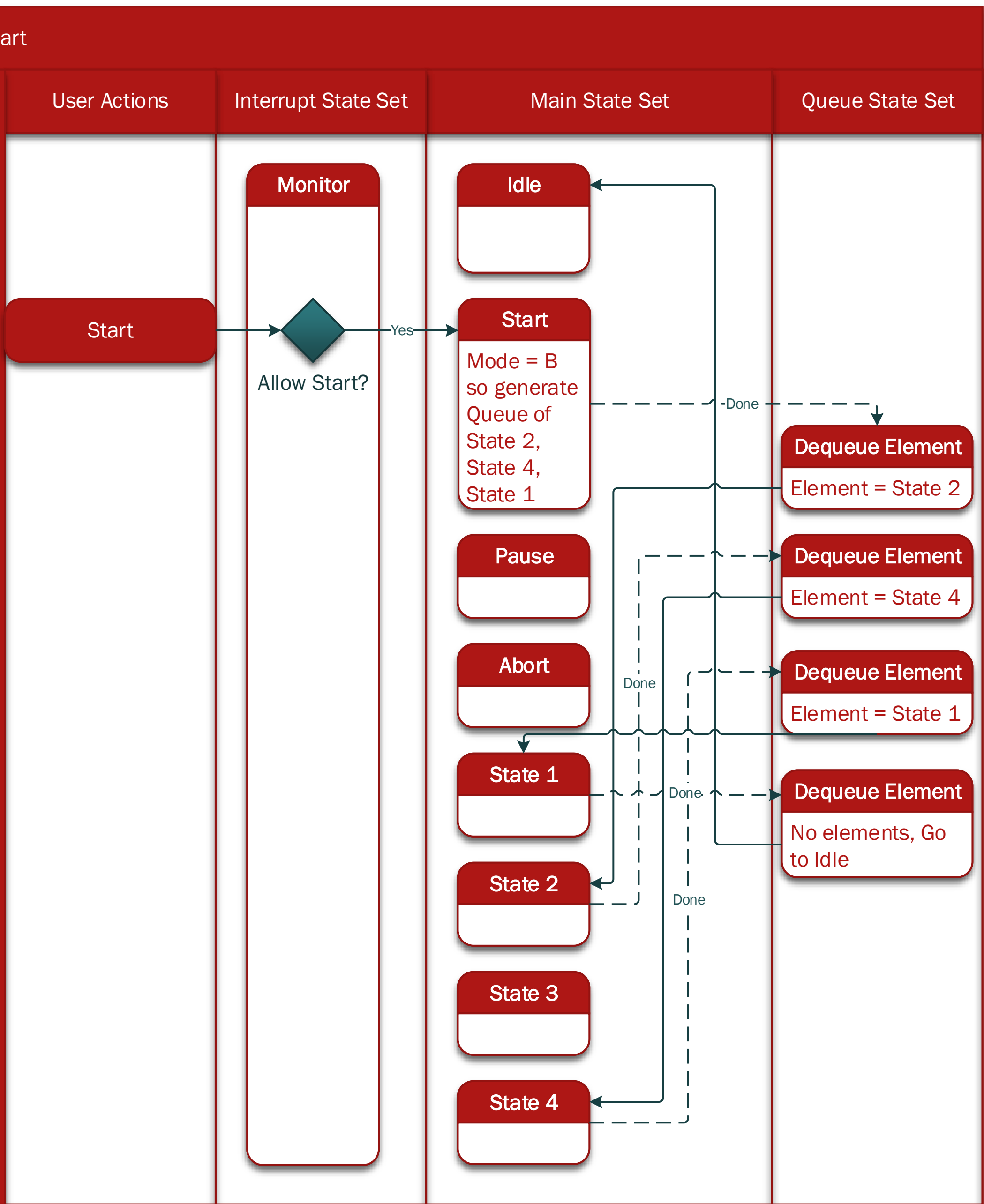


Figure 2: What happens on a start

An Abstracted System

Let us consider a fairly simple abstracted system, which can be started, paused, resumed, and aborted.

The system can be run in Mode A, where a start requires going through states 1, 2 and 3; Mode B, where a start necessitates states 2, 4, and 1 to be run in that order; or Mode C which runs states 1, 3, 4 and 2. Any pause or abort has to be acted on quickly.

If we consider three state sets, we can see a way of interleaving them to provide such functionality.

