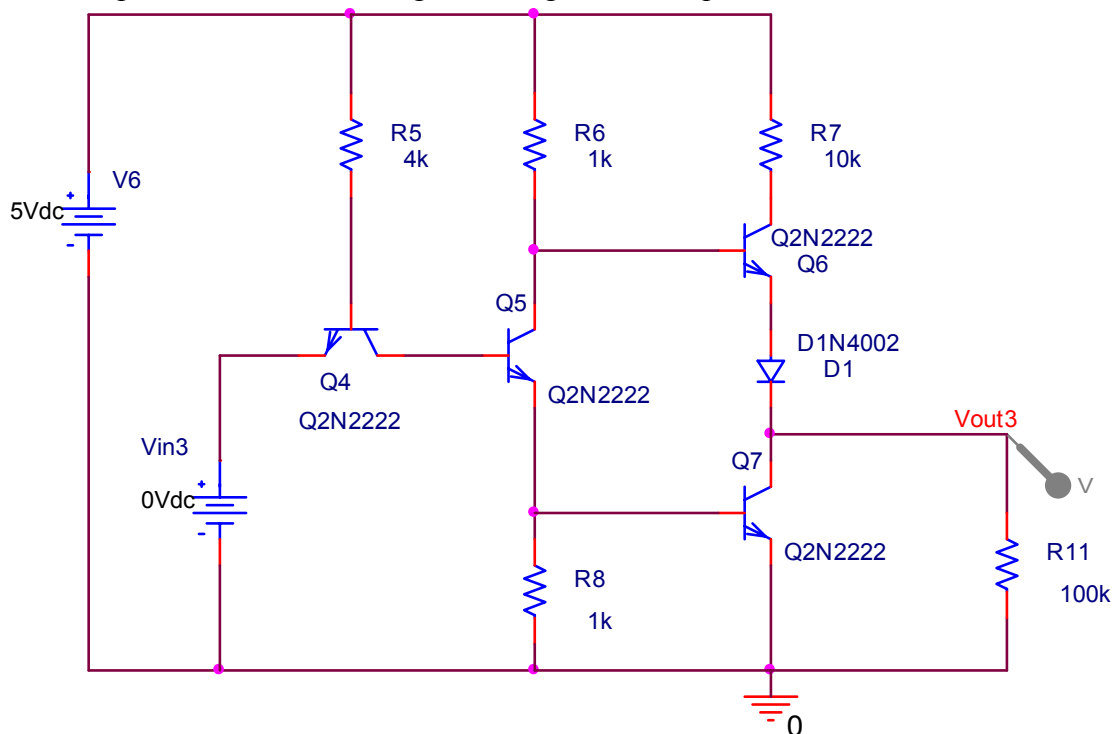


ECE 2274
Pre Lab for Experiment #12
TTL LOGIC and RING OSCILLATOR

I. TTL Logic Inverter

1. Build in PSpice a TTL logic inverter. Run a DC sweep from 0V to 5V on the input V_{in} while observing the change in the output V_{out} .

