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Computer Architecture
Homework 1

1.) Fill up the truth table on the right side.

S	X_0	X_1	Y
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

2.) Express the Boolean function $Y(S, X_0, X_1)$ with respect to SOP.

$$Y(S, X_0, X_1) = \bar{S} X_0 \bar{X_1} + \bar{S} X_0 X_1 + S \bar{X_0} X_1 + S X_0 X_1$$

3.) Express the Boolean function $Y(S, X_0, X_1)$ with respect to POS

$$Y(S, X_0, X_1) = (S + X_0 + X_1)(S + X_0 + \bar{X_1})(\bar{S} + X_0 + X_1)(\bar{S} + \bar{X_0} + X_1)$$

4.) Using K-map, simplify the boolean function $Y(S, X_0, X_1)$ obtained in (2.)

$$\boxed{y = S X_1 + \bar{S} X_0}$$

5.) Using K-map, simplify the boolean function $Y(s, x_0, x_1)$ obtained in 3

$$y = (\bar{s} + x_0)(s + x_1)$$

K-map:
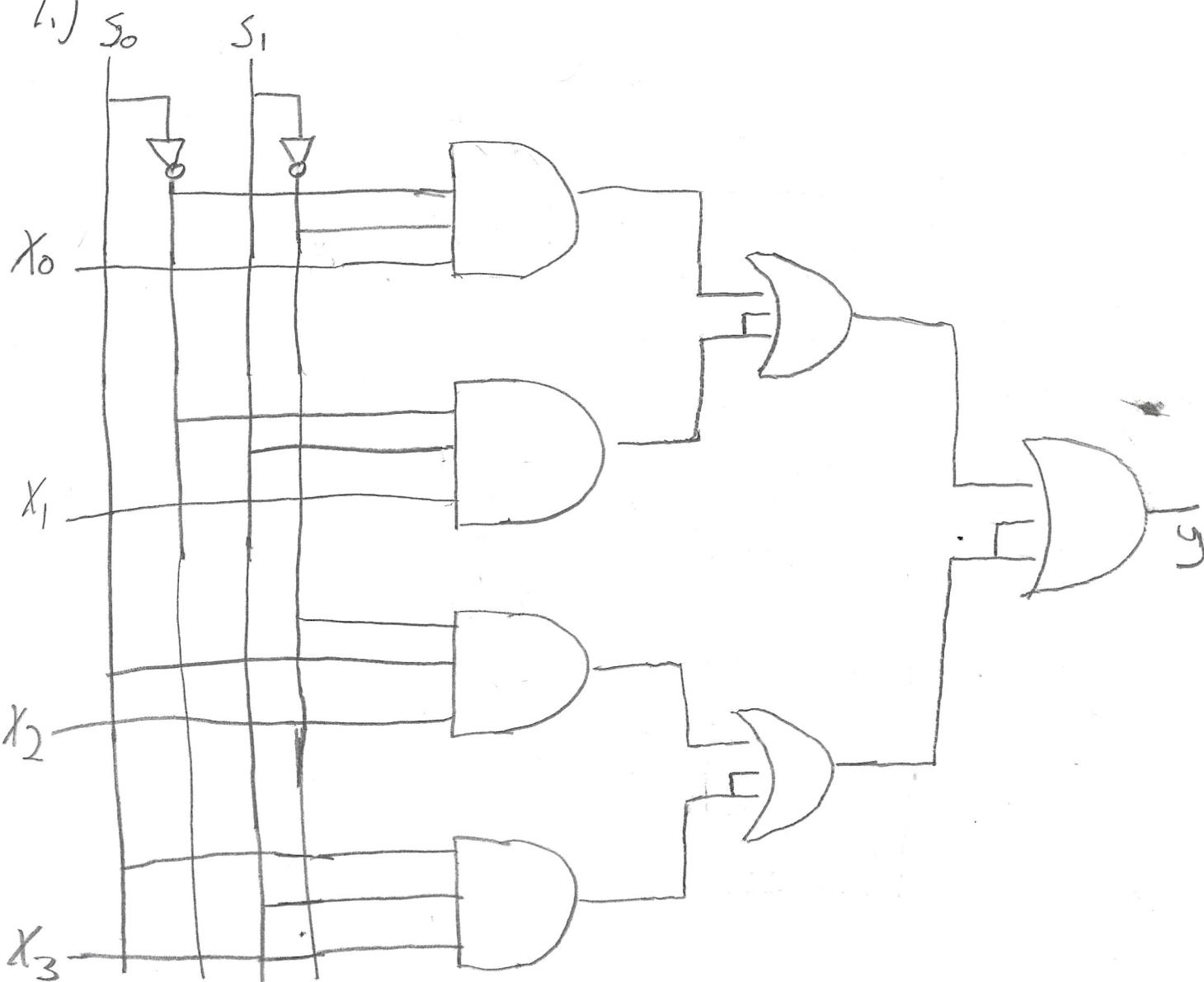
$s \backslash x_0 x_1$	00	01	11	10
0	0	0	1	1
1	0	1	1	0

