



**North South University**  
Department of Electrical & Computer Engineering

**Project**

19Z20S0

Submitted By:

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Course: CSE231

Section: 4

Submitted To:

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①

CSE 231

① Truth Table

19Z2050

| Input |   |   |   | Output |   |   |   |   |   |   |
|-------|---|---|---|--------|---|---|---|---|---|---|
|       | x | y | z | a      | b | c | d | e | f | g |
| 1     | 0 | 0 | 0 | 0      | 1 | 1 | 0 | 0 | 0 | 0 |
| 9     | 0 | 0 | 1 | 1      | 1 | 1 | 1 | 0 | 1 | 1 |
| Z     | 0 | 1 | 0 | 1      | 1 | 0 | 1 | 1 | 0 | 1 |
| 2     | 0 | 1 | 1 | 1      | 1 | 0 | 1 | 1 | 0 | 1 |
| 0     | 1 | 0 | 0 | 1      | 1 | 1 | 1 | 1 | 1 | 0 |
| 5     | 1 | 0 | 1 | 1      | 0 | 1 | 1 | 0 | 1 | 1 |
| 0     | 1 | 1 | 0 | 1      | 1 | 1 | 1 | 1 | 1 | 0 |
| x     | 1 | 1 | 1 | x      | x | x | x | x | x | x |

② k-map

|   | 00 | 01 | 11 | 10 |
|---|----|----|----|----|
| 0 | 0  | 1  | 1  | 1  |
| 1 | 1  | 1  | x  | 1  |

$$a = Z + Y + X \text{ (SOP)}$$

$$\rightarrow a = (X + Y + Z) \text{ (POS)}$$

|   | 00 | 01 | 11 | 10 |
|---|----|----|----|----|
| 0 | 1  | 1  | 1  | 1  |
| 1 | 1  | 0  | x  | 1  |

$$b = X' + Z' \text{ (SOP)}$$

$$\rightarrow b = (X' + Z') \text{ (POS)}$$

|   | 00 | 01 | 11 | 10 |
|---|----|----|----|----|
| 0 | 1  | 1  | 0  | 0  |
| 1 | 1  | 1  | x  | 1  |

$$c = Y' + X \text{ (SOP)}$$

$$c = (X + Y') \text{ (POS)}$$

|   | 00 | 01 | 11 | 10 |
|---|----|----|----|----|
| 0 | 0  | 1  | 1  | 1  |
| 1 | 1  | 1  | x  | 1  |

$$d = X + Y + Z \text{ (SOP)}$$

$$\rightarrow d = (X + Y + Z) \text{ (POS)}$$

|   | 00 | 01 | 11 | 10 |
|---|----|----|----|----|
| 0 | 0  | 0  | 1  | 1  |
| 1 | 1  | 0  | x  | 1  |

$$e = Y + XZ' \text{ (SOP)}$$

$$e = (X + Y)(Y + Z') \text{ (POS)}$$

|   | 00 | 01 | 11 | 10 |
|---|----|----|----|----|
| 0 | 0  | 1  | 0  | 0  |
| 1 | 1  | 1  | x  | 1  |

$$f = X + Y'Z \text{ (SOP)}$$

$$f = (X + Z)(X + Y') \text{ (POS)}$$

|   | 00 | 01 | 11 | 10 |
|---|----|----|----|----|
| 0 | 0  | 1  | 1  | 1  |
| 1 | 0  | 1  | x  | 0  |

$$g = Z + X'Y \text{ (SOP)}$$

$$g = (Y + Z)(X' + Z)$$

|   | 00 | 01 | 11 | 10 |
|---|----|----|----|----|
| 0 | 0  | 1  | 0  | 0  |
| 1 | 1  | 1  | x  | 1  |

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③ Simplified Equation (SOP & POS)

| Simplified Equation SOP | Simplified Equation POS |
|-------------------------|-------------------------|
| $a = x + y + z$         | $a = (x + y + z)$       |
| $b = x' + z'$           | $b = (x' + z')$         |
| $c = x + y'$            | $c = (x + y')$          |
| $d = x + y + z$         | $d = (x + y + z)$       |
| $e = y + xz'$           | $e = (x + y)(y + z')$   |
| $f = x + y'z$           | $f = (x + z)(x + y')$   |
| $g = z + x'y$           | $g = (y + z)(x' + z)$   |

