Chapter 7 Review Exercises

1: Explain what AND gate is, give an example

An AND gate is a digital logic gate that outputs true (1) only when all inputs are true (1). Otherwise, it outputs false (0).

Example:

Imagine a system where a door opens only when both switches are on.

Switch A = 1, Switch B = 1 → Door opens (Output = 1).

2: Explain what OR gate is, give an example

An OR gate is a digital logic gate that outputs true (1) if at least one input is true (1). It outputs false (0) only when all inputs are false.

Example:

A light that turns on if either of two switches is on:

Switch A = 1, Switch B = 0 → Light on (Output = 1).

3: Explain what XOR gate is, give an example

An XOR (exclusive OR) gate outputs true (1) only if exactly one input is true (1). If both inputs are the same, it outputs false (0).

Example:

A buzzer that sounds if exactly one of two switches is on:

Switch A = 1, Switch B = 1 → Buzzer off (Output = 0).

4: Explain what NOT gate is, give an example

A NOT gate (inverter) outputs the opposite of its input: true (1) becomes false (0), and vice versa.

Example:

A system where a light is off when the switch is on:

Input = 1 (Switch on) → Output = 0 (Light off).

5: Explain what De Morgan's laws are.

De Morgan’s laws are principles in Boolean algebra that describe the relationships between AND, OR, and NOT operations:

¬(A∧B)=¬A∨¬B\neg(A \land B) = \neg A \lor \neg B¬(A∧B)=¬A∨¬B (NOT (A AND B) is equivalent to NOT A OR NOT B).

¬(A∨B)=¬A∧¬B\neg(A \lor B) = \neg A \land \neg B¬(A∨B)=¬A∧¬B (NOT (A OR B) is equivalent to NOT A AND NOT B).

Example:

Simplifying Boolean expressions:

¬(x∨y)\neg(x \lor y)¬(x∨y) is the same as ¬x∧¬y\neg x \land \neg y¬x∧¬y.

6: Write a brief bio for the following luminary figures:

6.0 Augustus De Morgan- Augustus De Morgan (1806–1871) was a British mathematician and logician. He formulated De Morgan's laws, foundational in Boolean algebra and digital logic design. His work bridged formal logic and algebraic reasoning, influencing computational logic.

6.1George Boole - George Boole (1815–1864) was an English mathematician and logician, the creator of Boolean algebra, which is the basis for modern digital computer logic. His algebra provided the foundation for digital circuits and programming logic.

6.2 Clifford Berry - Clifford Berry (1918–1963) was an American electrical engineer who co-developed the Atanasoff-Berry Computer (ABC), the first electronic digital computer. He applied Boolean algebra to electrical circuits, forming the basis for digital circuit design.

6.3 Claude Shannon - John Atanasoff (1903–1995) was an American physicist and inventor, credited with creating the first electronic digital computer (ABC). He pioneered binary arithmetic and regenerative memory in computing.

6.4 John Atanasoff - John Mauchly (1907–1980) was an American physicist and co-inventor of the ENIAC, the first general-purpose electronic digital computer. He advanced programmable computing, enabling large-scale calculations.

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6.6 John von Neumann - John von Neumann (1903–1957) was a Hungarian-American mathematician and polymath. He developed the Von Neumann architecture, a design model for modern computers. His architecture introduced the stored-program concept, central to all modern computers.