

AQA Computer Science AS Level
3.4.2 Finite state machines (FSMs)
Intermediate Notes



Specification:

3.4.2.1 Finite state machines (FSMs) without output:

Be able to draw and interpret simple state transition diagrams and state transition tables for FSMs with no output.



Finite State Machines

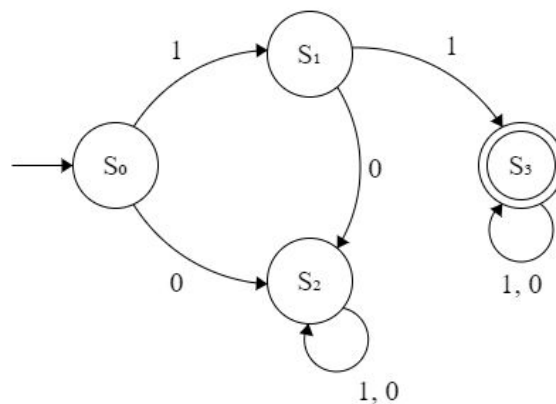
A finite state machine (or FSM for short) is a **model** for a machine that is **always in a fixed state**. Each finite state machine has a **set number of states** and can **only ever be in one state** at once.

Data can be input to a finite state machine and if the input data is valid, the finite state machine will terminate in what's known as an **accepting state**.

A finite state machine's state **can change** and does so according to **transition rules**, rules that describe what a finite state machine should do given certain criteria.

State Transition Diagrams

State transition diagrams are used by computer scientists as a **visual representation** of a finite state machine. They consist of **states** (circles) joined by **transitions** (arrows) and an **accepting state**, shown as a **double circle**.



For example, the state transition diagram above has **four states**: S_0 , S_1 , S_2 and S_3 . S_3 is an accepting state.

The **transition functions** are each represented by an **arrow** from one state to another.

The finite state machine represented by the state transition diagram will **only accept** input data that starts with 11. For example: 11, 110, 11101 and 11001100.



State Transition Tables

The **transition function** between S_0 and S_1 in the previous diagram could be described in English as “If the finite state machine is in state S_0 and the input is 1, move to state S_1 .”

The transition functions in a finite state machine can be notated more formally using a **state transition table**, with columns for current state, input and next state, like the one below.

Current State	Input	Next State
S_0	1	S_1
S_0	0	S_2
S_1	1	S_3
S_1	0	S_2

Example - Parking Machine

The finite state machine shown by the state transition diagram below represents a parking machine which requires 50p to be payed. The machine is only designed to take coins worth 10p or more.

If the customer first pays 10p, the machine moves into the 10p state, from which the customer can input another 10p or 20p. The 50p state is the accepting state.