④ Generalized SOP circuit with basic gates

$$\# a = x + y + z$$

$$a = \sum(1, 2, 3, 4, 5, 6)$$

$$= xy'z' + x'y'z + xy'z + x'y'z' + x'y'z' + x'y'z$$

$$\# b = x' + z'$$

$$b = \sum(0, 1, 2, 3, 4, 6)$$

$$= x'y'z + x'y'z' + x'y'z + x'y'z' + x'y'z' + x'y'z'$$

$$\# c = y' + x$$

$$c = \sum(0, 1, 4, 5, 6)$$

$$= xy'z + xy'z' + x'y'z + x'y'z' + xy'z'$$

③

$$\# d = x + y + z$$

$$d = \sum(1, 2, 3, 4, 5, 6)$$

$$= xyz' + xy'z + x'y'z + x'yz + x'y'z + x'y'z$$

$$\# e = y + xz'$$

$$e = \sum(2, 3, 4, 6)$$

$$= xyz' + x'y'z + x'y'z' + xy'z'$$

$$\# f = x + y'z$$

$$f = \sum(1, 4, 5, 6)$$

$$= xyz' + xy'z + xy'z' + x'y'z$$

$$g = z + xy$$

$$g = \sum(1, 2, 3, 5)$$

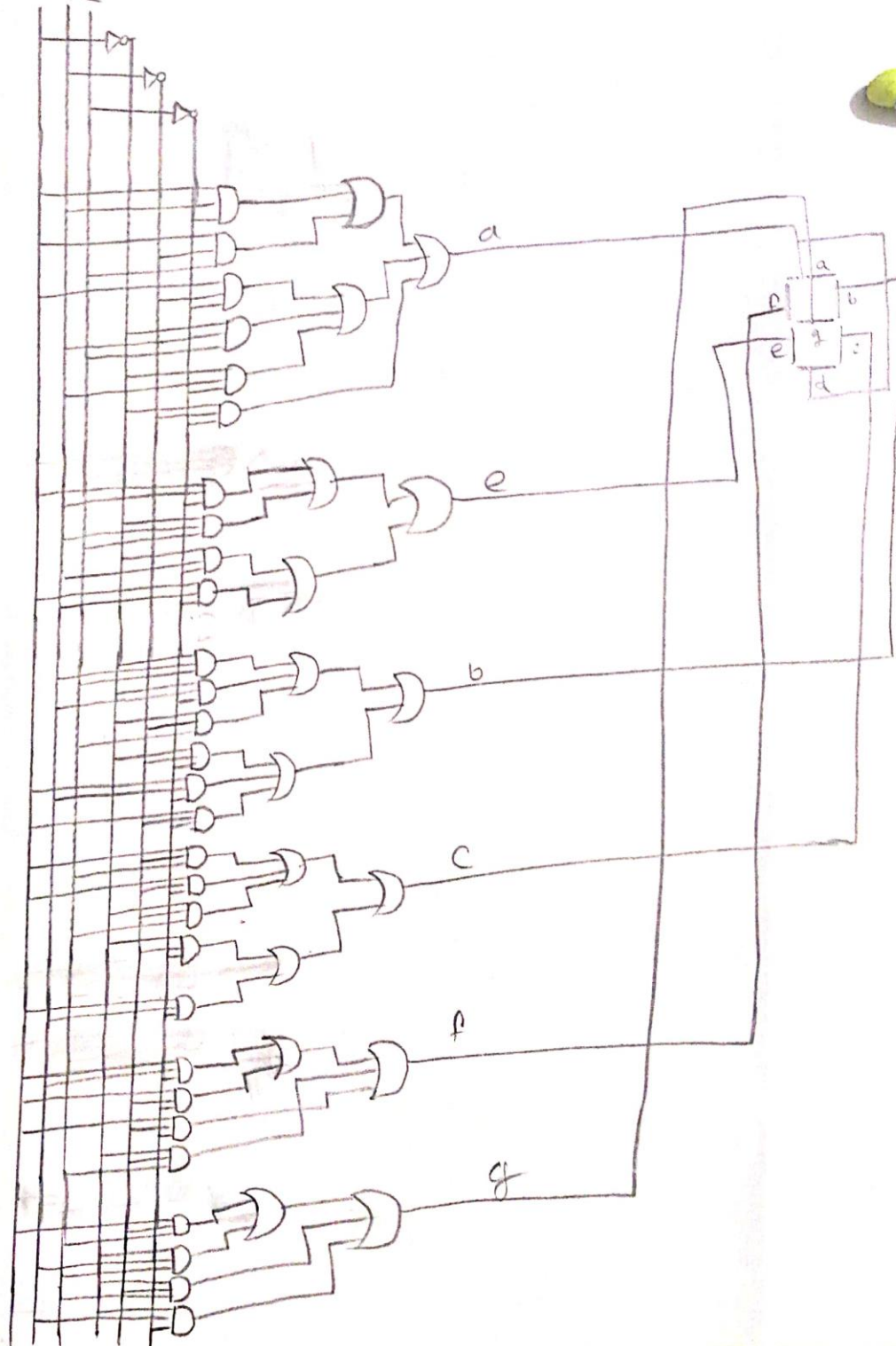
$$= xy'z + x'y'z + x'y'z' + x'y'z'$$



# Generalized SOP circuit with basic gates

(9)