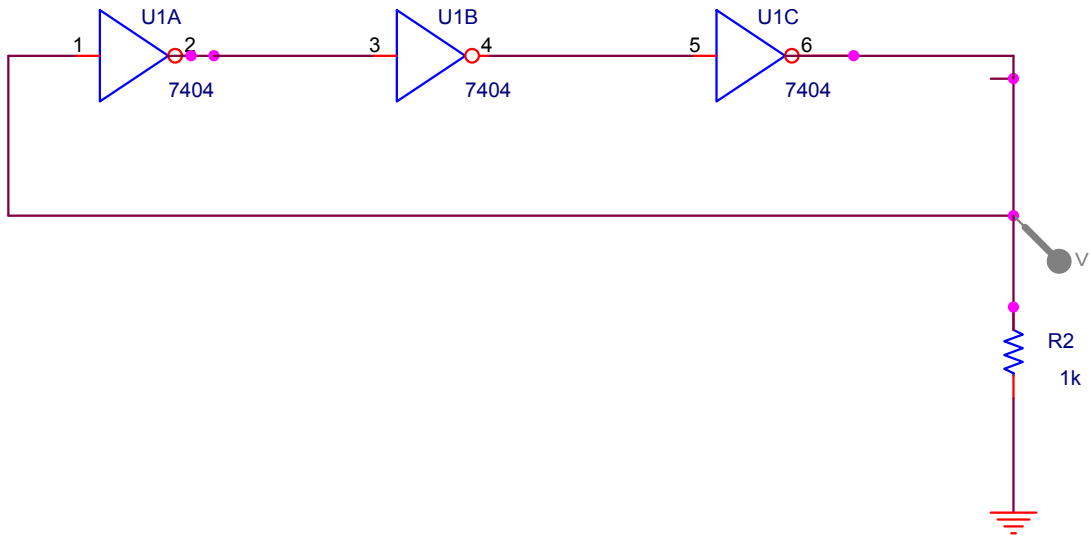


2. Change V_{in} to 0V so that the output is high. Now run a Bias Point simulation on the circuit. **What happened to the output current through the load? What happened to the output voltage?**

3. Now change the load to 100 Ω . Run the same Bias Point simulation on the circuit. Observe the output current through the load. **What changes do you notice in the current? What changes do you notice in the output voltage?**

II. Ring Oscillator

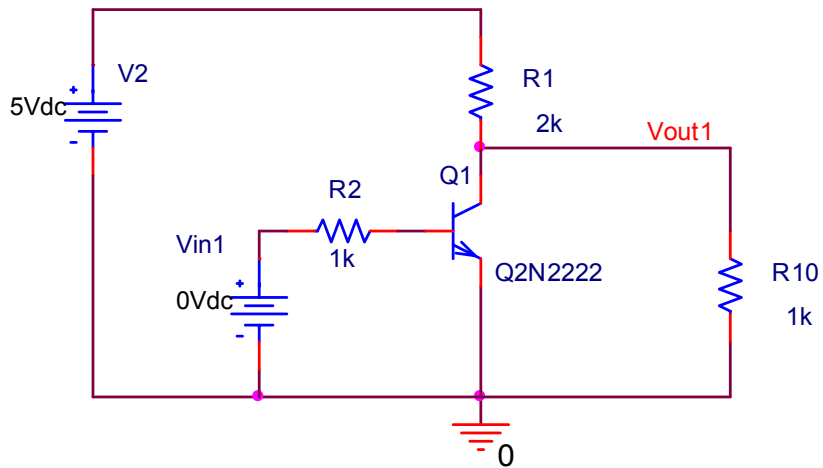
1. Build the inverter Ring Oscillator shown below in PSpice. **Graph the output waveform and label your graph to be turned in. What type of waveform? What is the amplitude and frequency?**



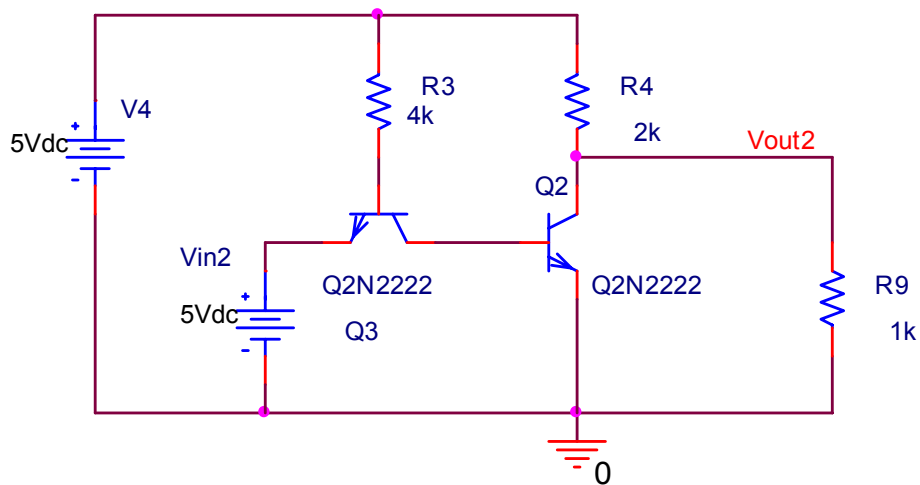
2. **Go to the web and make a copy of a data sheet for a TTL 7404 hex inverter to be turned in with your lab.** (don't turn it in with the pre-lab you will need the data sheet during the lab)

