Name_____

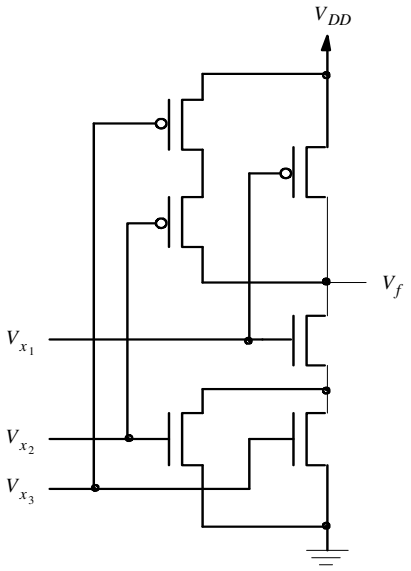
Partial credit will be given if you show your work.

1. (25 pts.) Given the following truth table, find the minimum-cost sum-of-products (SOP) expression for *f*.

Row #	x_1	x_2	x_3	f
0	0	0	0	0
1	0	0	1	0
2	0	1	0	1
3	0	1	1	1
4	1	0	0	0
5	1	0	1	1
6	1	1	0	0
7	1	1	1	1

2. (25 pts.) Implement the multiplexer circuit using NAND gates. A multiplexer implements the following function: $f = \bar{s}x_1 + sx_2$.

3. (25 pts.) Find the function *f* the following circuit implements.



4. (25 pts.) In a CMOS inverter assume that $k_n' = 20\frac{\mu A}{V^2}$, $k_p' = 0.4 \times k_n'$, $\frac{W_n}{L_n} = \frac{W_p}{L_p} = \frac{5.0\ \mu m}{0.5\ \mu m}$, $V_{DD} = 5V$. If the inverter drives a capacitance of 150 fF, find the longest propagation delay we can expect from this gate.