x 12





⑤ Generalized POS Circuit with Basic gates

$$a = \pi(0) = (x + y + z)$$

$$b = \pi(5) = (x' + y + z')$$

$$c = \pi(2, 3)$$

$$= (x + y' + z)(x + y' + z')$$

$$d = \pi(0) = (x + y + z)$$

$$e = \pi(0, 1, 5)$$
$$= (x + y + z)(x + y + z')(x' + y + z')$$

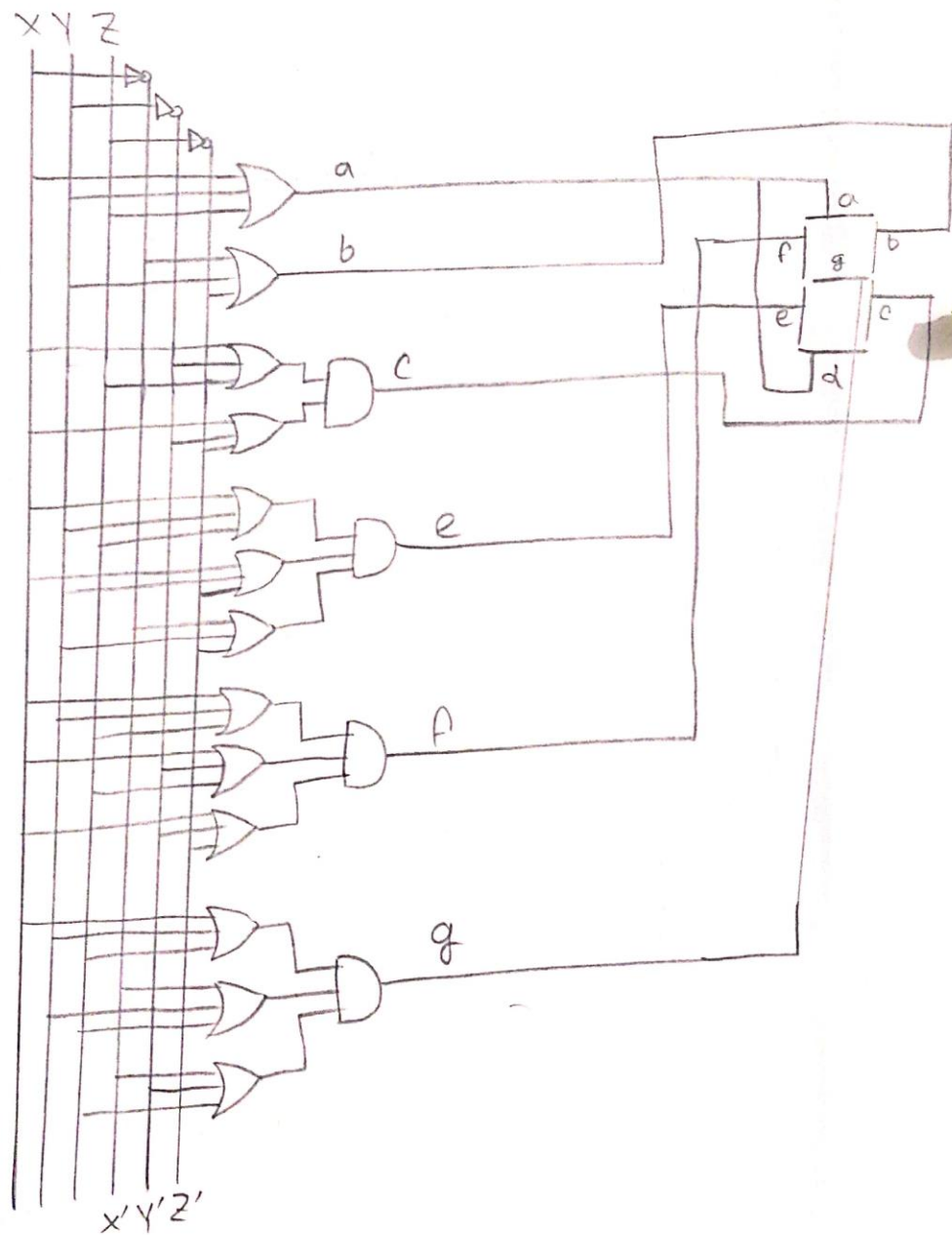
$$f = \pi(0, 2, 3)$$

$$= (x + y + z)(x + y' + z)(x + y' + z')$$

