Digital Integrated Circuits – EECS 312

http://ziyang.eecs.umich.edu/~dickrp/eecs312/

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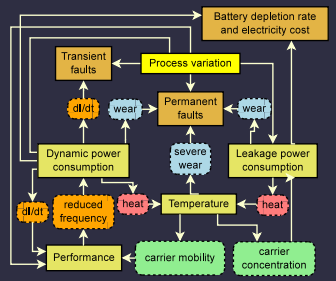
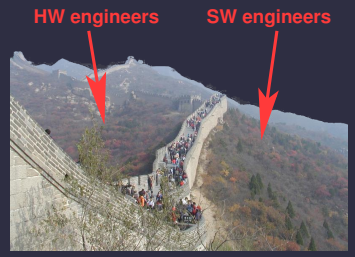
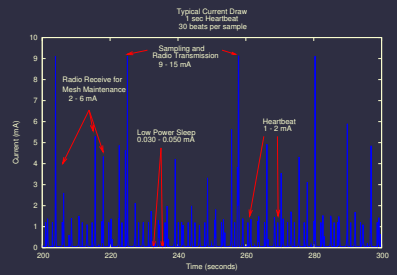
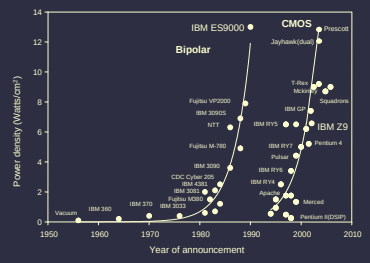
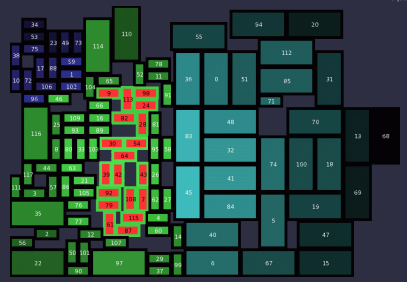










Review

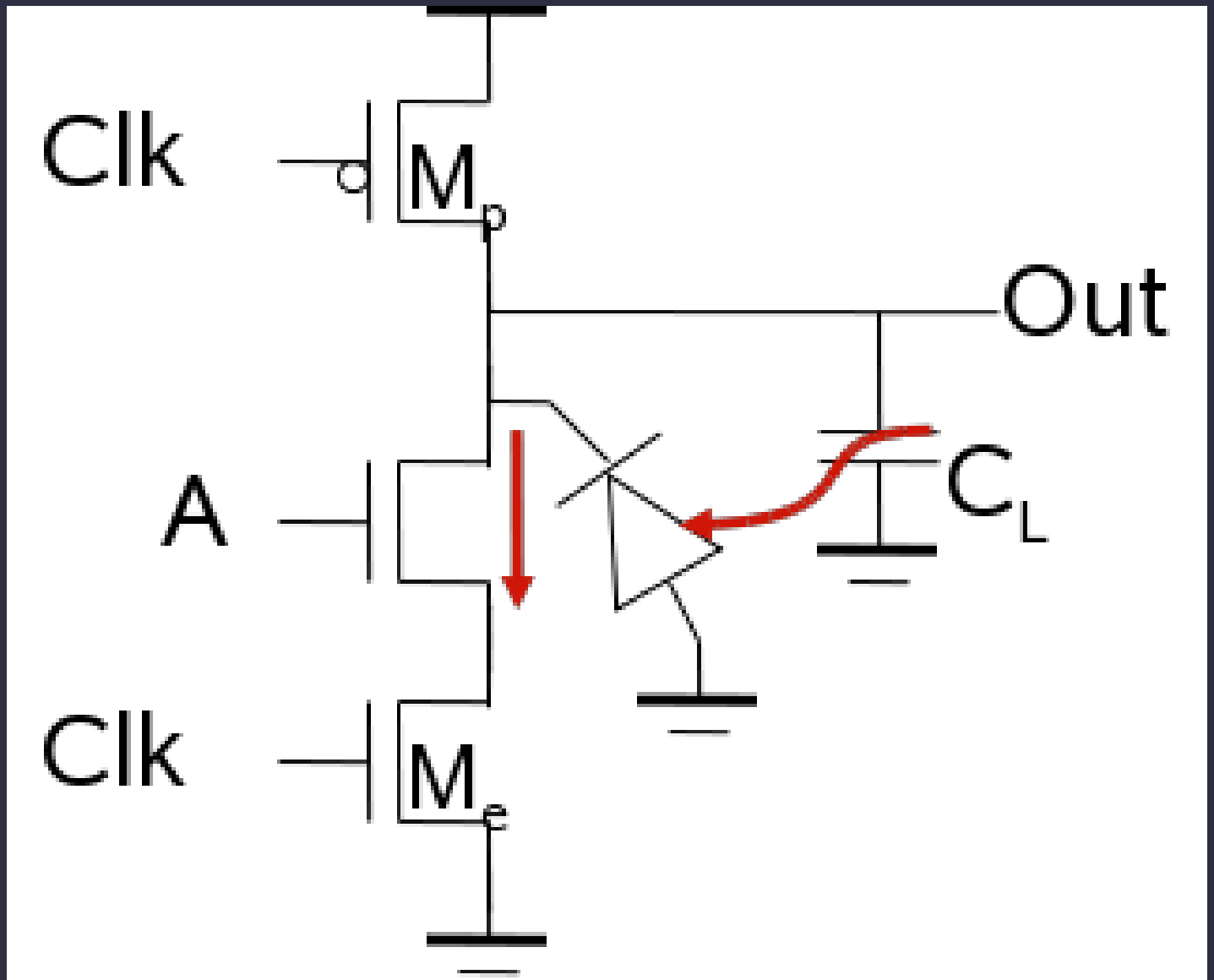
- What are dynamic hazards?
- What are static hazards?
- What problems do hazards cause?
- What is the root cause of static hazards?
- Let's implement a function using DCVSL.

