Quiz 11 – to be finished in 15 minutes

Student Name:

Question 1

A combinational circuit that satisfies the following specification:

- This circuit has four input signals (A, B, C, D). ABCD represents a binary number, where A is the Most Significant Bit and D is the Least Significant Bit.
- This circuit sets the output signal F to logic HIGH when ABCD represents a prime number in the range 0b0000 to 0b1010, inclusively. It sets the output signal F to logic LOW when ABCD does not represent a prime number in the range 0b0000 to 0b1010, inclusively.
- When ABCD represents a number higher than 0b1010 (i.e., 0b1011, 0b1100, 0b1101, 0b1110, and 0b1111), the users of the circuit do not care the output signal.
- Prime numbers smaller than 20 are: 2, 3, 5,7,11,13, 17, and 19.

Given the above description, complete the following K-map for output signal F, and derive the most simplified Boolean equation of output signal F, in the form of sum of products.
You must show the loops clearly.

Prime numbers = 0010, 0011, 0101, 0111 (output 1)
Non-prime numbers = 0000, 0001, 0100, 0110, 1000, 1001, 1010 (output 0)
Don't care = 1011, 1100, 1101, 1110, 1111

AB / CD	00	01	11	10
00	0	0	*	0
01	0	1	*	0
11	1	1	*	*
10	1	0	*	0

F = ~A~BC + BD.

Grading: if the table is wrong -6
If miss one loop, have one extra loop, have one wrong loop, -2.
For additional mistakes, -2.