Digital Electronics – Worksheet Answer

1. **02-03 C3 Digital Electronics**

$$\overline{\overline{AB}\,\overline{B+C}} = \overline{\overline{AB} + \overline{B+C}} = AB + B + C = B(A+1) + C = B + C$$

(*, 0, 0)
OR
(1,0,0) (0,0,0)

2. **02-03 C3 Digital Electronics**

The circuit is represented by $\overline{\overline{A}B + C\overline{D}}$.

a. (0,1,0,1) = not (1 + 0) = 0
b. (1,0,1,0) = not (0 + 1) = 0
c. (1,1,1,1) = not (0 + 0) = 1
d. (1,0,0,1) = not (0 + 0) = 1
e. (0,0,1,1) = not (0 + 0) = 1

c, d and e

3. **03-04 C3 Digital Electronics**

The circuit translates to $\overline{A}B + \overline{B}$

(1,1)

A	B	$\overline{A}$	$\overline{A}B$	$\overline{B}$	$\overline{A}B + \overline{B}$
0	0	1	0	1	1
0	1	1	1	0	1
1	0	0	0	1	1
1	1	0	0	0	0

4. **03-04 C3 Digital Electronics**

The circuit translates to: $\overline{\overline{A}AB\overline{B+C}}$. Parentheses are not required and should not be part of the answer. AND operation symbols (∗ or •) may be included.

$\overline{\overline{A}AB\overline{B+C}}$

5. **04-05 C3 Digital Electronics**

The diagram translates to:

$$\overline{\overline{A}B + B} = 1 \Rightarrow \overline{A}B + B = 0 \Rightarrow \overline{A}B = 0 \text{ AND } B = 0$$

Therefore $A = *$. There are 2 ordered pairs (0, 0) and (1,0)

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6. **04-05 C3 Digital Electronics**

The diagram translates to: (1,1,0) , (0,1,0)

$\overline{(A+B)(B\overline{C})} = 0 \Rightarrow (A+B)(B\overline{C}) = 1 \Rightarrow$

$A+B=1$ AND $B\overline{C}=1 \Rightarrow B=1$ AND $C=0$

Since $B=1$ then $A=*$. There are 2 ordered triples (*, 1, 0).

7. **05-06 C3 Digital Electronics**

The circuit translates to

: $\overline{\overline{A}+AB} = \overline{\overline{A}} * \overline{AB} = A(\overline{A}+\overline{B}) = A\overline{A}+A\overline{B} = 0+A\overline{B} = A\overline{B}$ $A\overline{B}$

8. **05-06 C3 Digital Electronics**

The circuit translates to: $\overline{\overline{A}B+B+C}$. No parentheses are required. $\overline{\overline{A}B+B+C}$

9. **06-07 C3 Digital Electronics**

The circuit translates as follows: $\overline{\overline{A}(A+B)}+\overline{B\overline{C}+D}$ $\overline{\overline{A}(A+B)}+\overline{B\overline{C}+D}$

10. **06-07 C3 Digital Electronics**

The circuit translates to $\overline{(AB)(B+C)} = 1 \Rightarrow \overline{ABB+ABC} = 1 \Rightarrow$ 6

$ABB+ABC=0 \Rightarrow AB+ABC=0 \Rightarrow AB(1+C)=0 \Rightarrow AB=0$

If A = 0 then B = * and C = *

If B = 0 then A = * and C= *

11. **07-08 C3 Digital Electronics**

The circuit translates as follows: 0

$(\overline{A}(A+B))\overline{B+C}$

$(\overline{A}(A+B))\overline{B+C} = (\overline{A}A+\overline{A}B)\overline{B}\overline{C}$

$= (0+\overline{A}B)\overline{B}\overline{C}$

$= \overline{A}B\overline{B}\overline{C} = 0$

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12. **07-08 C3 Digital Electronics**

The circuit translates to $\overline{A\overline{B}} + \overline{B}$ (0,0), (0,1), (1,0)

$\overline{A\overline{B}} + \overline{B} = \overline{A} + \overline{\overline{B}} + \overline{B} = \overline{A} + \overline{B}$

If $A = 0$, then $1 + \overline{B} = 1$ Hence $B = *$ ∴ (0,*)

If $A = 1$, then $0 + \overline{B} = 1$ So $\overline{B} = 1 \Rightarrow B = 0$ ∴ (1,0)