Derive and explain.

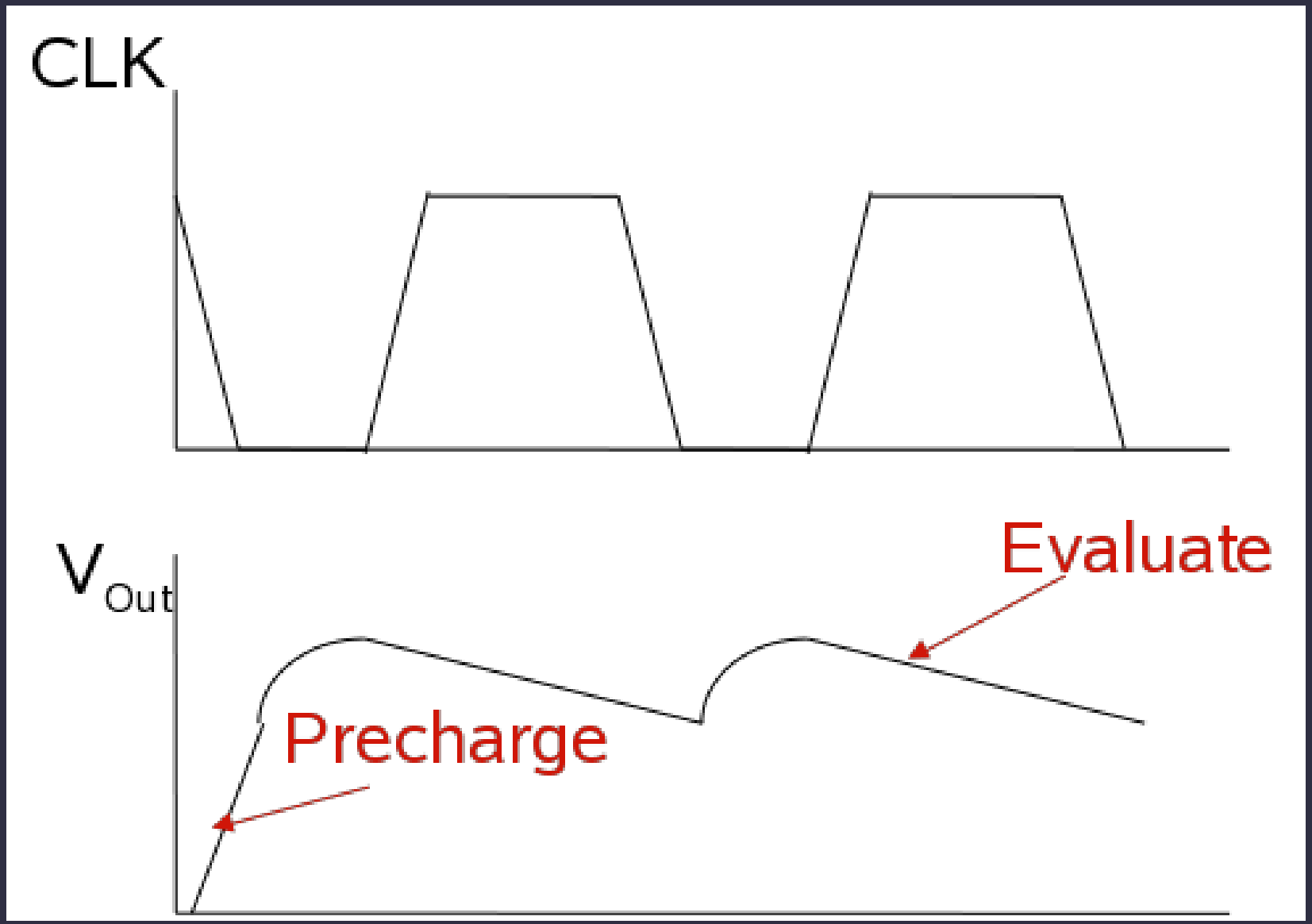
Lecture plan

1. Charge sharing
