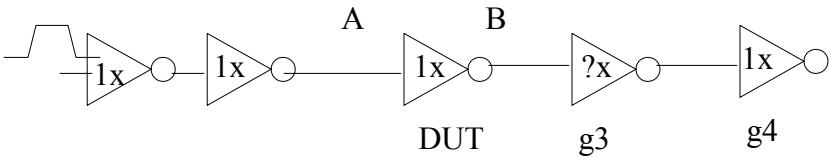
Delay Prediction Homework

- All Spice problems in this homework are to be done for technologies
  - tsmc_0_35.model, tsmc_0_18.model
  - Vdd = 3.3 V, default temp
  - all input waveforms should have rise/fall times of 100 ps.
- It is suggested that you do the complete homework with only one technology, then go back and do it for the other technologies.

Part #1 – Data Measurement



a. Measure TPLH, TPHL for the gate marked as DUT for cases of G3 = noload, 1X, 3X, 6X. When measuring delay, measure the time between the 30% and 70% points of the waveform.

b. Repeat (a) for DUT = 2X, 3X, 6X. Present this data in tabular format.

Part #2 – Model Fit

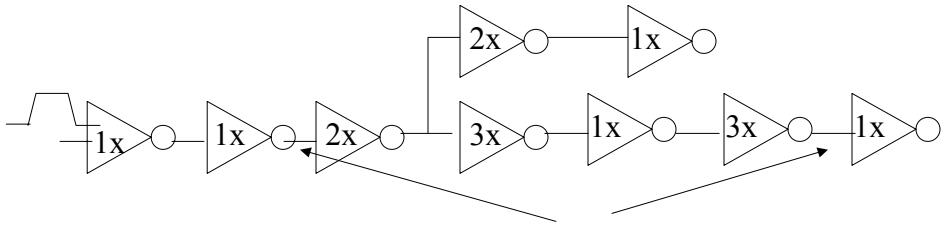
Based on your previous data, come up with the parameters for the basic RC timing model:

delay = Tnoload + K * L

where L is the load measured in inverter loads. You should have two equations – one for TPHL, and one for TPLH. Note that this equation DOES NOT include a factor for slew.

There are many ways to do this – you need to try to find a 'good' value for K based on the previous data. You must explain and justify your approach. You can try straight line curve fitting of load case, then average the resulting K's, you can try computing K's for each case and then averaging, etc...

Part #3: Delay Prediction



1. Measure TPLH, TPHL between the points indicated.
2. Compute the predicted delay based upon your RC model. Give the % differences as (expected – measured)/measured * 100%

Part #4: More Accurate Delay Prediction

Use different K values based on driving gate sizes and see if you can get a more accurate delay prediction that what you achieved for part #3.

Report

- I expect a report in PDF format to submitted for your homework results.
  - I want to see all data presented in clear, tabular formats (label columns so that I know what is being presented) – label tables so that I know what the table contains
  - I want a clear EXPLANATION and JUSTIFICATION of how you came up with the K values for your final delay prediction equations
  - For all predicted delays (TPLH, TPHL), show me the delays predicted at each stage and how your equations are used to compute this. I do not just want to see a final predicted value with no idea how you arrived it.
- 30% of grade is based upon the professionalism of the report. Think of this as an engineering report that you are giving to your boss.
  - I do not need any background information on the problem (i.e. a 'theory' section).
  - Gross grammar mistakes, spelling errors will be treated harshly.