EHB205E Introduction to Logic Design
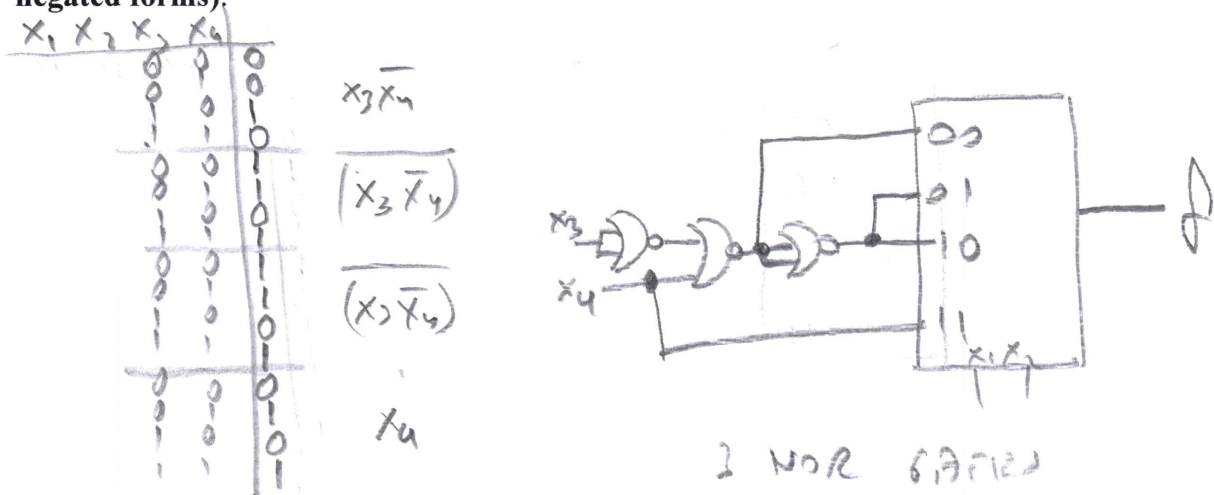# Quiz 2

Duration: 45 Minutes
Grading: 1) 40%, 2) 60%,
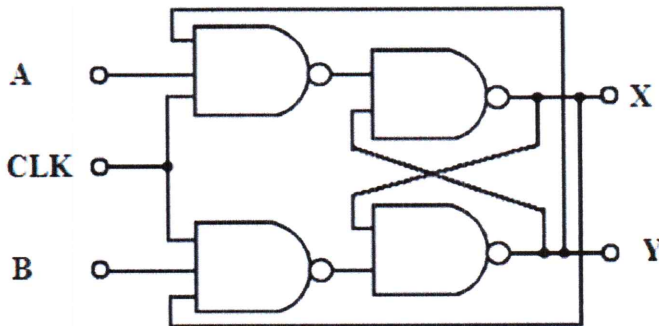*Quiz is in closed-notes and closed-books format*
For your answers please use the space provided in the exam sheet
GOOD LUCK!

1. Implement a 4-variable Boolean function $f(x_1, x_2, x_3, x_4) = \sum(2,4,5,7,8,9,11,13,15)$ using **a single 4-to-1 multiplexer** and minimal number of **two-input NOR gates.** Use x_1 and x_2 as select input lines in the multiplexer. Use only variables x_1, x_2, x_3, x_4 as inputs (**not their negated forms**).

2. Consider a sequential circuit shown below. It has three input A, B, and CLK and two outputs X and Y. **Obtain its truth table**, and **Boolean expressions** for X and Y.

CLK=0   HOLD   CLK=1

$X_2 X_{pre}$ $Y_2 Y_{pre}$

A	B	X	Y	
0	0	X_{pre}	Y_{pre}	
0	1	0	1	
1	0	1	0	
1	1	$\overline{X}_{pre}$	$\overline{Y}_{pre}$	toggle

$X = \overline{CLK}\, X_{pre} + \overline{A}\,\overline{B}\, X_{pre} + CLK\, \overline{A}B + CLK\, A\overline{B}\, \overline{X}_{pre}$

$Y = \overline{CLK}\, Y_{pre} + \overline{A}\,\overline{B}\, Y_{pre} + CLK\, \overline{A}B + CLK\, A\overline{B}\, \overline{Y}_{pre}$