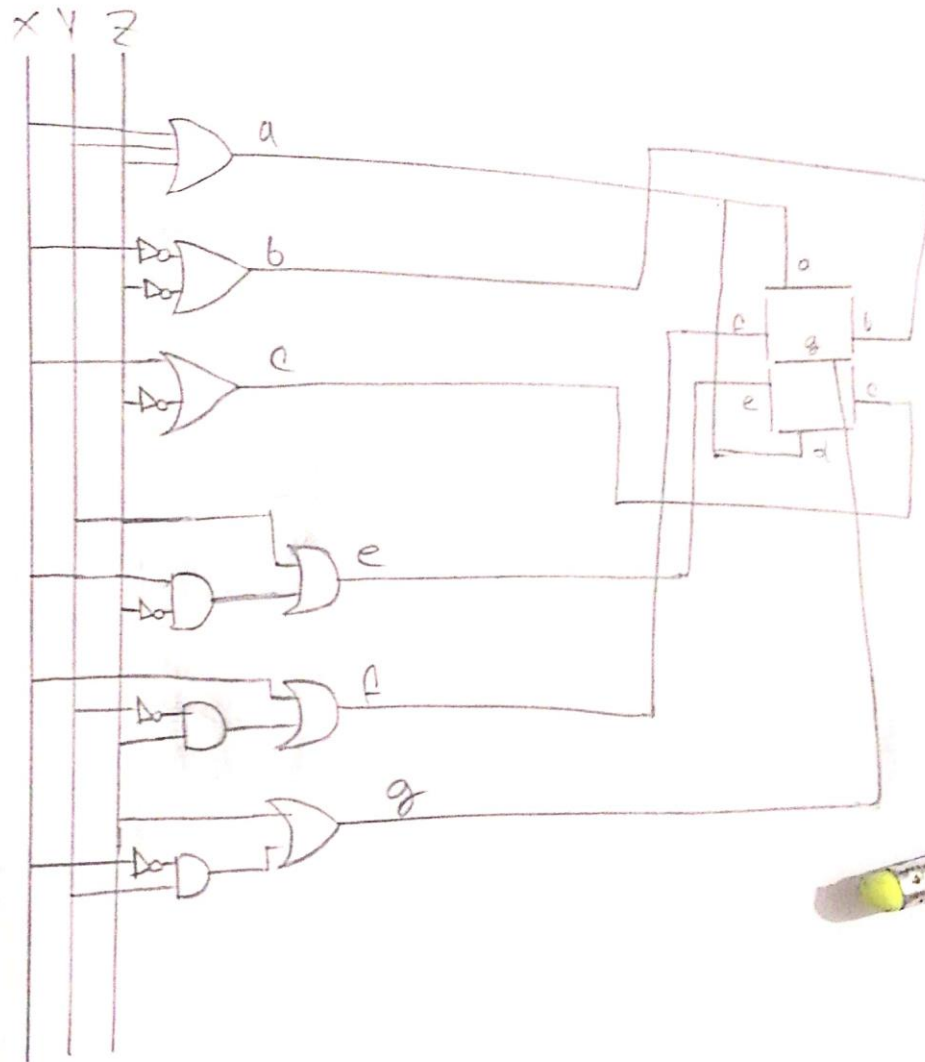
$$g = \pi(0, 4, 6)$$

$$= (x + y + z)(x' + y + z)(x' + y' + z)$$

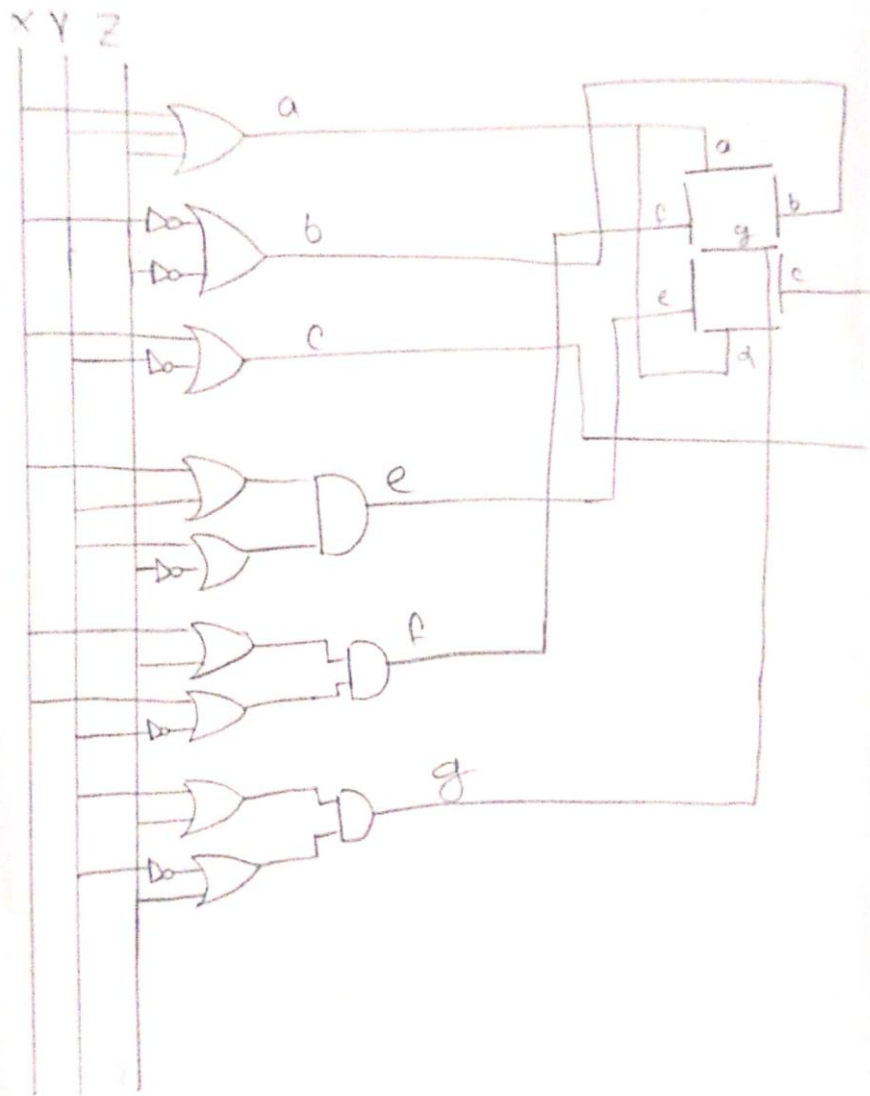
#Generalized POS circuit with basic gates



