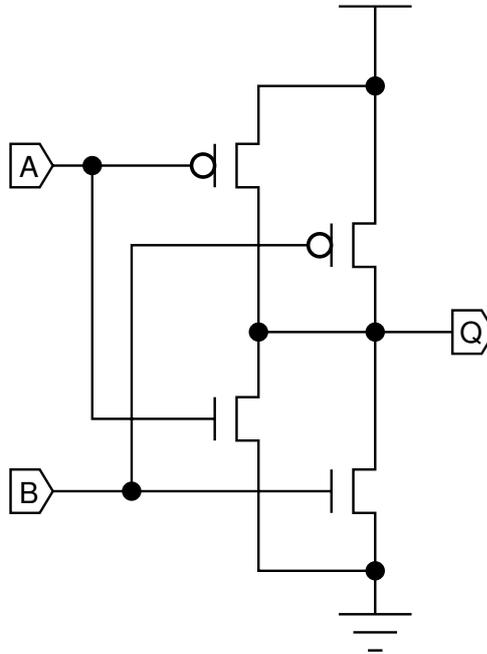


2005 Paper 8 Question 8

VLSI Design

- (a) Sketch the circuit of a 2-input NOR gate in static CMOS, and explain how it works. [4 marks]
- (b) Johnson's alternative design has the following circuit:



Explain how it works. [4 marks]

- (c) Correct operation relies on careful choice of the transistor sizes. Assuming that a conducting p-channel has a resistance γ times that of a similarly sized n-channel and that the threshold voltage is $\frac{1}{5}$ the operating voltage, calculate suitable widths for the transistors, and explain the reasons for their values. [2 marks]
- (d) Calculate the logical effort and parasitic delay for both designs when $\gamma = 2$. [10 marks]