# Graph Theory Note

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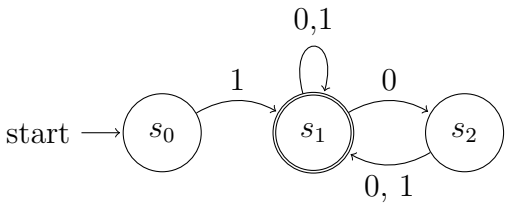
## 1 Regular Languages




**state diagram** of **finite automaton** $M$. $q_0, q_1, q_2$ are **states**. $q_0$ is **start state**. $q_1$ is **accept state**. Arrows are called **transitions**. Input is string of 0s and 1s. The output is either **reject** or **accept**.

**Finite Automaton** $M$ is 5-tuple $(Q, \sigma, \delta, q_0, F)$ where

1. $Q$ is a finite set called the states
2. $\sigma$ is a finite set called the alphabet
3. $\delta : Q \times \sigma \to Q$ is the transition function
4. $q_0 \in Q$ is the start state
5. $F \subset Q$ is the set of accept states.

**Language of machine** $M$, $A$ is the set of all strings that $M$ accepts and write $L(M) = A$. We say $M$ accepts $A$ or $M$ recognizes $A$.

**Language operations**: Let $A$ and $B$ be languages

1. Union: $A \cup B = \{x | x \in A \text{ or } x \in B\}$
2. Concatenation: $A \circ B = \{xy | x \in A, y \in B\}$
3. Star: $A^* = \{x_1 x_2 \dots x_k | k \geq 0 \text{ and } x_i \in A\}$

**Regular Language** is a language accepted by some finite automatons. The class of regular language is closed under union and concatenation.