Name: Dalton McClain Grade: /15

1) [15] The following Boolean function is algebraically reduced to two different forms denoted as X1 and X2 as follows. Please verify the simplification process.

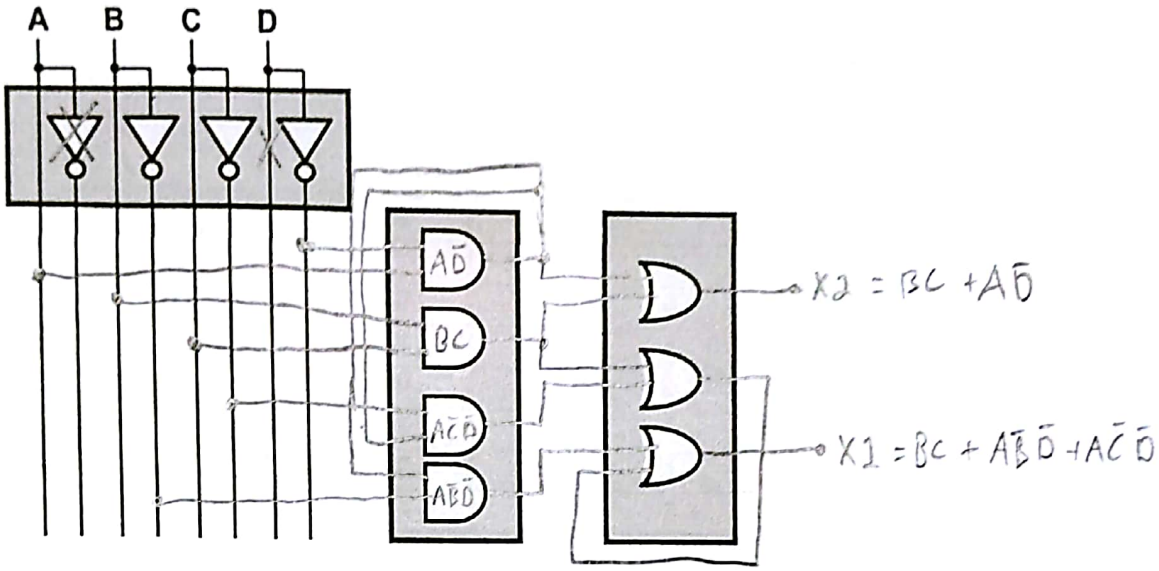
$$X = B C \overline{D} + B C D + A \overline{B} \overline{D} + A B \overline{C} \overline{D}$$
$$= BC(\overline{D} + D) + (\overline{B} + B\overline{C}) A\overline{D}$$
$$= BC + (\overline{B} + \overline{C}) A\overline{D} = \underline{BC + A\overline{B}\overline{D} + A\overline{C}\overline{D} = X1}$$
$$\text{or} = BC + \overline{(BC)} A\overline{D} = \underline{\underline{BC + A\overline{D} = X2}}$$

1.a) [3] Verify the equivalence of X1 and X2 using the following truth table:

ABCD	BC	$A\overline{B}\overline{D}$	$A\overline{C}\overline{D}$	$A\overline{D}$	X1	X2
0000	0	0	0	0	0	0
0001	0	0	0	0	0	0
0010	0	0	0	0	0	0
0011	0	0	0	0	0	0
0100	0	0	0	0	0	0
0101	0	0	0	0	0	0
0110	1	0	0	0	1	1
0111	1	0	0	0	1	1
1000	0	1	1	1	1	1
1001	0	0	0	0	0	0
1010	0	1	0	1	1	1
1011	0	0	0	0	0	0
1100	0	0	1	1	1	1
1101	0	0	0	0	0	0
1110	1	0	0	1	1	1
1111	1	0	0	0	1	1

1.b) [4] Implement the above two reduced functions, X1 and X2, using exactly 4 2-input AND gates, 3 2-input OR gates:

Name: Dallon McClain Grade: /15



1.c) [6] Build the above 2-output circuit using exactly 1/2 7404, 1 7408 and 3/4 7432 chips on your breadboard and then connect inputs ABCD to 4 DIP switched and the outputs X1 X2 to two LED indicators. Test all the 16 different input combinations and observe the two outputs to be equivalent. Use the following chip pin-out to conveniently plan your wiring.

1.d) [2] You can verify the circuit design/behavior by implementing the circuit using Quartus. You may wish to do this before you actually build the circuit on the breadboard.