2. Homework

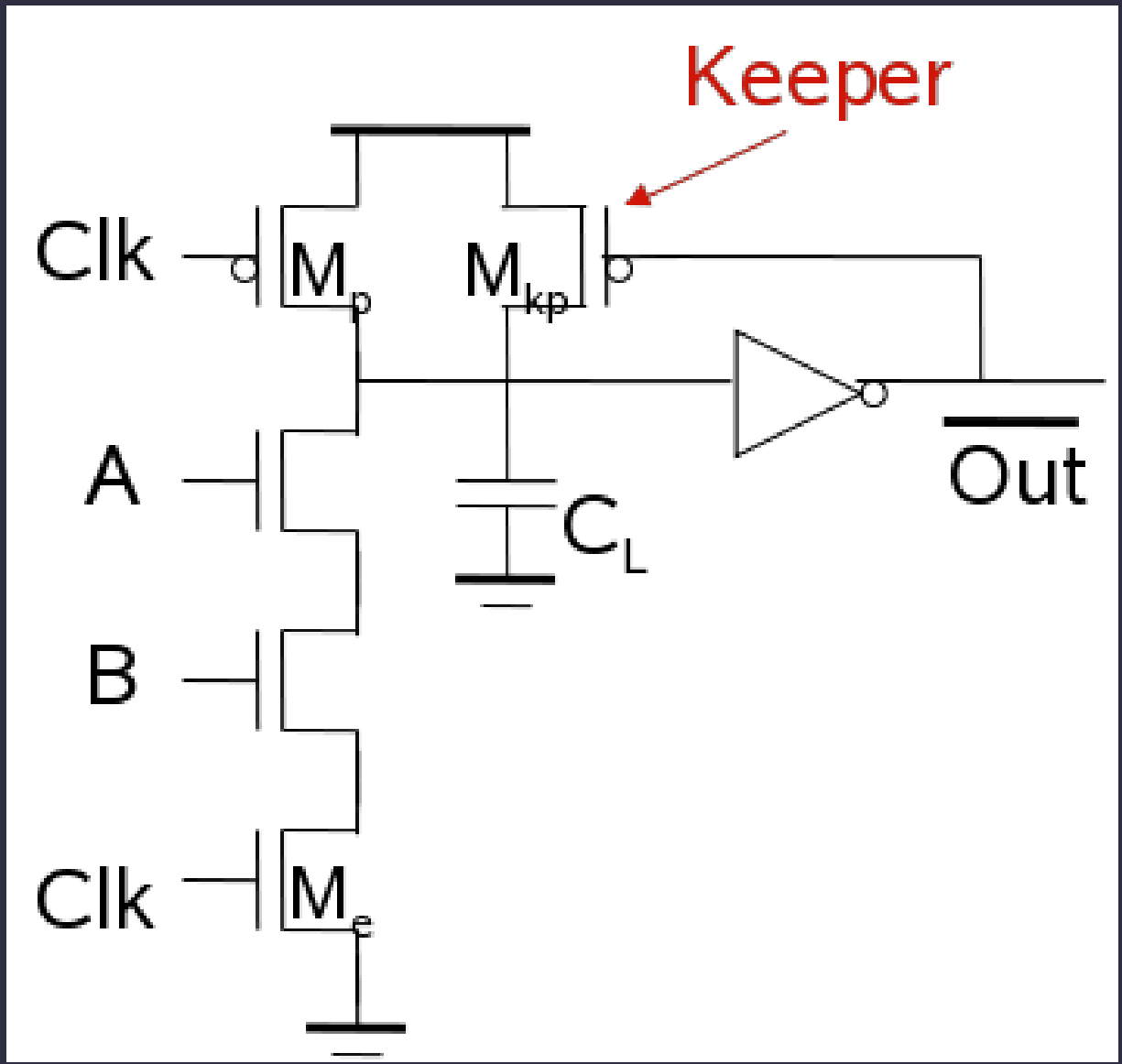
Dynamic logic charge leakage



