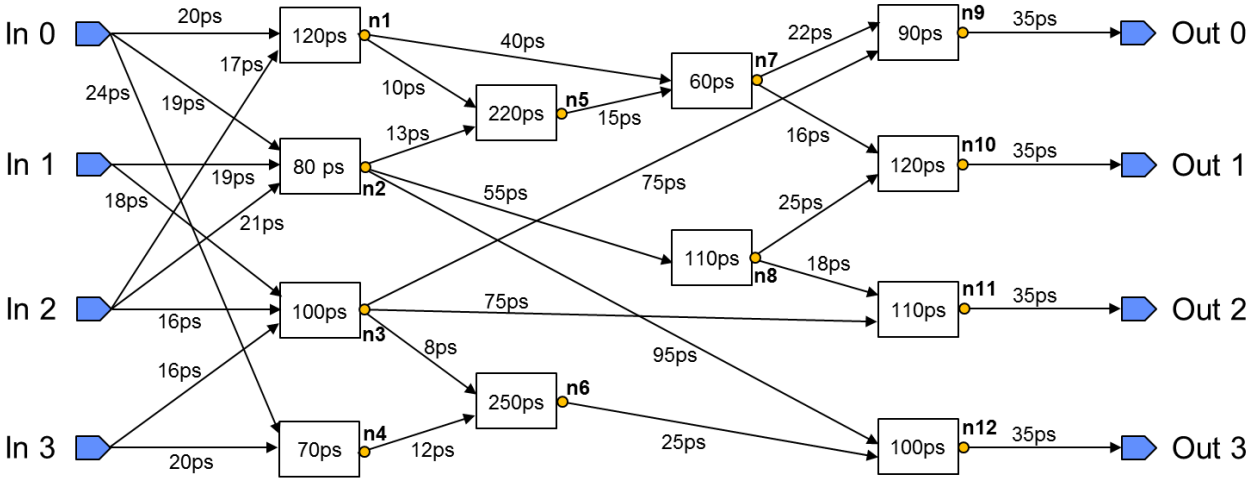
Homework Assignment 8

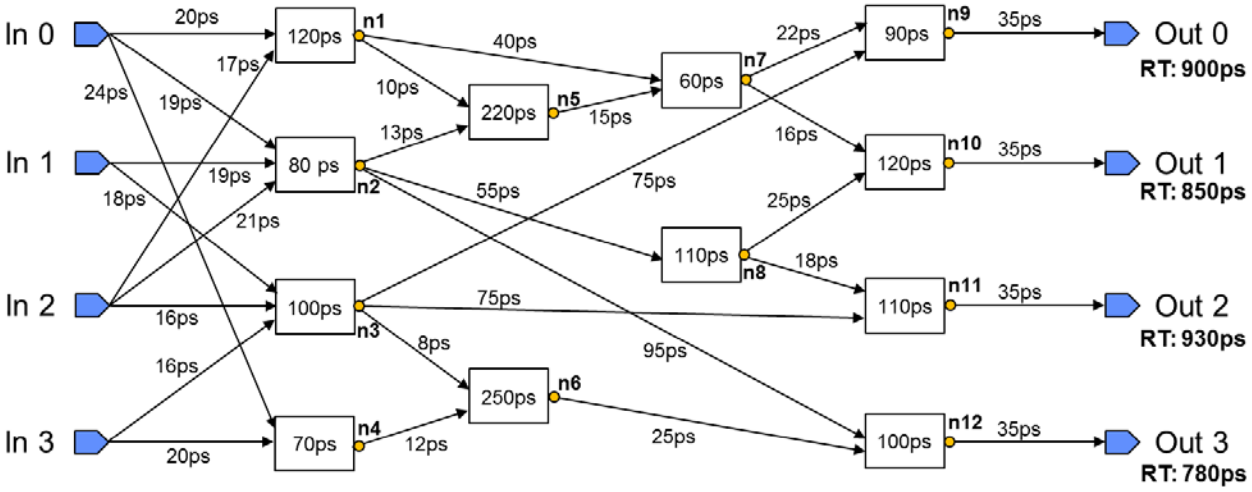
(Due Apr. 22nd at the beginning of the class)

1. [Timing Analysis, **15 points**] The following shows the delay of each net and cell. Compute arrival time at each node (n1 ~ n12, Out 0 ~ Out 3) shown below.



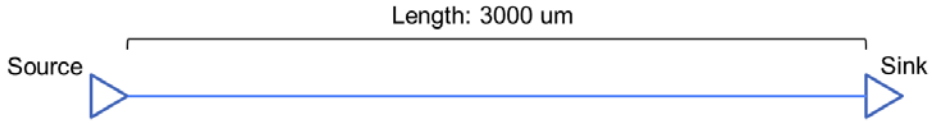
	Arrival time		Arrival time
n1		n9	
n2		n10	
n3		n11	
n4		n12	
n5		Out 0	
n6		Out 1	
n7		Out 2	
n8		Out 3	

2. [Timing Analysis, **15 points**] The following shows the delay of each net and cell and the required time at each output. Compute required time at each node (n1 ~ n12, In 0 ~ In 3).



	Required time		Required time
n1		n9	
n2		n10	
n3		n11	
n4		n12	
n5		In 0	
n6		In 1	
n7		In 2	
n8		In 3	

3. [Timing Analysis and Buffer Insertion, **60 points**] A source drives a sink as follows:



The length of the wire is 3000 um. The following shows the characteristics of the source, the sink, and the wire:

- Source
  - Output resistance: 1kΩ
  - Cell delay: 50ps
- Sink
  - Input capacitance: 10fF
  - Cell delay: 100ps
- Wire
  - Unit resistance: 3Ω/um
  - Unit capacitance: 0.2fF/um

1) The arrival time at the input of the source is 0. Compute arrival time at the output of the sink.

2) The required time at the output of the sink is 2500ps. Compute required time at the input of the sink, at the output of the source, and at the input of the source.

3) Compute slack at the output of the sink, at the input of the sink, at the output of the source, and at the input of the source.

4) Let's insert a buffer into the net. The following shows the characteristics of the buffer:
   a. Output resistance: 200Ω
   b. Input capacitance: 20fF
   c. Cell delay: 50ps

   Find an optimal location for this buffer.

5) Repeat 1) after buffer insertion.

6) Repeat 3) after buffer insertion.