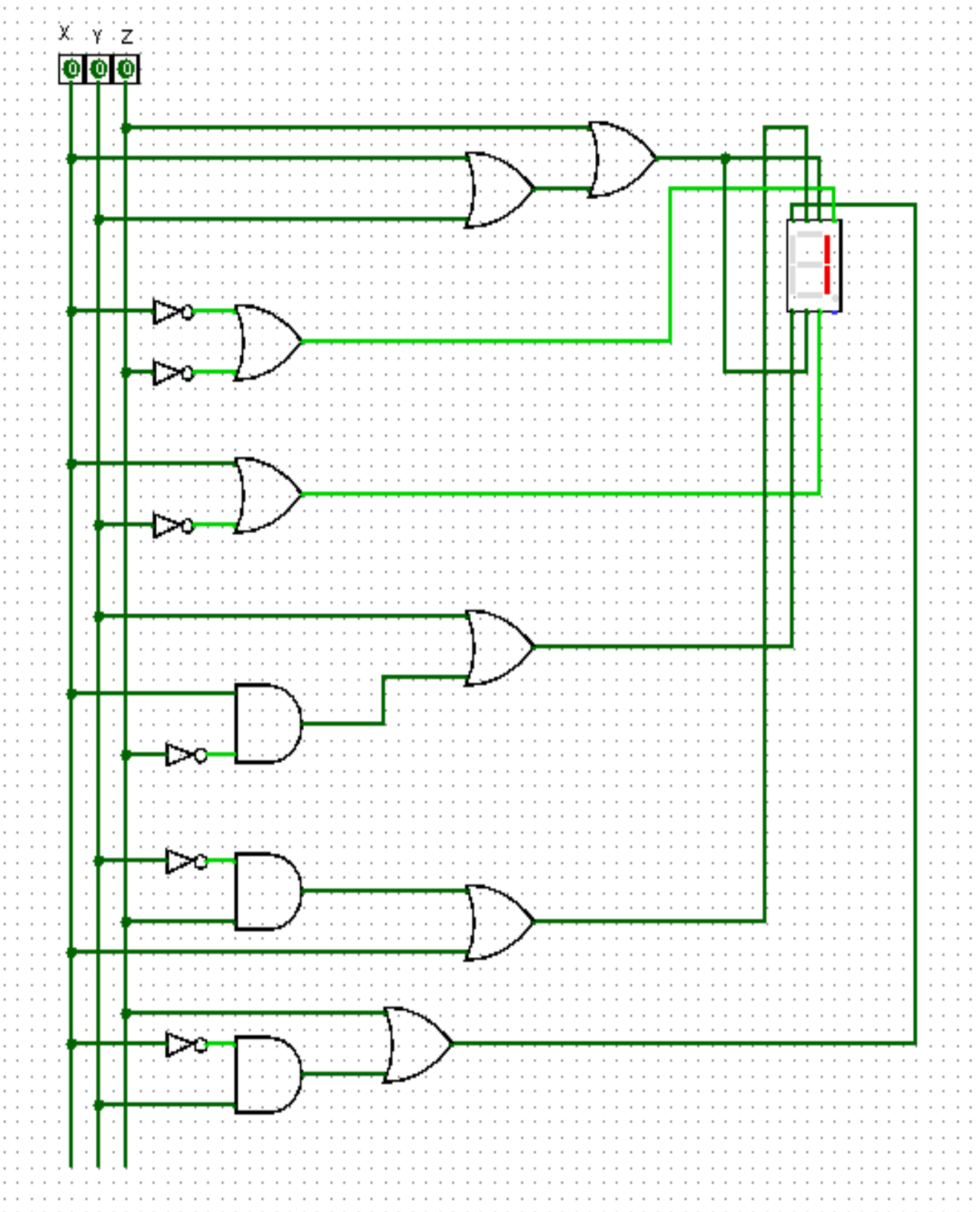
⑥ Simplified SOP circuit with basic gates