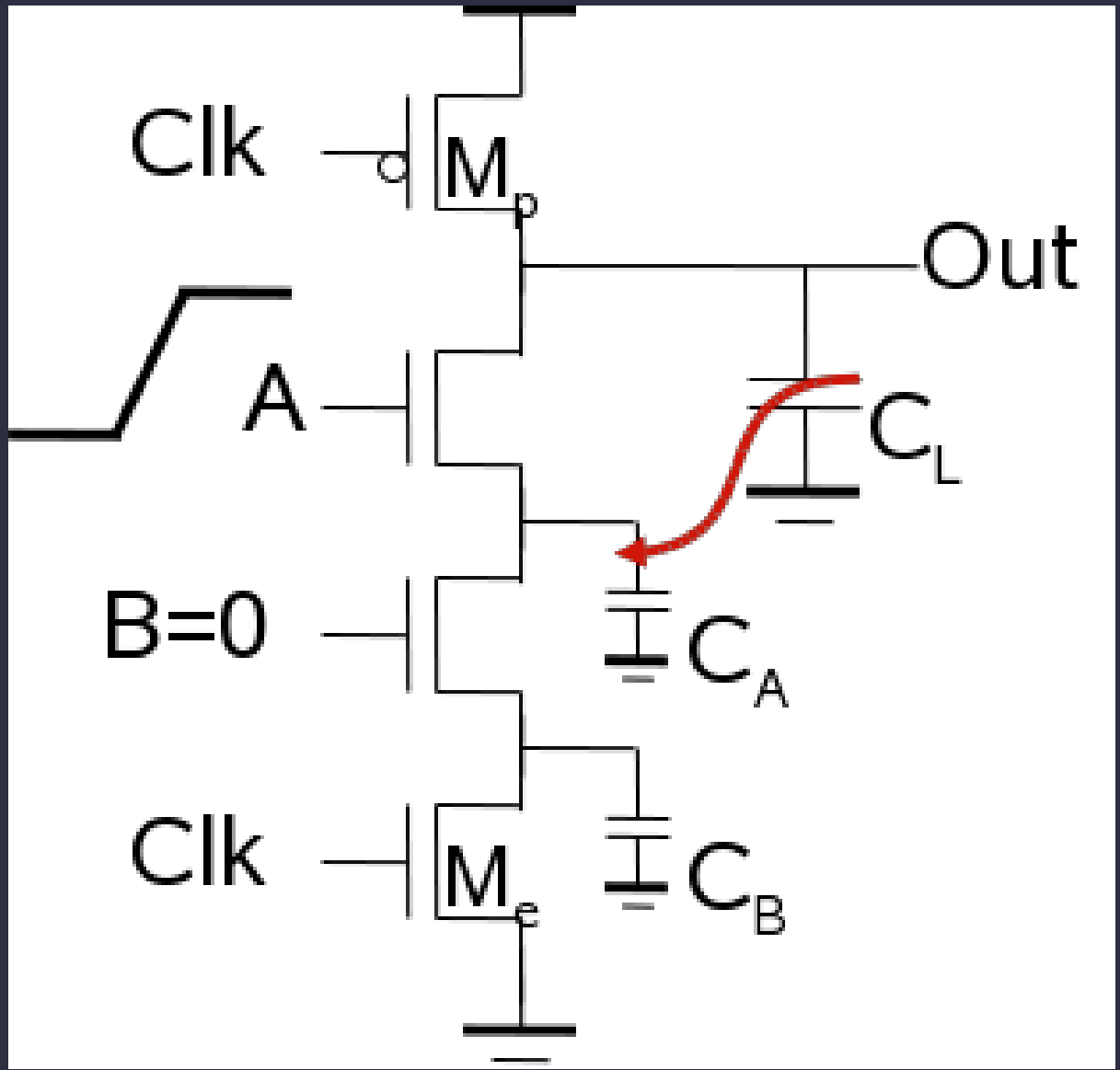
Dynamic logic charge leakage timing diagram



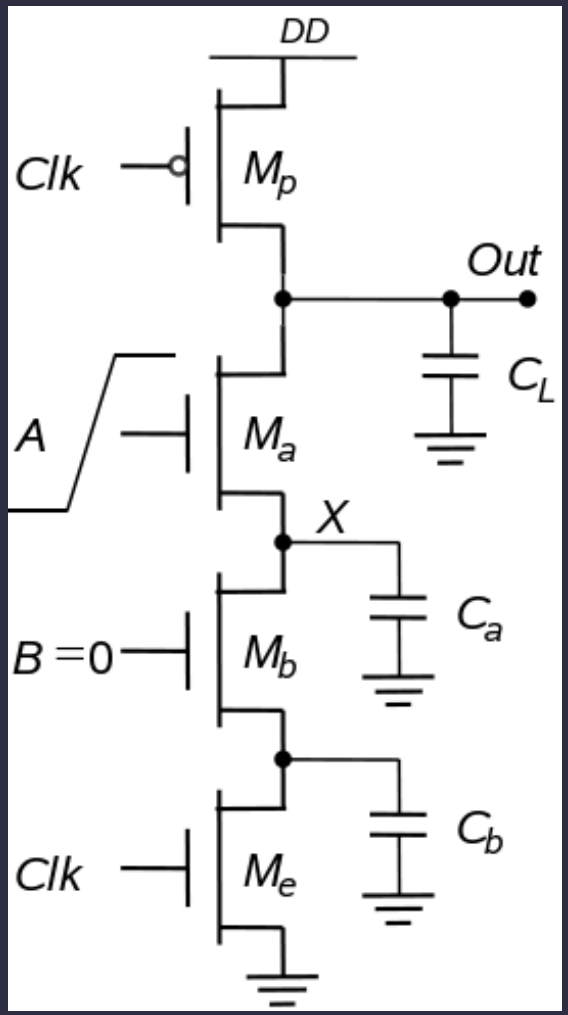
Leakage prevention



Charge sharing



Charge sharing model



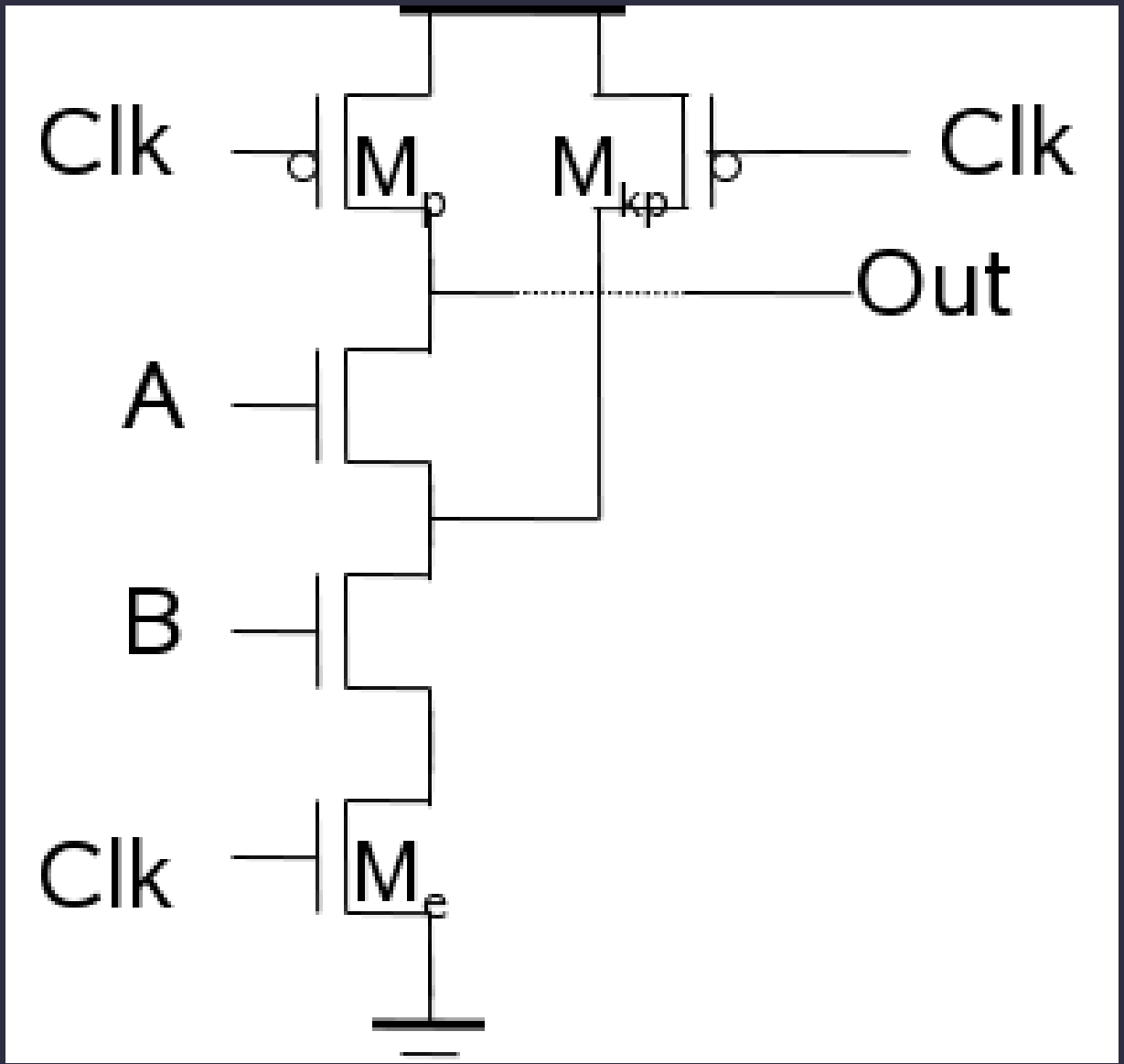
1. Determine condition by setting $\Delta V_{out} = V_{Tn}$.
2. This yields $\frac{C_a}{C_L} = \frac{V_{Tn}}{V_{DD} - V_{Tn}}$.

