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Question 1

6 pts

What is the decimal value of the number 544.1_9

☐ $445 \frac{1}{9}_{10}$
☐ 545.9_{10}
☐ $454 \frac{1}{9}_{10}$
☐ $545 \frac{1}{9}_{10}$
☐ 454.1_{10}
☐ 445.1_{10}
☐ 454.9_{10}

☐

Question 2

6 pts

Devise a scheme for converting base 9 numbers directly to base 3. Use your method to convert the following number to base 3: 832.7_9

☐ 2210122.122_3
☐ 221002.21_3
☐ 112121.30_3
☐ 121111.001_3
☐ 111212.10_3

☐

Question 3

6 pts

Convert the number $83.E_{16}$ to Octal.

☐ 308.7_8
☐ 207.3_8
☐ 302.7_8
☐ 203.14_8
☐ 307.2_8
☐ 203.7_8

☐

Question 4

6 pts

Construct a table for 3-3-2-1 weighted code and write the number 253.

☐ 011001000100
☐ 001001100100
☐ 101101100100
☐ 101001100101
☐ 010001100100

[3 Parts] **Multiplying expressions.** Simplify the following expression to a minimum *sum of products (SOP)*:

$$(C+D+E)(D'+E+C)(B'+C+A')(A'+B+C)(C+E'+B)$$

Part 1: for the two sums $(C+D+E)(D'+E+C)$ above, what is the *simplified form* that can be used- Hint $(x+y)(x+y')$:

- a) $(D'+E)$
- b) $(C+D)$
- c) $(C+D')$
- d) $(C+E')$
- e) $(C+E)$

Answer 1: (Note: Indicate ONLY the LETTER corresponding to your choice)

Part 2: using the simplified form in Part 1 with other terms, the following is an intermediate result. hint $(x+y)(x+z)(x+w)=x+yzw$:

- a) $C+(A'+B')(A'BE)$
- b) $C+(A+B)(A'+B)(BE)$
- c) $C+(A'+B')(A'+B)(BE)$
- d) $A'+(C+B)(A'+B)(BE)$
- e) $B+(A'+B')(A'BE)$

Answer 2: (Note: Indicate ONLY the LETTER corresponding to your choice)

Part 3: using the simplified forms in Part 1 & Part 2, find the simplified sum of product SOP (final). hint $(, ,)=xy+x'z$:

- a) $C+E'+AE'D$
- b) $D'+CBE'+A'$
- c) $C+D'+A'$
- d) $C+A'BE$
- e) $C+A'D+E'D$

Answer 3: (Note: Indicate ONLY the LETTER corresponding to your choice)



Question 6

10 pts

Factor the following expression to obtain the *Product Of Sums (POS)*: (Hint. 2 steps, factor to have form $AB+A'C$ then $= (A+C)(A'+B)...$)

$$W'X'Y + XY' + WY'$$

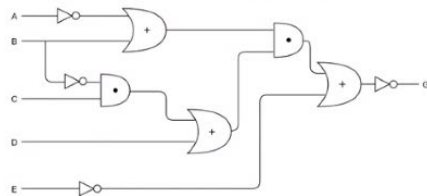
- ☐ $(W'+X)(X+Y')$
- ☐ $(W'+X+Y)(X+W)Y'$
- ☐ $(W'+X)(Y+X+W)Y'$
- ☐ $(W'+Y)(X+Y')(W+X+Y)$
- ☐ $(W'+X+Y)(X+Y')(W+Y')$
- ☐ $(X+W)(Y+W'+X')(X+Y)$



Question 7

15 pts

For the following circuit, find the expression for G and simplify. In the simplified form, only individual variables should be complemented:



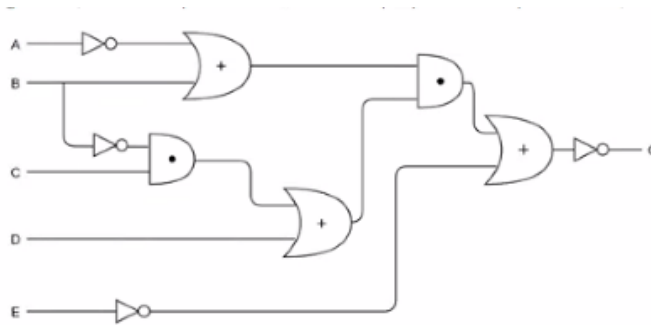
Part 1: Write the Boolean expression of the circuit.