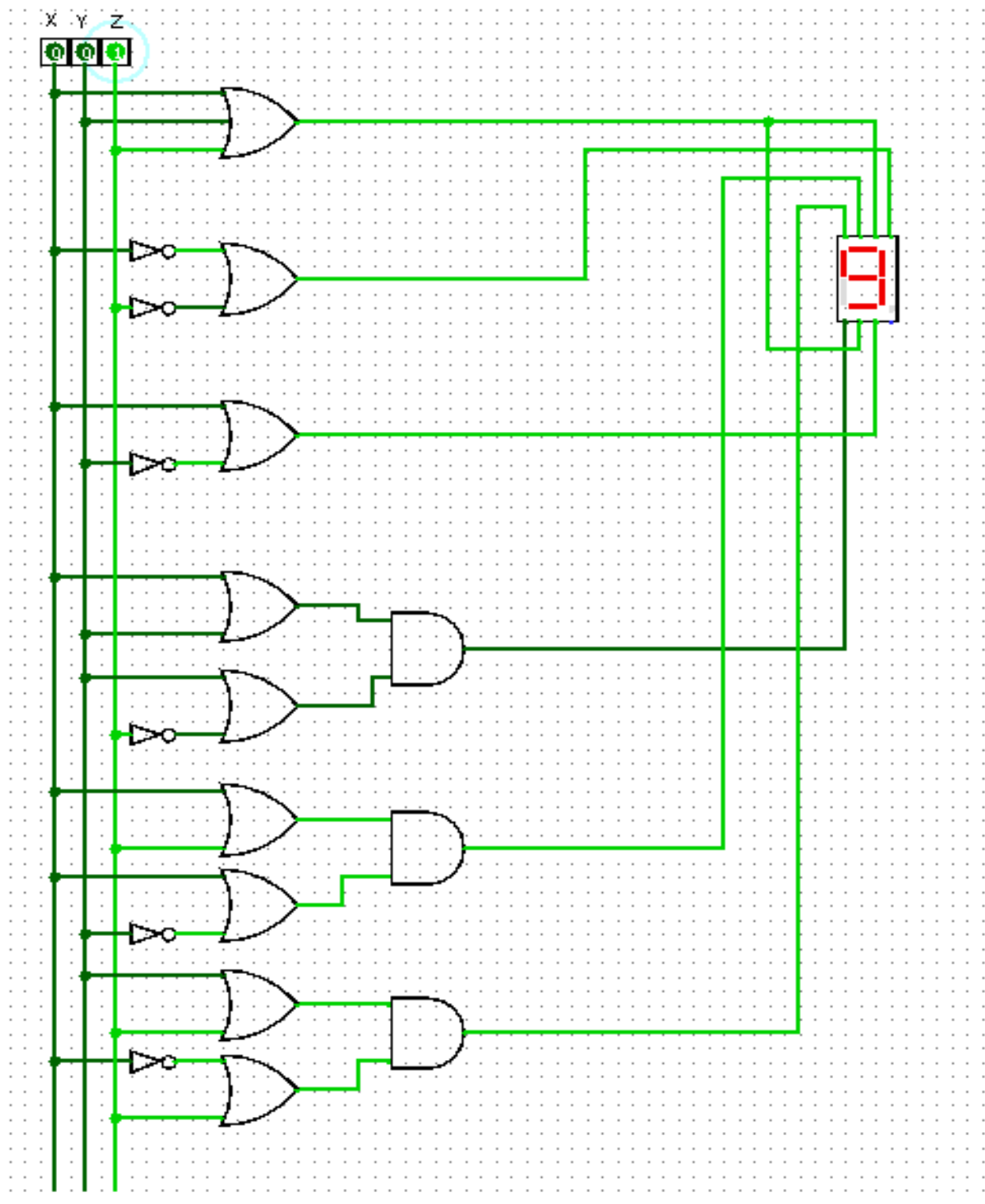
⑧ Simplified ~~the~~ circuit with basic gates



