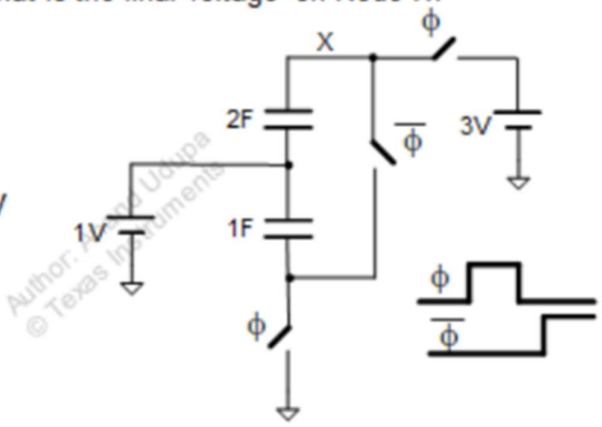
TI BYTE Simulation Exercise

Week 1 : RC Circuits

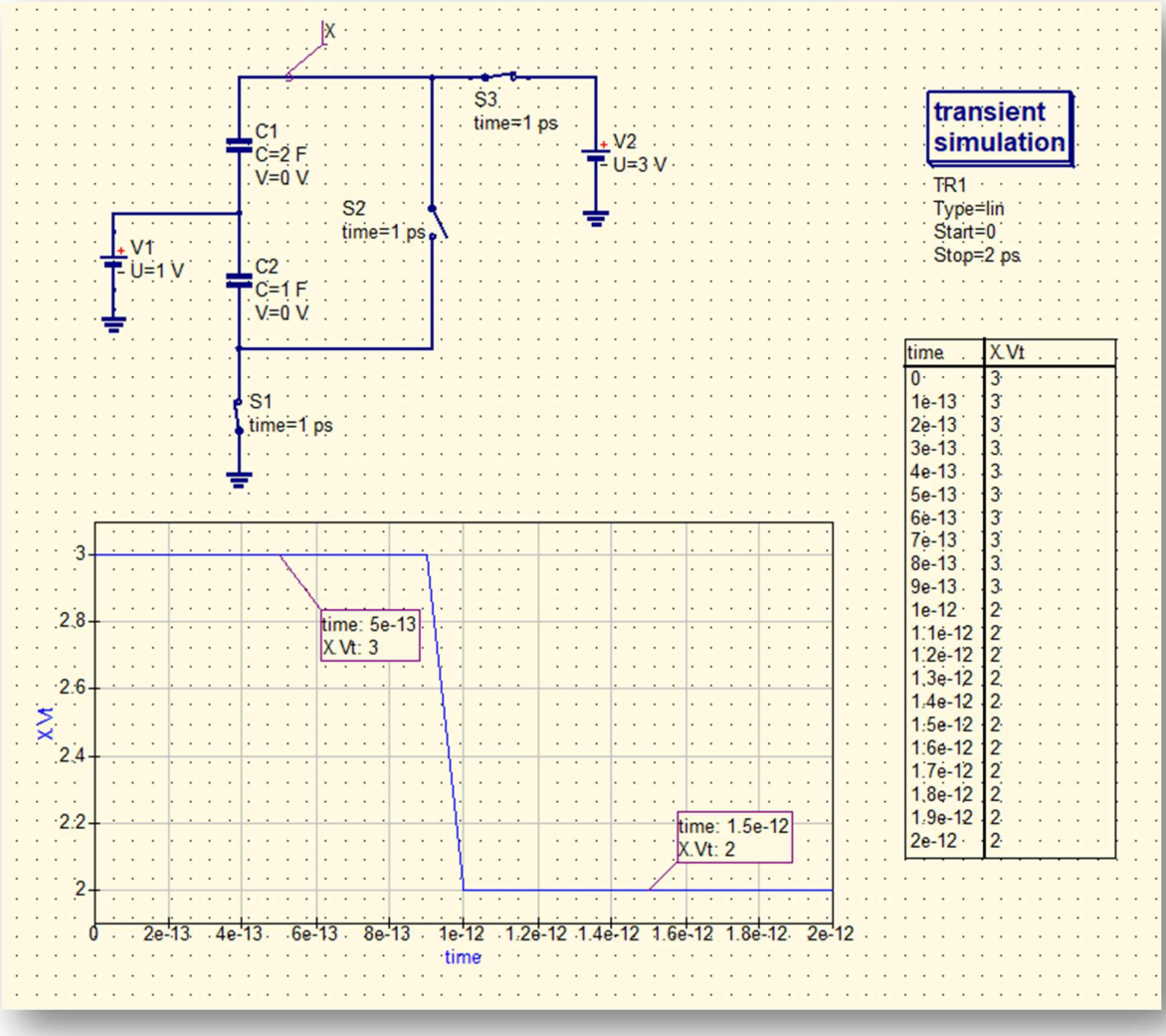
- **Question 1:**

206. What is the final voltage on Node X?

(a) -2V
(b) -1V
(c) 0V
(d) 1V
(e) 1.5V
(f) 2V
(g) 3V
(h) 4V



- **QUCS Circuit:**



time	X.Vt
0	3
1e-13	3
2e-13	3
3e-13	3
4e-13	3
5e-13	3
6e-13	3
7e-13	3
8e-13	3
9e-13	3
1e-12	2
1.1e-12	2
1.2e-12	2
1.3e-12	2
1.4e-12	2
1.5e-12	2
1.6e-12	2
1.7e-12	2
1.8e-12	2
1.9e-12	2
2e-12	2

- **X is used to label the node and find the voltage at that node.**
- **Switches S1 and S3 are initially closed at t = 0, and S2 is opened.**
- **At t = 1 ps, the switches S1 and S3 are opened, and switch S2 is turned closed.**

➢ QUCS Result:

Therefore, from the simulation, we get our answer as:

V_x = 2V

Answer: (f)

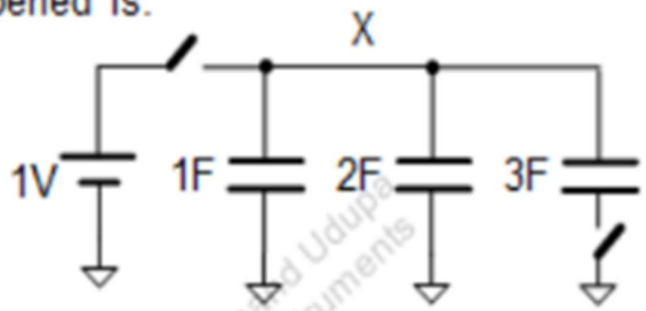
➢ Conclusion:

- **Since the resistance in these circuits are 0, the voltage sources provide Impulse currents, and thus the capacitors C1 and C2 are charged instantaneously at t = 0, up to 2V and 1V respectively.**
- **The voltage at X at t = 0 is 3V.**
- **At t = 1 ps, when S1 and S3 are opened and S2 is closed, the capacitors C1 and C2 share their charges and instantaneously arrive at a final voltage of V_x = 2V.**
- **The slope in the simulated Cartesian diagram at t = 1 ps is due to the fact that, the step in the Transient simulation was taken as 0.1 ps.**

