

Additionally, a monoid can be commutative

```
class Semigroup a where  
  append :: a → a → a
```

```
class Semigroup m ≤ Monoid m where  
  mempty :: m
```

```
class Monoid m ≤ CommutativeMonoid m
```

**Semigroup**



Identity

**Monoid**

**Commutative or *abelian* monoid**

A monoid, which is also commutative and idempotent  
is a **bounded semilattice**

```
class Semigroup a where  
  append :: a → a → a
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```
class Semigroup m ≤ Monoid m where  
  mempty :: m
```

```
class Monoid m ≤ CommutativeMonoid m
```

```
class CommutativeMonoid m  
  ≤ BoundedSemilattice m
```

**Semigroup**



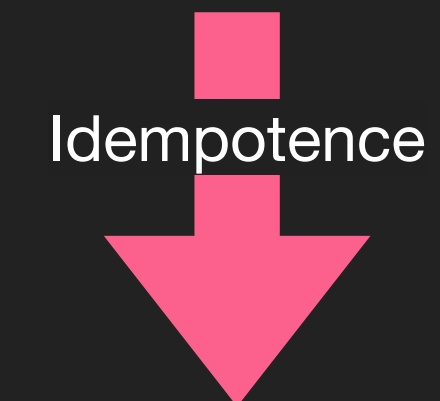
Identity

**Monoid**



Commutativity

**Commutative or *abelian* monoid**



Idempotence

**Bounded semilattice**