Problem 1

\[ S_i = \bar{A} \bar{B} \bar{C} + \bar{A} \bar{B} \bar{C} + \bar{A} \bar{B} C + ABC \]

Problem 2

\[ S_i = \overline{A B C + ABC + ABC + ABC} \]

\[ S_i = \overline{A B \bar{C} A \bar{B} C A B C} \]

\[ A_i \]
\[ B_i \]
\[ C_{i-1} \]

\[ S_i \]
Problem 3

This is a total of 40 xistors.
Problem 4

There are a few possibilities for this problem.

\[ S_i = A\bar{B}\bar{C} + \bar{A}B\bar{C} + \bar{A}\bar{B}C + ABC \]

\[ S_i = A(\bar{B}\bar{C} + BC) + \bar{A}(BC + \bar{BC}) \]

There are a total of 30 xistors here.
Problem 5

Problem 6

\[ OUT = \overline{E(ABC + ABD + ACD + BCD)} + ABCD \]

Perform double-negation:

\[ OUT = E(ABC + ABD + ACD + BCD) + ABCD \]

Double-negate \((ABC + ABD + ACD + BCD)\):

\[ OUT = \overline{EABC ABD ACD BCD ABCD} \]

Note: This is perhaps easier done graphically, swapping gates until in a simpler form.
There are 48 xistors.
Problem 7

a)

There are 36 xistors.
b)
Gate-level diagram:
There are 50 xistors here.
Problem 8

a)

The fourth case is a “don’t care”, so we can select input $C$ with just $S_0$. 