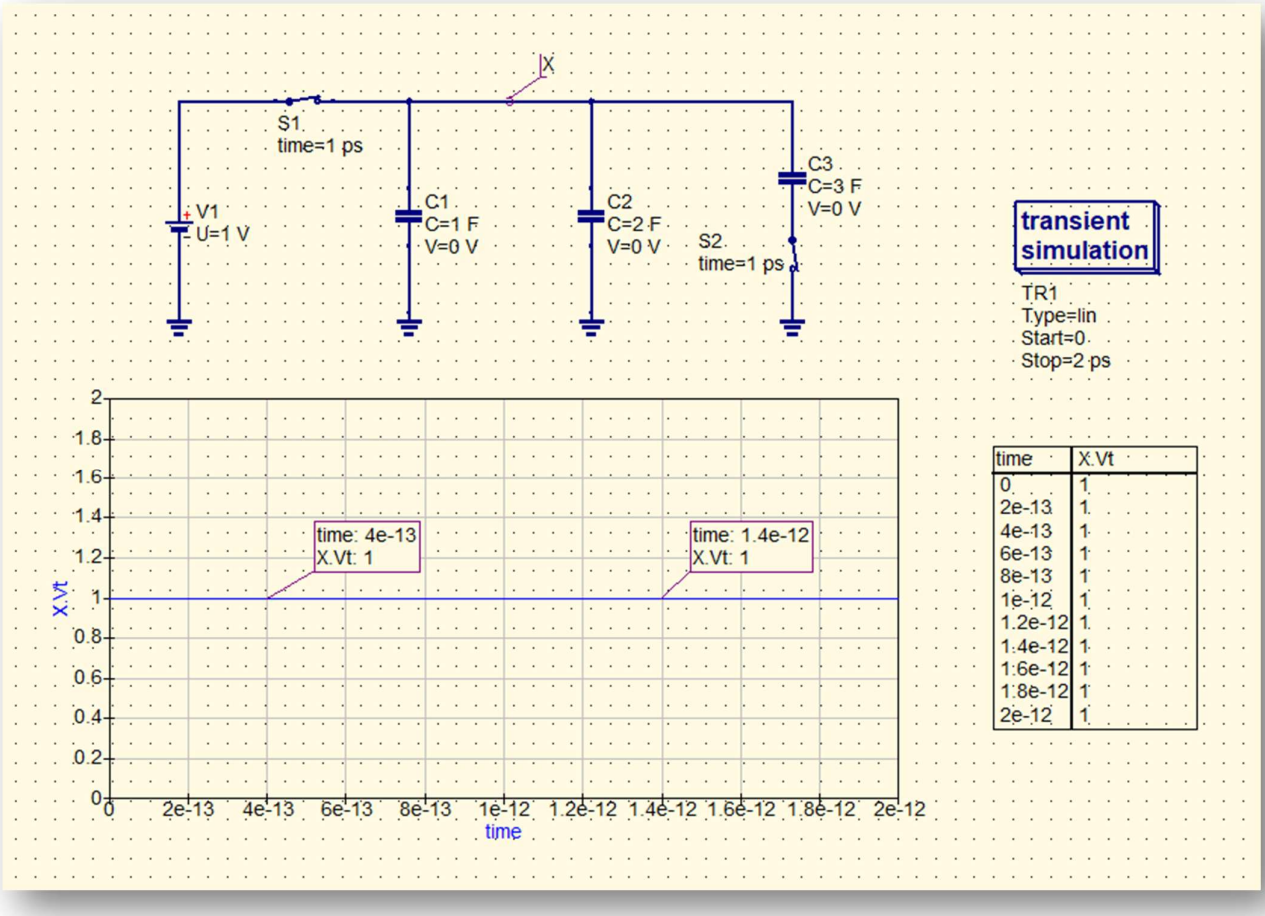
- **Question 2:**

204. The 2 switches in the circuit are initially closed and then opened. Voltage at node X after the 2 switches are opened is:

(a) 1V
(b) 0V
(c) 1/3V
(d) 1/6V
(e) 3V
(f) 6V
(g) 5V
(h) 1.5V



- **QUCS Circuit:**



time	X.Vt
0	1
2e-13	1
4e-13	1
6e-13	1
8e-13	1
1e-12	1
1.2e-12	1
1.4e-12	1
1.6e-12	1
1.8e-12	1
2e-12	1

- **The node X is used to find out the resulting voltage at that node.**
- **Switches S1 and S2 are initially closed at t = 0.**
- **At t = 1 ps, the switches S1 and S2 are opened.**

➢ QUCS Result:

Therefore, from the simulation, we get our answer as:

V_x = 1V

Answer: (a)

➢ Conclusion:

- **Since the resistance in these circuits are 0, the voltage sources provide Impulse currents, and thus the capacitors C1, C2 and C3 all are charged instantaneously at t = 0, up to 1V.**
- **The voltage at X at t = 0 is 1V.**
- **At t = 1 ps, when S1 and S2 are opened, the lower plate of capacitor C3 becomes floating (or open-ended), and so no current flow will occur through that.**
- **Alongside, since both capacitors C1 and C2 both are charged up to 1V, thus no charge sharing occurs, it's voltage remains at 1V. Thus the final voltage at node X is 1V.**