- a) $[(A'B+C), (B'C+D) + E']'$
- b) $[(A'B), (B'+C+D) + E']'$
- c) $[(A'+BC), (B'+D) + E']'$
- d) $[(A'+B), (B'C+D) + E']'$
- e) $[(A'+B), (B'+C.D) + E']'$

Answer 1: (Note: Indicate ONLY the LETTER corresponding to your choice)

Part 2: One possible intermediate step when applying DeMorgan's law is one of the following expressions, choose one.

- a) $[AB' + (B+C), D']', E$
- b) $[A+B' + BC' + D']', E$
- c) $[(AB' + B+C), D']'+E'$
- d) $[AB' + B+C, D']', E$
- e) $[A+B' + (B+C), D']', E'$



Part 1: Write the Boolean expression of the circuit.

- a) $[(A'B+C). (B'C+D) + E']'$
- b) $[(A'B). (B'+C+D) + E']'$
- c) $[(A'+BC). (B'+D) + E']'$
- d) $[(A'+B). (B'C+D) + E']'$
- e) $[(A'+B). (B'+C.D) + E']'$

Answer 1: (Note: Indicate ONLY the LETTER corresponding to your choice)

Part 2: One possible intermediate step when applying DeMorgan's law is one of the following expressions, choose one.

- a) $[AB' + (B+C'). D'] . E$
- b) $[A+B' + BC' + D'] . E$
- c) $[(AB' + B+C'). D'] + E'$
- d) $[AB' + B+C'. D'] . E$
- e) $[A+B' + (B+C'). D'] . E'$

Answer 2: (Note: Indicate ONLY the LETTER corresponding to your choice)

Part 3: The simplified expression of G in SOP form :

- a) $E' + AD' + B'D + A'B'C$
- b) $AE + BD'E + C'D'E$
- c) $AB'E + BD'E + C'D'E$
- d) $AE + B'D'E + D'E$
- e) $E + BD'E + C'D'E$

Answer 3: (Note: Indicate ONLY the LETTER corresponding to your choice)

Question 8
8 pts

Identify two consensus terms in the following expression: (Only one answer has the two correct terms, no partial credit if you choose an answer that has only one correct term):

$a'bd + bcd + acd' + b'cd' + abc$

- ☐ $ac'd'$ and bcd
- ☐ acd' and bcd
- ☐ $a'cd$ and bcd'
- ☐ acd and bcd
- ☐ acd and bcd'

Question 9

10 pts

Given: $F(a, b, c) = abc' + b'$. Express F as a minterm expansion.

☐ $\prod M(0, 1, 4, 5, 6)$
☐ $\sum m(0, 1, 5, 6)$
☐ $\prod M(2, 3, 7)$
☐ $\sum m(0, 1, 4, 5, 6)$
☐ $\sum m(2, 3, 7)$

Question 10

8 pts

Determine which of the following equations are not valid.

☐ $x \oplus 1 = x'$
☐ $x' \oplus x' = 0$
☐ $x \oplus x' = 1$
☐ $x \oplus x = 0$
☐ $x \oplus 0 = x'$

Question 11

10 pts

Find the minimum sum-of-products expression for the following function.

$f(a, b, c, d) = \prod M(0, 1, 6, 8, 11, 12) \cdot \prod D(3, 7, 14, 15)$

☐ $a'bc' + ac'd + b'cd'$
☐ $abc + a'cd + ab'c'd + a'bc'd'$
☐ $a'bc' + ac'd + b'cd' + bc'd$
☐ $a'bc' + ac'd + b'cd' + a'cd + abc$