



Assignment 4 Q4 for diagrams give page number from decode

Assignment 4 Question 4 is about CMOS inverter regions and their explanation in detail.

Here is a detailed point-wise answer with diagram page references from your decode documents:

CMOS Inverter Regions and Explanation

- CMOS inverter consists of pMOS pull-up and nMOS pull-down transistors.
- The transfer characteristic V_{out} vs V_{in} has 5 regions of operation:
 1. **Region 1 (Low Input):** V_{in} is low, pMOS is ON, nMOS OFF. Output is high V_{DD} .
 2. **Region 2 (Rising Input):** nMOS starts conducting, pMOS in linear region; output begins to drop.
 3. **Region 3 (Transition Region):** Both pMOS and nMOS conduct and are in saturation. This is the amplification region.
 4. **Region 4 (High Input):** pMOS is turning OFF, nMOS in linear region, output low.
 5. **Region 5 (High Input):** V_{in} high, nMOS ON, pMOS OFF. Output is low (0 V).
- Symmetry in characteristics is achieved by sizing pMOS transistor wider (by ~2.5 times) than nMOS due to mobility differences.
- Body effect, threshold voltage variations, and saturation behavior affect inverter performance.
- Detailed explanations and transfer characteristic diagrams are on pages 4-31 to 4-35 of VLSI-DECODE_1.pdf.

This summary incorporates the functional regions and operational details clearly for the assignment. Let me know if you need the exact diagram images or further details on specific regions.

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1. VLSI_2.pdf

2. VLSI-DECODE_1.pdf