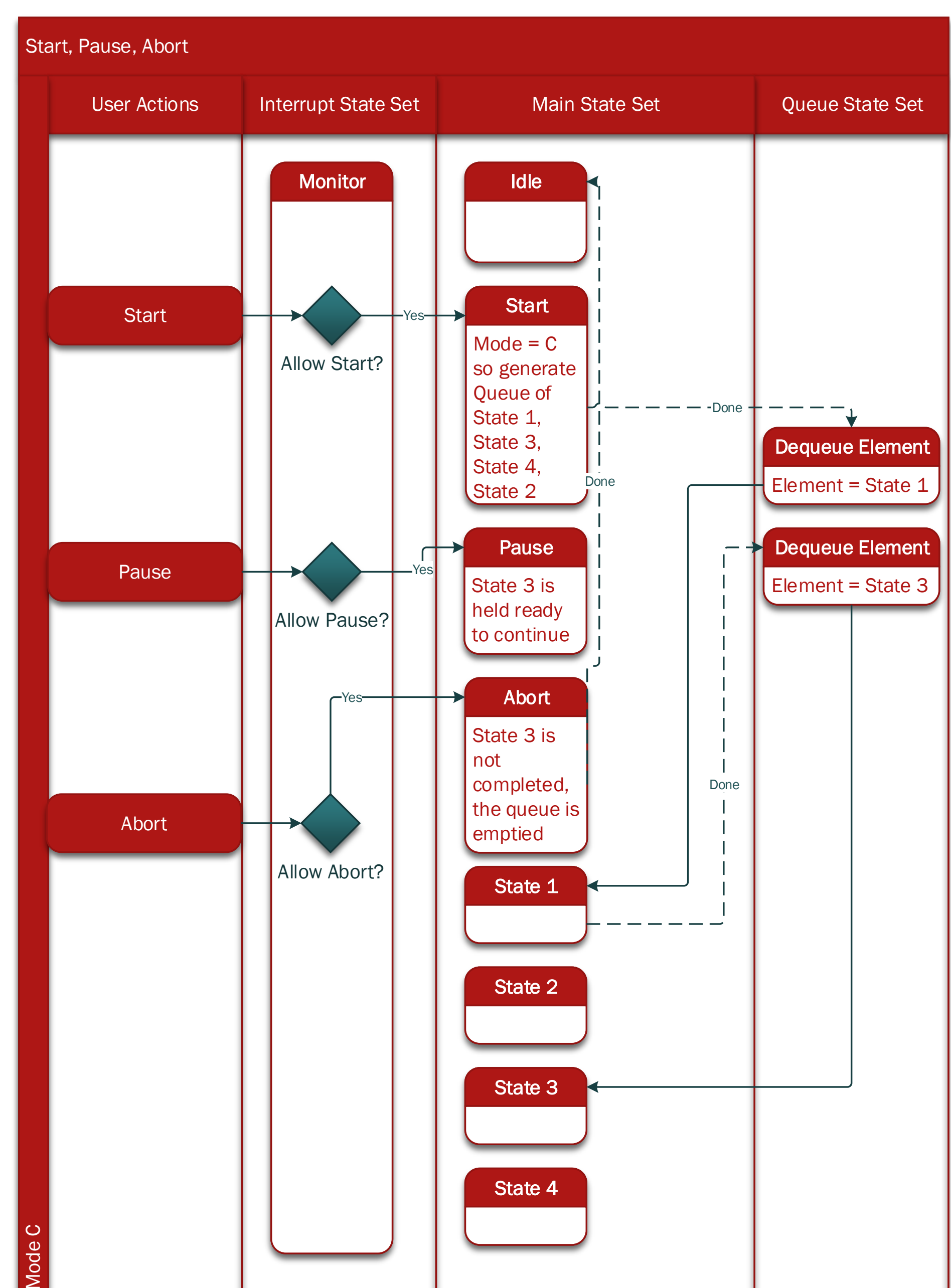


Figure 3: What happens with a start, pause and abort

Glossary

State Machine/State Set

"A device which can be in one of a set number of stable conditions depending on its previous condition and on the present values of its inputs" [https://www.lexico.com/en/definition/state_machine]

Event

An event is something that happens, it may be a timeout or value is reached, or it may be that a button is pressed.

Transition

A move from one state to another triggered by an event

Interrupt

A break or stop of something continuous [<https://www.lexico.com/en/definition/interrupt>]