BIRZEIT UNIVERSITY

Electrical and Computer Engineering Department

Summer Semester 2019 Digital Systems (ENCS234) First Exam

Time: 08:00 - 09:30 Date: 14/07/2019 Room: A.Shaheen150

Instructor: □ Ahmad Alsadeh □ Aziz Qaroush

Student Name: ______________________________________**Student ID**: ___________________

Question #	Full Mark	Student Mark
Q1	**34**	
Q2	**12**	
Q3	**4**	
TOTAL	**50**	

Note: write your solution on the space provided. If you need more space, write on the back of the sheet containing the question.

Q1] Select the correct answer **(<u> 30 points, 2 points each</u>):**

1) The representation of the binary number $(111.0101)_2$ in Octal is

A. $(7.24)_8$

B. $(7.5)_8$

C. $(7.05)_8$

D. $(7.25)_8$

2) In octal, the twelve-bit two's complement of the hexadecimal number $3BE_{16}$ is

A. 1676_8

B. 1677_8

C. 6101_8

D. **6102_8**

3) What is the Gray code value for the binary value 1011

A. 1110

B. 0110

C. 1101

D. 1111

4) On subtracting $(010110)_2$ from $(1011001)_2$ using 2's complement, we get _____________

A. 0111001

B. 1100101

C. 0110110

D. 1000011

5) The sign magnitude representation of -9 is ___________

A. 00001001

B. 10001001

C. 11111001

D. 10001001

6) If you are given a word of size n bits, the range of 2's complement of binary numbers is:

A. -2^{n+1} to $+2^{n+1}$

B. -2^{n-1} to $+2^{n-1}$

C. -2^{n-1} to $+2^{n+1}$

D. **-2^{n-1} to $+2^{n-1}-1$**

7) What is the BCD decimal number 29.25

A. 11101.010

B. 11101.100

C. 0010 1001. 010

D. **0010 1001. 0010 0101**

8) Given that 86 students have registered in the ENCS234 course this summer, and each of these students should be assigned a unique n-bit binary code. The minimum value of n is

A. 5
B. 6
C. **7**
D. 8

9) Which of the following functions is the constant **0** function?

A. $x' + xy$

B. $xy + y' + x'y$

C. $\boldsymbol{xy'(x' + y)}$

D. $(x' + y)(xy)$

10) Without simplification, what is the dual form of the following expression: $(x + y'z')(wx'z + w'yz')$

A. $(x + y'z')(wx'z + w'yz')$
B. $(x' + yz)(w'xz' + wy'z)$
C. $\boldsymbol{x.(y' + z') + (w + x' + z)(w' + y + z')}$
D. $x'.(x + y) + (w' + x + z')(w + y' + z)$

11) Give the simplest form of $F = y(x + y) + (x + y)'z + yz$

A. $xy + x'z$
B. $xy + yz$
C. $xy + x'z + yz$
D. $xy + x'y'z + yz$
E. $\boldsymbol{y + x'z}$

12) Which of the following is equal to $F(x, y) = \sum(m_1, m_2)$

A. $xy + x'y$

B. $\boldsymbol{xy' + x'y}$

C. $(x + y')(x' + y)$

D. $\boldsymbol{(x' + y')(x + y)}$

13) Given the Boolean function $F(x, y, z) = (x + y)(x + z)(x' + z')$. Express F as a sum-of-minterms

A. $F = \sum_m(2,3,5)$
B. $F = \sum_m(0,1,2,5,7)$
C. $\prod_M(3,4,6)$
D. $\prod_M(0,1,2,5,7)$
E. $\boldsymbol{F = \sum_m(3,4,6)}$

14) Convert the following Sum of product (SoP)expression to an equivalent Product of Sum expression

$$ABC + AB'C' + AB'C + ABC' + A'B'C$$

A. $(A' + B' + C')(A + B + C')(A' + B + C)$
B. $\boldsymbol{(A + B + C)(A + B' + C)(A + B' + C')}$
C. $(A' + B' + C')(A + B' + C)(A + B' + C)$
D. $(A + B + C)(A' + B + C')(A + B' + C)$

15) One of De Morgan's theorems states that . Simply stated, this means that logically there is no difference between: $(x + y)' = x'.y'$

A. **a NOR and an AND gate with inverted inputs**

B. a NAND and an OR gate with inverted inputs

C. an AND and a NOR gate with inverted inputs

D. a NOR and a NAND gate with inverted inputs

16) How many gates would be required to implement the following Boolean expression after simplification?

$xy + x(x + z) + y(x + z)$

A. 1 OR gate, 1 AND gate

B. 1 OR gate, 2 AND gates

C. 3 OR gates, 3 AND gates

D. 1 OR gate, 3 AAND gates

17) The NAND or NOR gates are referred to as "universal" gates because either:

A. can be found in almost all digital circuits

B. can be used to build all the other types of gates

C. are used in all countries of the world

D. were the first gates to be integrated

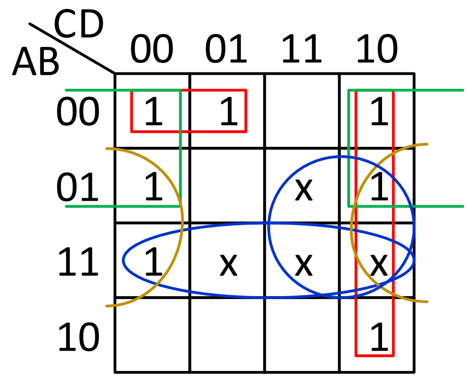
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A	**D**	**A**	**D**	**B, D**	**D**	**D**	**C**	**C**	**C**	**E**	**B, D**	**E**	**B**	**A**	**A**	**B**

Q2 (12 points): For the following function, whose on-set minterms are shown using the sigma (Σ) notation together with don't care conditions; derive a minimum Sum-of-Product (SOP) form expression using Karnaugh map (K-map).

$$F(A,B,C,D) = \sum(0,1,2,4,6,10,12)$$
$$\sum d(7,13,14,15)$$

a) Find **all** prime implicants

$CD', A'B'C', A'D', BD', AB, BC$



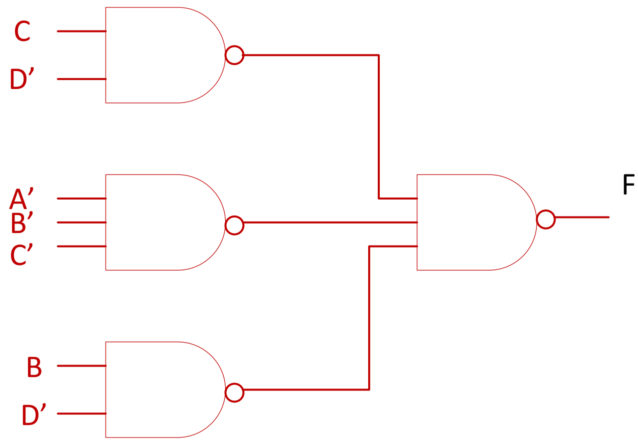
b) What are the essential prime implicants

$CD', A'B'C'$

c) Write the optimized SOP expression of *F*

$F(A,B,C,D) = CD' + A'B'C' + BD'$

d) Implement the optimized function using two- level NAND gates only



Q3: (<u>4 points</u>): Derive the circuits for a three-bit parity generator and four-bit parity checker using odd parity bit.

Answer