ECE 320 - Homework #9

TTL Logic, MOSFET Theory, MOSFET Switch. Due Monday, October 23rd, 2017

TTL Logic

1) For the following TTL inverter

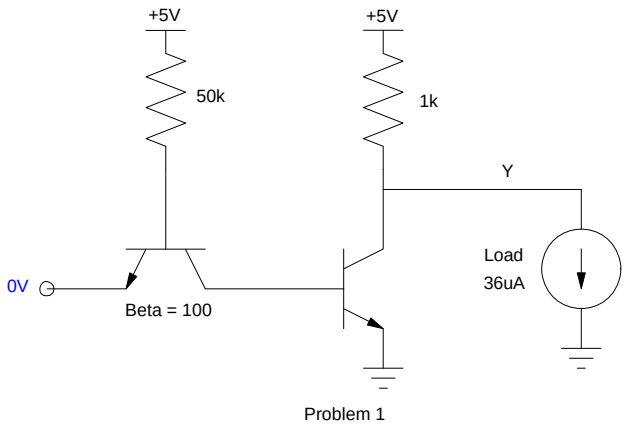
1a) Determine the voltages and currents

1b) Determine how many 36uA loads you can connect to Y and keep the voltage at Y > 4V (the fan-out high)

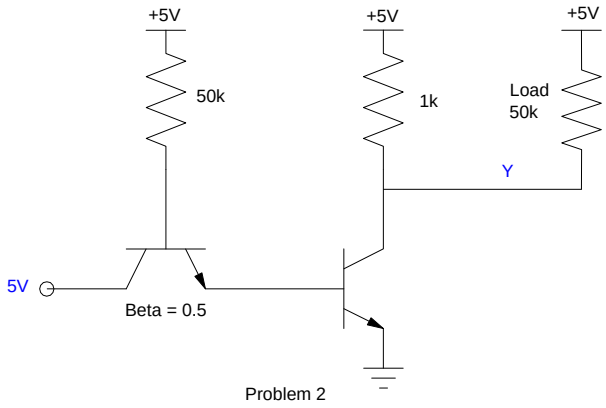
2) For the following TTL inverter

2a) Determine the voltages and currents

2b) Determine how many 50k loads you can attach to the load and keep the trnansistor saturated (the fanout low)



Problem 1



Problem 2

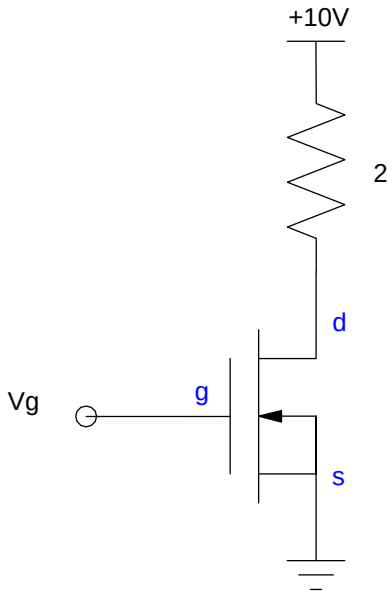
MOSFET Theory

3) For the MOSFET graph given on the back of this page,

- Determine the transconductance gain, kn,
- Mark the off / saturated / ohmic regions

4) On this graph, draw the load-line for the following circuit. Also mark the operating point when