Lab Exercise
Experiment 12
TTL Logic and Ring Oscillator

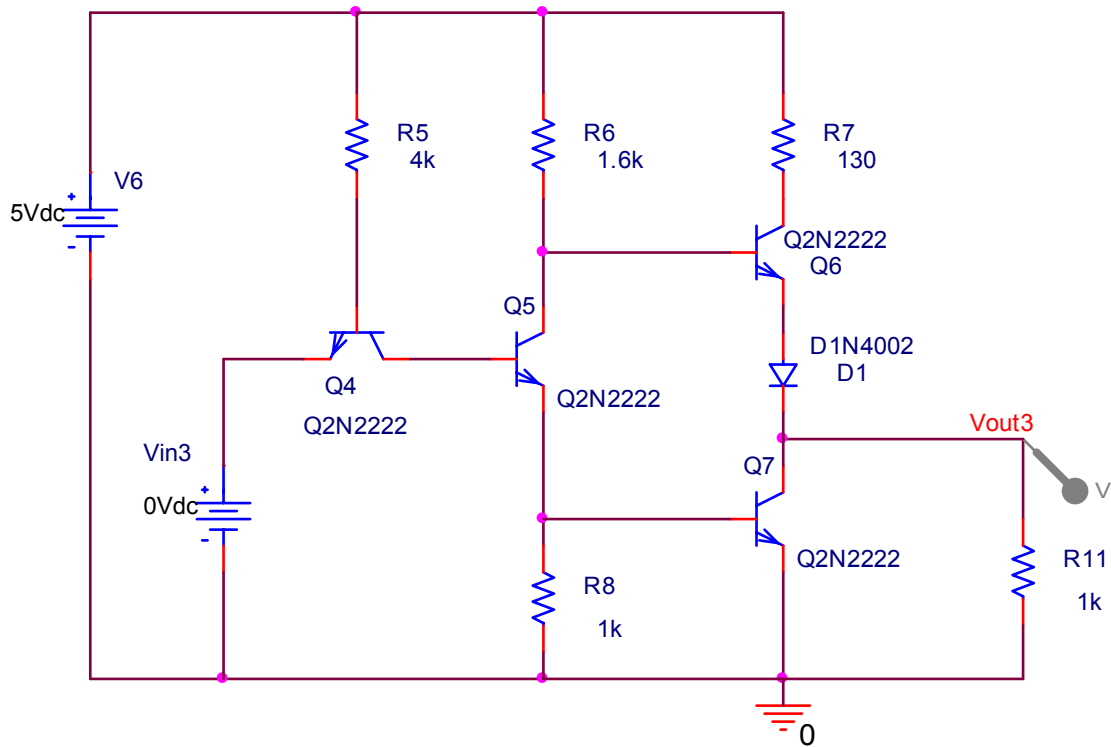
1. Build the following inverter circuit. Perform a DC sweep from 0V to 5V on Vin1. Capture and save the output voltage of the circuit.



2. Build the following inverter circuit. Perform a DC sweep from 0V to 5V on Vin2. Capture and save the output voltage of the circuit.



3. Build the following inverter circuit. Perform a DC sweep from 0V to 5V on Vin3. Capture and save the output voltage of the circuit.



Compare the three output voltage graphs. At what input voltage level do you notice that the output makes the transition from logic 1 (high) to logic 0 (low) for the three inverters?

Compare the three output voltage graphs. When the output is in the logic 1 (high) state, what differences in maximum voltage level do you notice for the three inverters?

4. **Build the inverter Ring Oscillator shown in your pre-lab.** Instead of the usual 1X probe that you use for the oscilloscope, use the gray colored 10X probe to observe the oscillator output on the oscilloscope. The 10X probe will help to reduce capacitance in the input cable.
5. **What is the output frequency of the Ring Oscillator? How does this measured frequency compare with the PSpice frequency?**

6. Use the measured frequency to determine the propagation delay of the 7404-inverter chip. How does the measured propagation delay compare with the data sheet spec?

ECE 2274
TTL LOGIC and RING OSCILLATOR
Data Sheet

1. Turn in graph.
2. Turn in graph.
3. Turn in graph.

Compare the output voltages for the three inverters:

#1 inverter

Input Voltage: _____ Output Voltage: _____

#2 inverter

Input Voltage: _____ Output Voltage: _____

#3 inverter

Input Voltage: _____ Output Voltage: _____

4. Observation:
5. $F_o =$ _____ $F_{O_{pspice}} =$ _____
% _____
6. Measured propagation delay _____ Stated propagation delay _____
% _____