Assigment 1

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Question 1

Based on the diagram, we can solve the sub parts in the following way:

Part a

Rise time (t_r) is defined as the time taken for the voltage to rise from $0.1(V_{dd})$ to $0.9(V_{dd})$. Fall time (t_f) is defined as the time taken for the voltage to to fall from $0.9(V_{dd})$ to $0.1(V_{dd})$.

Hence the rise time and fall time for the waveform V_{out} can be calculated as:

$$t_r = 383.86ps - 359.95ps = 23.91ps \tag{1}$$

$$t_f = 132.36ps - 113.35ps = 19.01ps \tag{2}$$

Part b

The high-to-low propogration delay (t_{pHL}) is defined as the time delay between $0.5(V_{in})$ in the rising edge and $0.5(V_{out})$ in the falling edge. Based on the graph provided in the question, the following can be obtained:

$$t_{pHL} = 120.88ps - 108.62ps = 12.26ps \tag{3}$$

Part c

The low-to-high propogration delay (t_{pLH}) is defined as the time delay between $0.5(V_{in})$ in the falling edge and $0.5(V_{out})$ in the rising edge. Based on the graph provided in the question, the following can be obtained:

$$t_{pLH} = 368.35ps - 355.05ps = 13.3ps \tag{4}$$

Part d

Based on the diagram, we can assume that the clock cycle in pico-seconds can be assumed to be T_{in}.
Hence:

$$\frac{10}{100} * T_{in} = 355.05ps - 108.62ps = 246.43ps \tag{5}$$

Solving this for T_{in} would result in the following:

$$T_{in} = 246.43ps * 10 = 2464.3ps \tag{6}$$

The frequency can be calculated to be the following:

$$f_{in} = \frac{1}{2464.3 * 10^{-12}} = 406 * 10^6 Hz = 406MHz. \tag{7}$$