Let's walk through what this slide is showing and how it relates to the "Adjacency Theorem" in Boolean/K-map simplification:

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1. Context: Adjacency Theorem and K-Maps

- The *adjacency theorem* (sometimes simply referred to as the idea behind K-map grouping) says that if flipping one input bit does **not** change the output, then that input bit can effectively be ignored (it becomes a "don't care" for that grouping).
- In a Karnaugh map (K-map), this principle lets us combine (or "group") adjacent 1-cells so that any bits which change between those cells get factored out of the final expression. Essentially, **"If changing an input doesn't change the output, it doesn't matter in that product term."**

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2. The Slide Layout

1. **Title: "Adjacency theorem"**
   It states, "If changing an input doesn't change the output, it doesn't matter. Kmap y2."

   - This captures the fundamental K-map rule: you can group cells that differ by only one variable and remove that variable from the product term.

2. **Truth Table Snippet** (on the right)

   - We see columns labeled $X2, X1, X0$ for inputs and $Y2, Y1, Y0$ for outputs.
   - Several rows show 0/1 combinations for $X2X1X0$ along with the corresponding output bits $Y2, Y1, Y0$.

3. **K-map Diagrams** (handwritten in red)

   - There is a K-map structure with some circled or grouped cells.

- The user has labeled or attempted to group regions in red to show which minterms can be combined.

4. **Seven-Segment Hints** (top right in purple)

   - The doodle labeled "1 3 7 2" or some sort of 7-segment illustration likely ties into a circuit that drives a digital display. Each Y-signal might be a segment driver or part of an overall display function.

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3. What the K-Map Groupings Show

K-Map Arrangement for 3 Inputs $(X2, X1, X0)$

A typical 3-variable K-map is a 2×4 or 4×2 grid with Gray-coded rows/columns so that adjacent cells differ in exactly one bit. For instance:

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   Columns: X1X0 = 00, 01, 11, 10
Rows: X2 = 0, 1
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Or any other arrangement that preserves adjacency. Once the 1-cells (where the output is 1) are placed in the map, you look for maximal groupings of 1s in powers of 2 (1,2,4,8, ...).

Adjacency Theorem in Action

- When two (or more) adjacent 1-cells differ by one bit, we "merge" them; that differing bit is dropped from the simplified expression.
- For example, if two cells differ only in $X0$ but have the same values for $X2$ and $X1$, the term becomes (for instance) $X2 \cdot \overline{X1}$ if those bits are 1 or 0 consistently among the grouped cells.

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4. Slide's Key Point

> **"If changing an input doesn't change the output, it doesn't matter."**

This is precisely how K-map grouping yields simpler expressions. You see red ovals grouping sets of cells. In each grouping:

- One input flips (e.g., $X0$ from 0 to 1), but the output remains 1 in both cells.
- Hence that bit is "irrelevant" to whether the output is 1.

For example, if you circle a vertical pair in the K-map, that usually means the top and bottom cell differ in $X2$ (or whichever row bit changes). If that difference doesn't change the output, you can omit $X2$ from the product term.

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5. Big Picture Takeaway

1. **Karnaugh Map Simplification**
    - The adjacency theorem is the conceptual basis of combining minterms in a K-map.
2. **Fewer Variables in Final Expression**
    - Each grouping removes the variable(s) that flip(s) across those cells. This leads to simpler Boolean expressions.
3. **Relation to the Slide**
    - The bullet "Kmap y2" suggests they're simplifying the expression for the Y2 segment (part of a 7-segment display driver or some output).
    - The annotated K-map with large red groupings shows that multiple input patterns yield the same output; therefore you can unify them into one simplified term.

Summary

From the slide, we see a basic principle of Boolean simplification: **adjacency in a K-map** means if two input combinations differ in only one bit and the output is the same, that bit can be dropped from the final expression. The handwritten circles highlight how the instructor or student grouped the 1-cells. This is how you reduce (for example) a four-term sum of products down to a two-term or even a one-term expression when possible, all thanks to the *Adjacency Theorem*.