1. Realize the following functions using CMOS technology with the **minimum** possible number of **transistors** (' is used to denote complementation).
   (a) $F = (((a + b) . c) + d)'$
   (b) $F = (a + b).(a + c)$
   (c) $F = a.b + a'.c + b.c.d$
   (d) $F = ((a + b + c).d.e)'$

2. A transistor with an "L" of 90nm has a gate oxide thickness of 16Å. What is the gate capacitance per micron of width?

3. As temperature rises, does the current through an ON transistor increase or decrease? Does current through an OFF transistor increase or decrease? Will a chip operate faster at high temperature or low temperature? Explain.

4. Give an expression for the output voltage for the pass transistor networks shown below. Neglect the body effect.
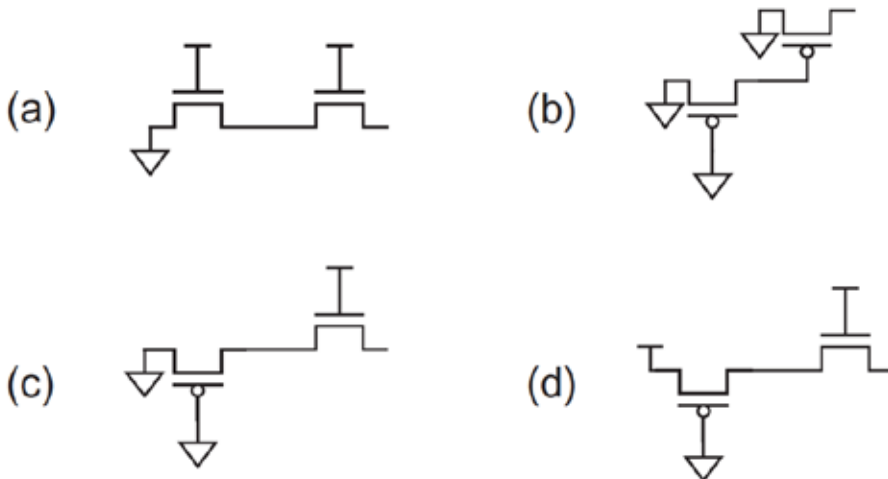
5. NewCo is offering to license to you a patented non-inverting buffer circuit shown below. Graphically derive the transfer characteristics for this buffer. How much money should you pay for access to this patent?
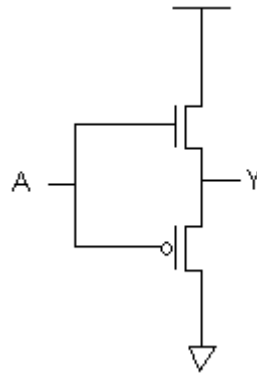
6. Suppose $V_{DD} = 1.2$ V and $V_t = 0.3$ V. Determine V_{out} in the following figure for:
   (a) $V_{in} = 0$ V;
   (b) $V_{in} = 0.6$ V;
   (c) $V_{in} = 0.9$ V;
   (d) $V_{in} = 1.2$ V.
   Neglect the body effect.