13. **08-09 C3 Digital Electronics**

The circuit translates as follows: $\overline{(\overline{A+B})(B+C)}$ 1

$\overline{(\overline{A+B})(B+C)} = \overline{A}\overline{B}(B+C) = \overline{A}B\overline{B} + \overline{A}\overline{B}C$

$= 0 + \overline{A}\overline{B}C = \overline{A}\overline{B}C$

$\overline{A}\overline{B}C = 1 \Rightarrow \overline{A} = 1 \wedge \overline{B} = 1 \wedge C = 1$ ∴ (0,0,1) makes it TRUE

14. **08-09 C3 Digital Electronics**

The circuit translates as follows: $\overline{\overline{A} + AB}$ $A\overline{B}$

$\overline{\overline{A} + AB} = \overline{\overline{A}}\,\overline{AB} = A(\overline{A} + \overline{B}) = A\overline{A} + A\overline{B} = 0 + A\overline{B} = A\overline{B}$

15. **09-10 C3 Digital Electronics**

The circuit translates as follows: $\overline{A}\,\overline{B}\,\overline{C}$

$(\overline{A} + B)(\overline{B+C}) = (\overline{A} + B)(\overline{B}\,\overline{C})$

$= \overline{A}\,\overline{B}\,\overline{C} + B\overline{B}\,\overline{C}$

$= \overline{A}\,\overline{B}\,\overline{C}$

16. **09-10 C3 Digital Electronics**

The circuit translates to (1,0,0), (0,0,0)

$\overline{\overline{A}B + (B+C)} = 1 \Rightarrow \overline{A}B + B + C = 0$

$\Rightarrow \overline{A}B = 0 \wedge B = 0 \wedge C = 0$

$\Rightarrow A = *$ ∴ (*,0,0)

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17. **10-11 C3 Digital Electronics**

The circuit translates as follows: $(\overline{A}+B)B$ B

$(\overline{A}+B)B = \overline{A}B+B = B(\overline{A}+1) = B$

18. **10-11 C3 Digital Electronics**

The circuit translates to $\overline{AB+\overline{C}}$ (0,0,1), (0,1,1), (1,0,1)

$\overline{AB+\overline{C}} = 1 \Rightarrow AB+\overline{C} = 0$

$\Rightarrow AB = 0 \wedge \overline{C} = 0$

$\Rightarrow AB = 0 \wedge C = 1$

If $A = 0$, then $B = *$. If $A = 1$, then $B = 0$.

19. **11-12 C4 Digital Electronics**

$\overline{(AB)(B+C)} = \overline{AB}+\overline{B+C} = \overline{A}+\overline{B}+\overline{B}\,\overline{C} = \overline{A}+\overline{B}(1+\overline{C}) = \overline{A}+\overline{B}$ (1,1,1), (1,1,0)

If $\overline{A}+\overline{B}$ =0, then $\overline{A} = 0 \wedge \overline{B} = 0$. So $A = 1 \wedge B = 1 \wedge C = *$.

20. **11-12 C4 Digital Electronics**

The circuit simplifies to: $AB\overline{C}$

$\overline{(B+C)A}+C = (\overline{\overline{(B+C)A}})(\overline{C}) = (AB+AC)\overline{C} = AB\overline{C}+AC\overline{C} = AB\overline{C}$

21. **12-13 C4 Digital Electronics**

(1,1)

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22. **12-13 C4 Digital Electronics**

The circuit translates to: $\overline{A} + A\overline{B}$ 3

A	B	$\overline{A}$	$\overline{B}$	$A\overline{B}$	$\overline{A} + A\overline{B}$
0	0	1	1	0	1
0	1	1	0	0	1
1	0	0	1	1	1
1	1	0	0	0	0

Therefore, the ordered pairs that make it TRUE are (0,0), (0,1), (1,0).

23. **13-14 C4 Digital Electronics**

The circuit translates to the Boolean expression: $\overline{(\overline{A} + AB)B}$ $\overline{B}$

$$\overline{(\overline{A} + AB)B} = \overline{\overline{A} + AB} + \overline{B} = \overline{\overline{A}}(\overline{AB}) + \overline{B} = A(\overline{A} + \overline{B}) + \overline{B}$$
$$= A\overline{A} + A\overline{B} + \overline{B} = \overline{B}(A + 1) = \overline{B}$$

24. **13-14 C4 Digital Electronics**

The circuit translates to: $\overline{(\overline{A + AB})(B + C)}\overline{C}$ $\overline{(\overline{A + AB})(B + C)}\overline{C}$

Note the first two factors may be commuted and the third may come first and the addends within the parentheses may be commuted.