Charge sharing equations

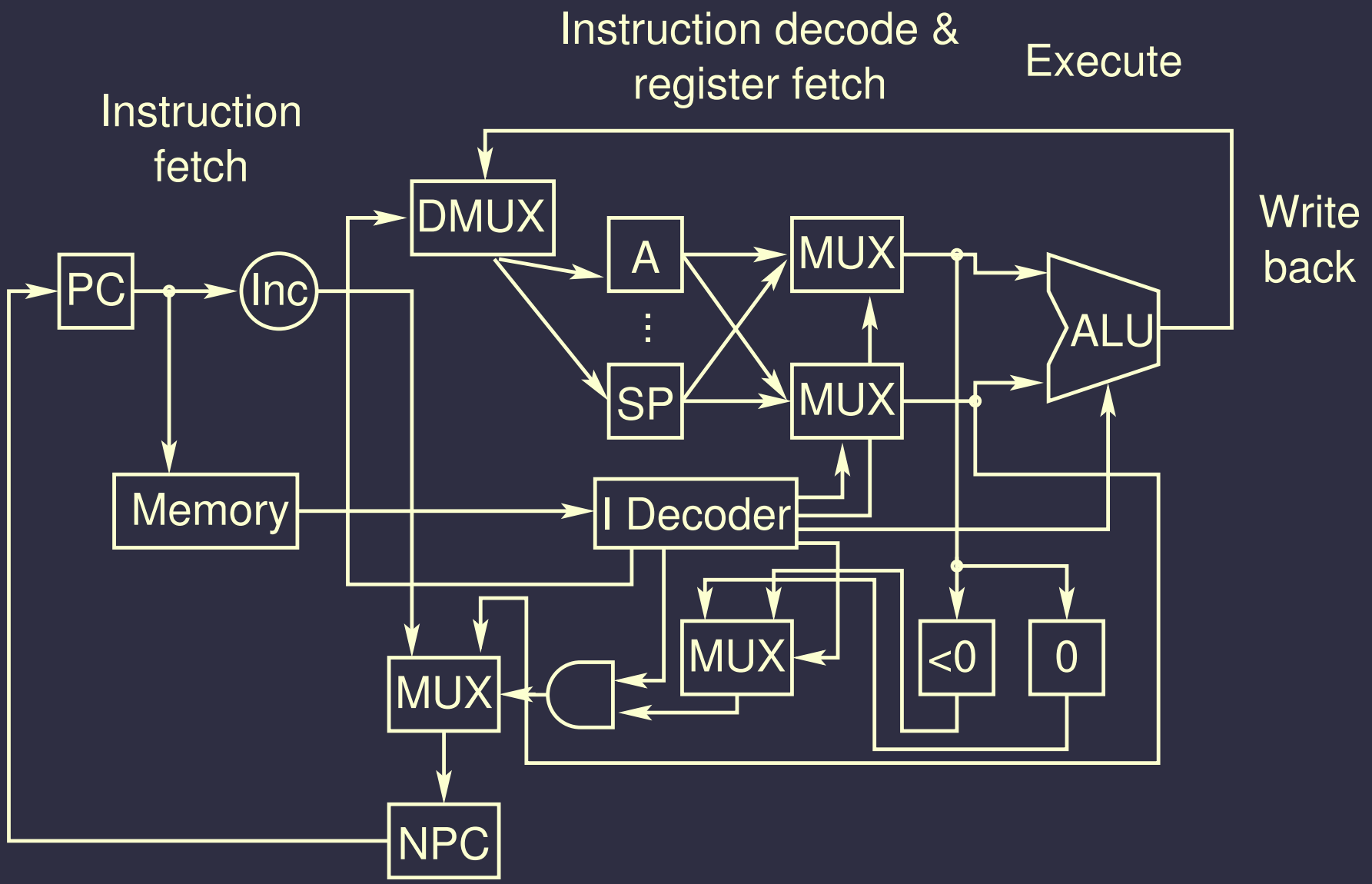
$$\Delta V_{out} = \begin{cases} V_{out}^{(final)} + V_{DD} = -C_a/C_L \left(V_{DD} - V_{Tn}^{(V_X)} \right) & \text{if } \Delta V_{out} < V_{Tn} \\ -V_{DD} \frac{C_a}{C_a + C_L} & \text{if } \Delta V_{out} > V_{Tn} \end{cases}$$

Note: The book has a sign error when deriving the boundary point.

Preventing charge sharing problems



Transition from combinational to sequential circuits



Upcoming topics

- Sense amplifiers.
- A more formal approach to gate sizing.

Lecture plan

1. Charge sharing
2. Homework

Homework assignment

- 18 November, Thursday: Read Sections 7.3.1 and 7.3.2 in J. Rabaey, A. Chandrakasan, and B. Nikolic. *Digital Integrated Circuits: A Design Perspective*. Prentice-Hall, second edition, 2003.
- 22 November, Monday: Lab 4.

Special topic: FinFETs

Sui Yu, Wang Yi, and Zhenghong.