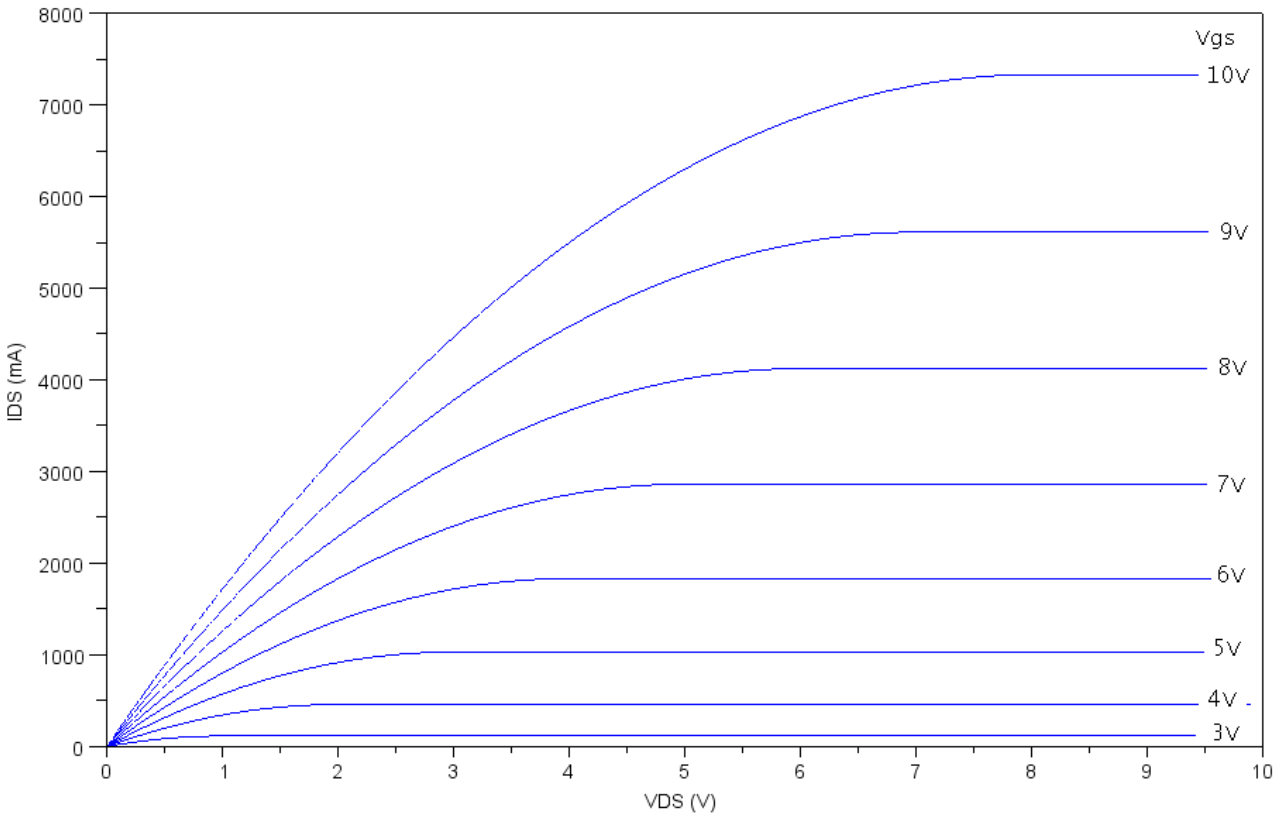
- Vg = 0V
- Vg = 5V
- Vg = 10V



5) A MOSFET has the following characteristics

- Rds = 0.65 Ohms @ 4A when Vgs = 10V.
- Vth = 2.0V

Design a switch which allows this MOSFET to turn on and off an 8 Ohm speaker at 10V using a 0V / 10V souce.



MOSFET Characteristics

Lab: Term Project (part 2)

Design one part of your term project. Some suggestions are:

- Use a Schmitt Trigger (part 1) and an AC to DC converter (part 2) to drive a 12V DC motor when the temperature is below 5C.
- Use a DTL NAND gate (part 1) and an H-bridge (part 2) to drive a 10V DC motor forward when switch when $\overline{AB}$ is true, reverse when false
- Use an AC to DC converter (part 1) to convert 20Vp 60Hz AC to 20VDC, capable of 100mA (part 1), which then drives a DC to DC converter (part 2) which drives a DC motor from 0V to 20V.
- Other

6) Requirements: Specify the

- Inputs
- Outputs
- How they relate

7) Analysis: Calculate the values of the components in your circuit to meet the requirements.

8) Simulation: Check your analysis using a circuit simulator, such as PartSim

9) Validation: Build your circuit and verify it meets the requirements