EECS 151/251A Homework 1

Due 11:59pm, Friday, Sep 8th, 2023

Submit your answers directly on the assignment on Gradescope.

Problem 1: Boolean Algebra

(a) Simplify the following expression: \((A + B) + A\)

Simplified Expression: 

(b) Simplify the following expression: \((A + BC)(\overline{A}C + B)\)

Simplified Expression: 

(c) Simplify the following expression: \( A(ABC + BCA) + CA + B \)

Problem 2: Boolean Logic Gates

For the following circuits built with logic gates, determine the equivalent and simplified boolean expressions.

(a) Circuit:

```
Simplified Expression: C = A \cdot B
```
(b) Circuit:

Simplified Expression: $C = A \cdot B$

(c) Circuit:

Simplified Expression: $D = A \cdot B \cdot C$
Problem 3: Basic Verilog

For each numbered blank, fill in the corresponding box below in the correct snippet of Verilog so that it matches the output of the 4-input 3-output Boolean function calculator. The inputs are $a$, $b$, $c$, and $d$, and the outputs are $e$, $f$ and $g$, which have the following boolean expression.

\[
\begin{align*}
    e &= a\overline{b}c + \overline{a}bc \\
    f &= a\overline{b}c + ab + \overline{a}\overline{b}\overline{c}d \\
    g &= b\overline{c} + ad
\end{align*}
\]

\[
\text{module boolean_calculator (}
\begin{align*}
    &\text{___(1)___ a, b, c, d,} \\
    &\text{___(2)___ wire e, g,} \\
    &\text{___(2)___ reg f}
\end{align*}
\);
\]

\[
\begin{align*}
    \text{assign e} &= (a \text{ ___(3)___ b}) \&\& c; \\
    \text{___(4)___ @(*) begin} \\
    \text{case}\{(a, b)\} \\
    \begin{align*}
        &2\text{'b00}: f = \text{ ___(5)___ ;} \\
        &2\text{'b01}: f = \neg c \&\& \text{ d;} \\
        &2\text{'b10}: f = c; \\
        &2\text{'b11}: f = 1\text{'b1;}
    \end{align*}
    \text{___(6)___}
\end{align*}
\]

\[
\begin{align*}
    \text{wire g0, g1;} \\
    \text{___(7)___ gate0 (g0, b, \neg c);} \\
    \text{___(8)___ gate1 (g1, a, d);} \\
    \text{___(9)___ gate2 (g, g0, g1);}
\end{align*}
\]

\text{endmodule}

(1):   (2):   (3):   


(7):   (8):   (9):