Simplified SOP Circuit using Basic Gates in Logisim:

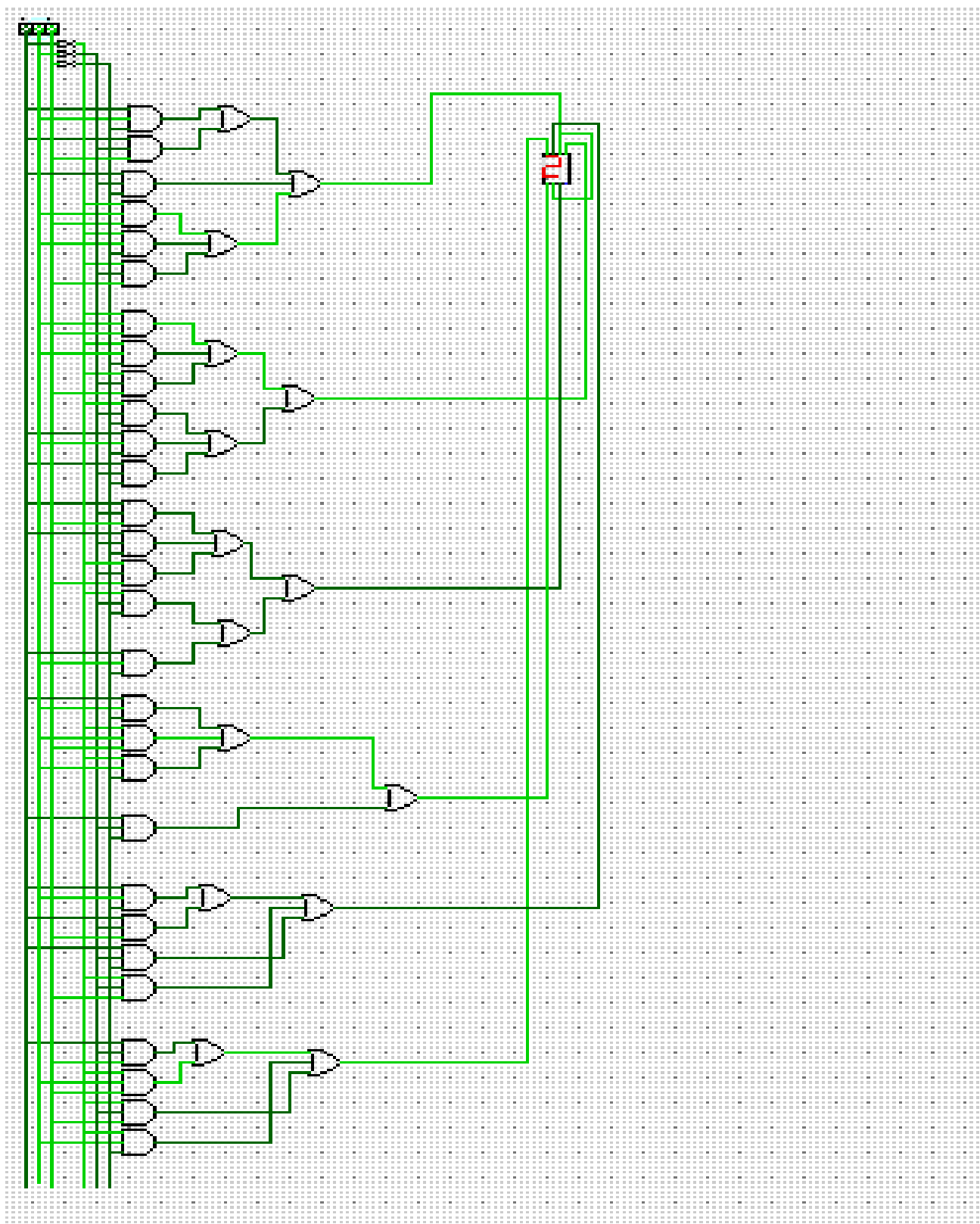


Simplified POS Circuit using Basic Gates in Logisim:





Generalized SOP circuit with basic gates in Logisim:



Generalized POS circuit with basic gates in Logisim:

