Computer Engineering Department
**Faculty of Engineering**
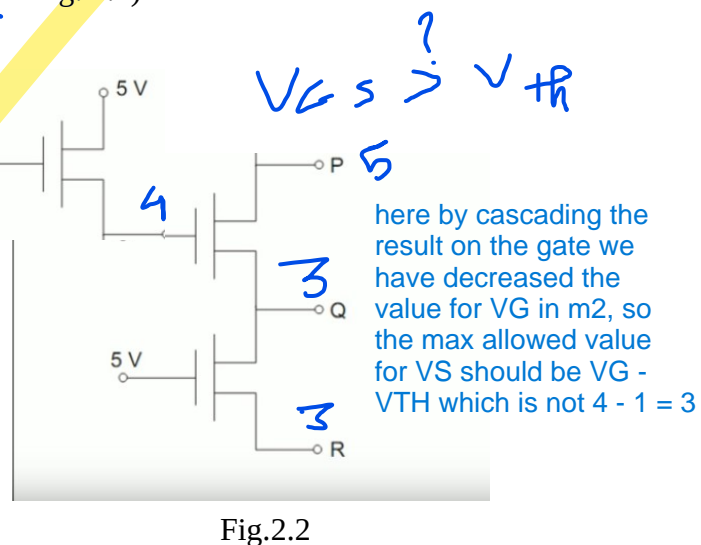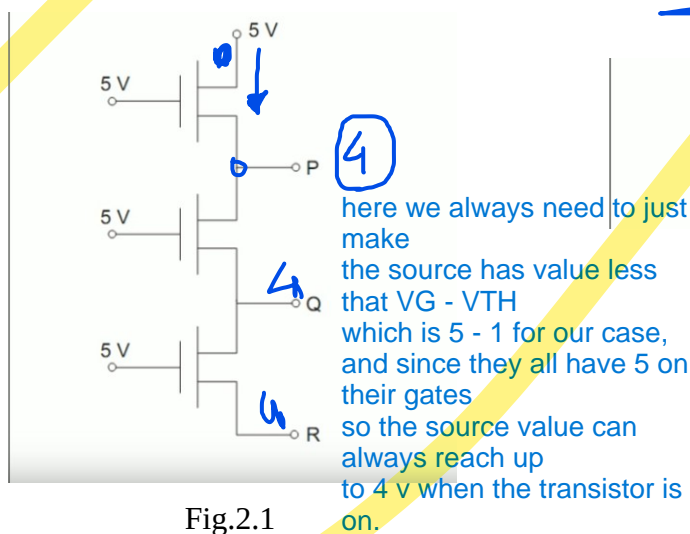**Cairo University**

Problem #1

Consider the circuit of Fig. 1. The signal waveforms of each signal within one period are shown in Fig. 2. You may assume that these signals are repeated with a frequency of 1 MHz (or T = 1μs). Using the following device parameters: $V_T = 0.5$ V, $\gamma = 0$, $R_{on} = 10$ KΩ, $R_{off} = \infty$.

- Draw the waveform of the signals on the nodes X and Y over one period T, assuming that all input signals are switching between 0 and 2.0 V. You may ignore the parasitic capacitance of the transistors.
- What is the logical expression of the circuit in fig. 1?

Fig. 1
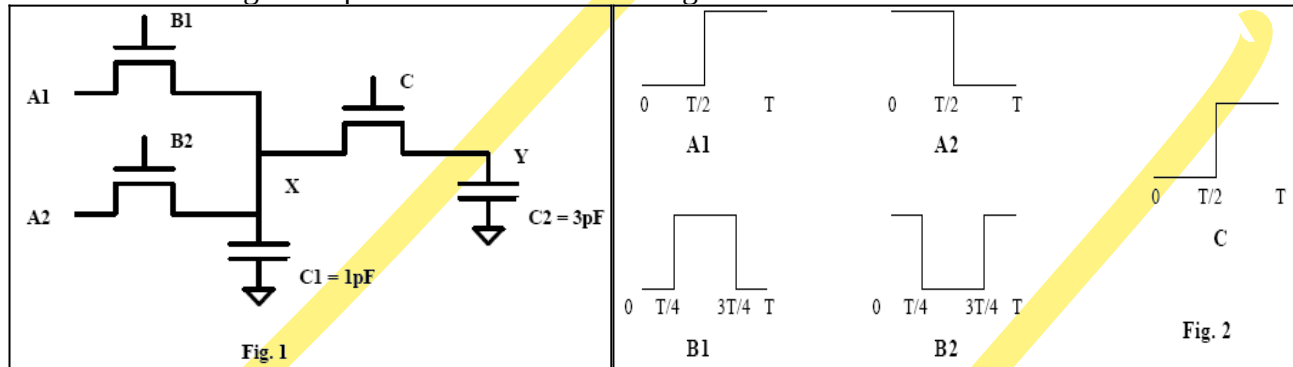
Fig. 2

Problem #2

For the given figures: Find the voltage at points P,Q,R if the threshold voltage = 1V (assume that we already took the body effect into account) (assume P=5V in fig. 2.2)

$V_{GS} \geq V_{th}$?

(4)

here we always need to just make
the source has value less
that VG - VTH
which is 5 - 1 for our case,
and since they all have 5 on their gates
so the source value can always reach up
to 4 v when the transistor is on.

5

here by cascading the result on the gate we have decreased the value for VG in m2, so the max allowed value for VS should be VG - VTH which is not 4 - 1 = 3

Fig.2.1   Fig.2.2

this happens because we need to satisfy this equation VGS >= VTH
so the maximum allowable value for vs is all values that should be less than VG - VTH > VS.

Implement the function S = ABC + !A!B!C + !A!BC + !AB!C using pass logic