Part 3: Boolean Algebra

* Boolean Algebra
  + A Boolean function can be represented by logic gates diagram and also by a truth table
  + If there are n different variables in a Boolean function, there are 2n different possible inputs for the truth table
    - F = AB’ + CD + A’B’
    - Since there are 4 variables A, B, C, D, there are 2^4 = 16 possible inputs
* Basic theorems of Boolean algebra (+ = or, \* = and)
  + Commutative law
    - A \* B = B \* A
    - A + B = B + A
  + Associative law
    - A + (B + C) = (A + B) + C
    - A \* (B \* C) = (A \* B) \* C
  + Distributive law
    - A \* (B + C) = A \* B + A \* C
  + 1. A + 0 = A – Identity
  + 2. A + 1 = 1 – Idempotent
  + 3. A \* 0 = 0 – idempotent
  + 4. A \* 1 = A – identity
  + 5. A + A = A – annulment
  + 6. A + A’ = 1 – complementary
  + 7. A \* A = A – annulment
  + 8. A \* A’ = 0 – complementary
  + 9. A’’ = A
  + De Morgan’s Theorems
    - A’ + B’ = A’ \* B’
    - Can be extended over several variables
      * (ABC)’ = A’ + B’ + C’
      * (A + B + C)’ = A’ \* B’ \* C’
* Simplification theorem of Boolean Algebra
  + Boolean algebra is useful for simplifying digital circuits
  + Example
    - F = A’BC + A’BC’ + AC
      * Simplification: F = A’B + AC
* Complement of Boolean Function
  + Using De Morgan’s Theorem
  + Using Duals
    - Take duals
    - Complement each literals
  + Duals of expression – an expression which can get by interchanging AND and OR operation