(label on left side: $(\bar{s} + x_0)$)
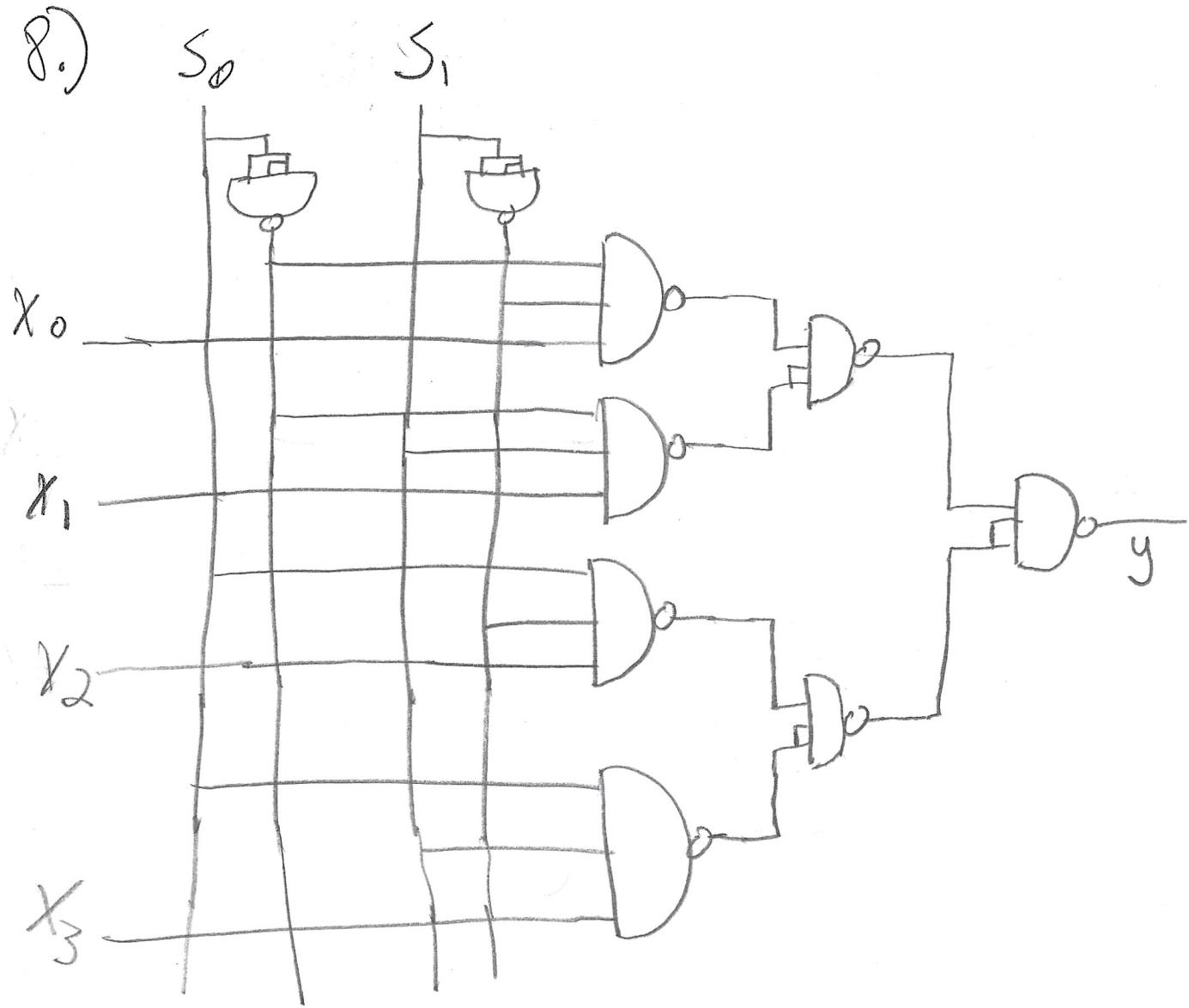
$S + X_1$

6.) $Y(S_0, S_1, X) = \bar{S_0}\bar{S_1}\,Y(0,0,X) + \bar{S_0}S_1\,Y(0,1,X) + S_0\bar{S_1}\,Y(1,0,X) + S_0 S_1 Y(1,1,X)$

$$\boxed{Y(S_0, S_1, X) = \bar{S_0}\bar{S_1}\,X_0 + \bar{S_0}S_1\,X_1 + S_0\bar{S_1}\,X_2 + S_0 S_1 X_3}$$

7.)

8.)

S_0 S_1

X_0

X_1

X_2

X_3

y

$$Y(S_0, S_1, X) = \overline{S_0}\,\overline{S_1}\,X_0 + \overline{S_0}S_1 X_1 + S_0\overline{S_1}X_2 + S_0 S_1 X_3$$

$\underbrace{}_{A}$ $\underbrace{}_{B}$ $\underbrace{}_{C}$ $\underbrace{}_{D}$

$$= \overline{\overline{A+B+C+D}} = \overline{\overline{A}\cdot\overline{B}\cdot\overline{C}\cdot\overline{D}}$$

$$Y(S_0, S_1, X) = \overline{(\overline{S_1}\,\overline{S_0}\,X_0)} \cdot \overline{(\overline{S_0}S_1 X_1)} \cdot \overline{(S_0\overline{S_1}X_2)} \cdot \overline{(S_0 S_1 X_3)}$$